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Enhancing Network Integrity with Catalyst SD-WAN

Deep Dive into End-to-End Security

Shamil Fernando - Global Solutions Architect
Session ID BRKENS-2567

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<https://ciscolive.ciscoevents.com/ciscolivebot/#BRKENS-2567>

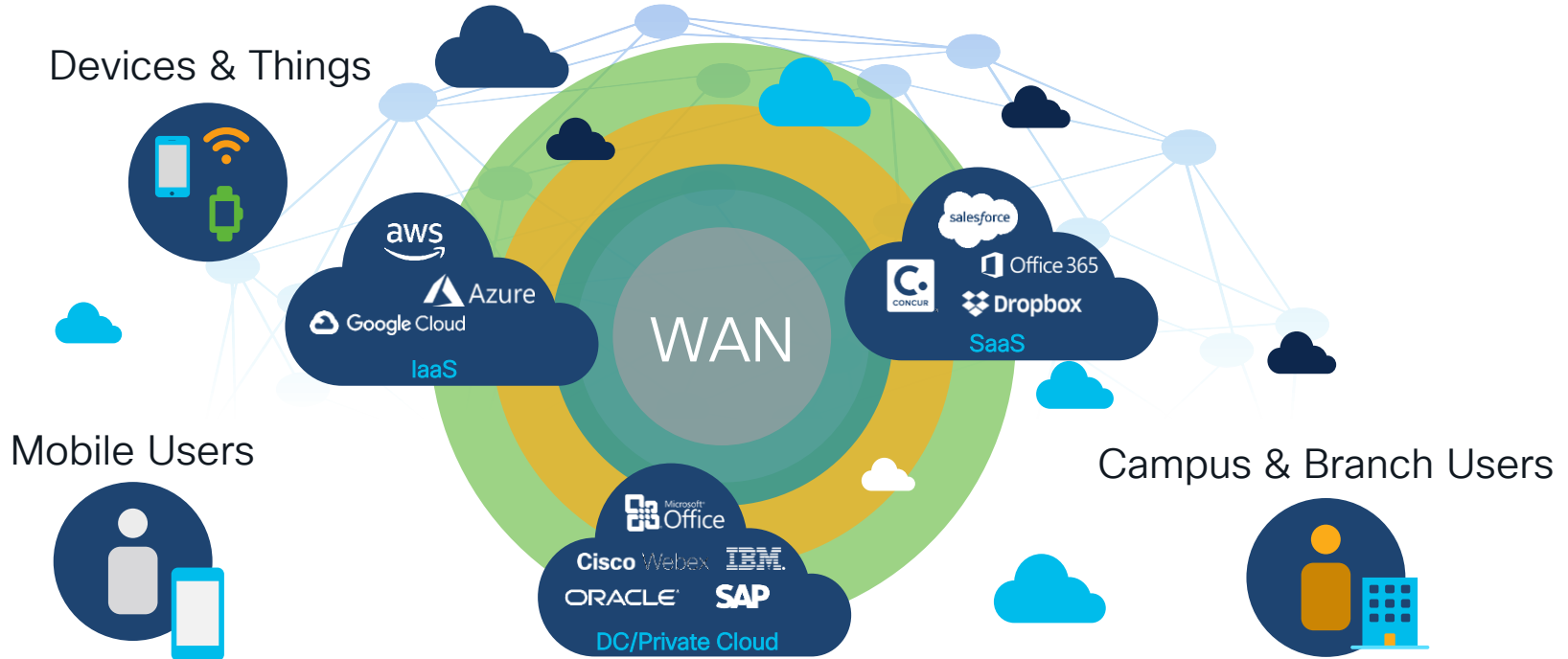




Agenda

- Catalyst SD-WAN
- Architecture
- Fabric Security
- Next-Gen Firewall in SD-WAN
- Secure Access Service Edge (SASE)
- ISE Integration & Segmentation
- Management and Reporting
- Wrap-Up
- Q&A

Today's application and security



Catalyst SD-WAN Architecture

Catalyst SD-WAN Architecture

Orchestration Plane

- First point of authentication

Management Plane

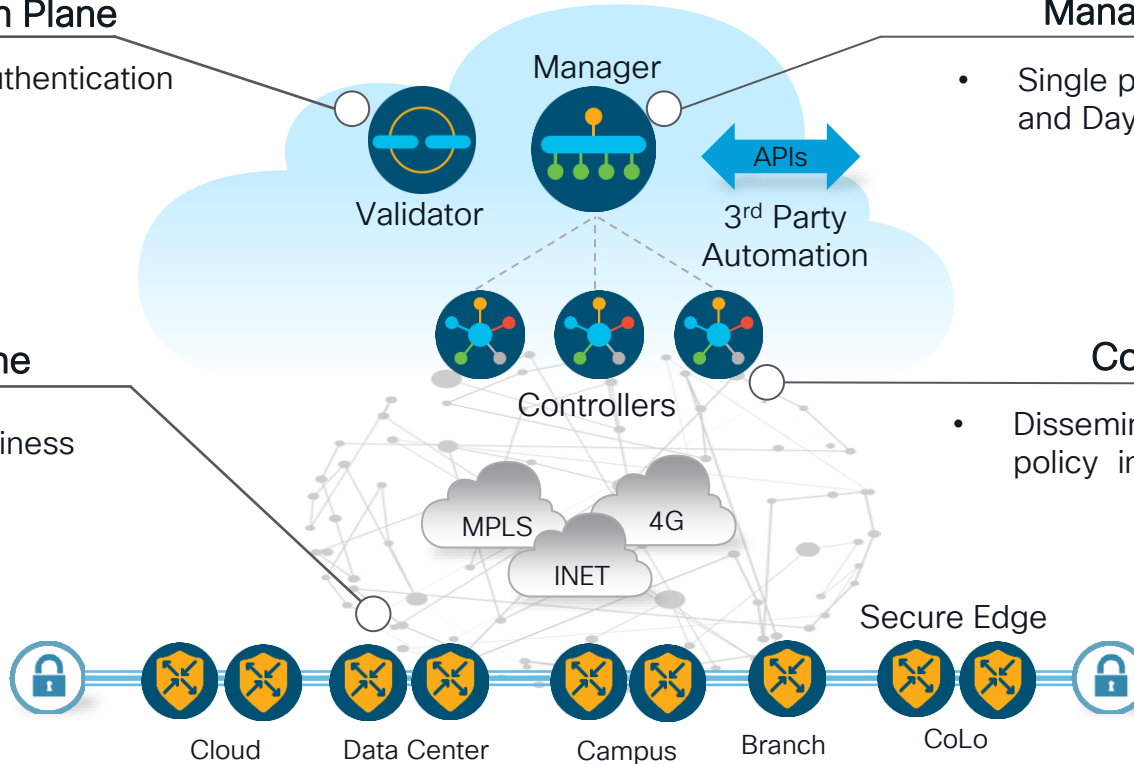
- Single pane of glass for Day0, Day1 and Day2 operations

Data Plane

- Implements business intent policies

Control Plane

- Disseminates control plane and policy information between Edges



Fabric Deployment Models

Reduce operational burden of customers

Customer Hosted (On-Prem, AWS & Azure)

Customer Data Center

MSP Data Center

Cisco Hosted (AWS & Azure)

Standard Environment
(Shared and Dedicated)

Certified Environment
(PCI, SOC2, ISO, C5, etc.)

Gov. Cloud
(FedRAMP)

Cloud-delivered (SaaS)

- Life Cycle Management of SD-WAN Fabric
- Agile and scalable service access
- Operational simplicity
- Rich analytics providing actionable insights

Flexible deployment models aligned to your business needs

Catalyst SD-WAN Fabric Security



Catalyst SD-WAN Fabric Security

NGFW in IOS-XE Secure Branch to Branch, Branch to Internet


Firewall
Stateful & App-aware NGFW
IPv6 support


Segmentation
Micro & Macro Segmentation


Intrusion Prevention System
(IPS) - Enhanced throughput with Snortv3


TLS Decryption
TLS encrypt/decrypt for security inspection


Advanced Malware Protection
File Reputation


Sandboxing
Secure Malware Analytics


URL Filtering


DNS Layer Security


Live Signature


Cisco ISE Integrations


Unified Logging


Dynamic Core Allocation

SD-WAN Integration with Cloud Security (SSE)


Tunnel Automation


Simplified Configuration


Layer-7 Health Check


Traffic Load Balancing


Service Resiliency


Multi-Tunnel support

Cisco SASE Integration Secure Branch to Internet


Cisco Umbrella


Cisco Secure Access


Cisco+ Secure Connect

3rd Party Integration


zscaler


paloalto
NETWORKS


CLOUDFLARE


Microsoft SSE


netkope

Fabric Security Confidentiality, Integrity, and Availability


Encrypted Control Plane


HW Based Device Authentication (SUDI)


Encrypted Data Plane


Enhanced Security Pairwise keys


DDoS Protection

Certification & Compliance Industry standards, fostering trust


PCI-DSS


SOC 2/SOC 3


C5


ISO 27001, 27017, 27018, 27701


FedRAMP


FIPS 140-2

Monitoring & Visibility


SD-WAN Manager SecOps Dashboard


Microsoft Sentinel


splunk

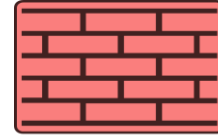
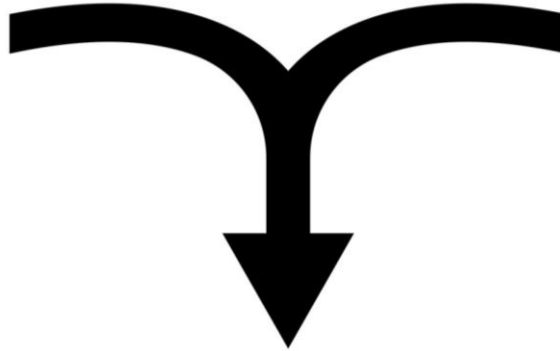
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Secure Edge

Network Team
Router (Private Links)



Security Team
Firewall (Public Links)



Cisco Catalyst Secure Edge
(Private & Public Links)



Fabric Security



Secure Edge Perimeter Protection

- Explicit Deny
- Zones Based Architecture
- No Open Ports
- DDOS Mitigation
- Trust Anchor Module (TAm)
- Secure Boot of Signed Images
- Runtime Defenses (RTD)



Onboarding & Authentication

- Devices Onboarding Process
- Zero Trust
- Certificate-based Authentication & Whitelisting
- Automate Custom Certificate Authority (CA)
- Management through using SD-WAN Manager



Transport Security

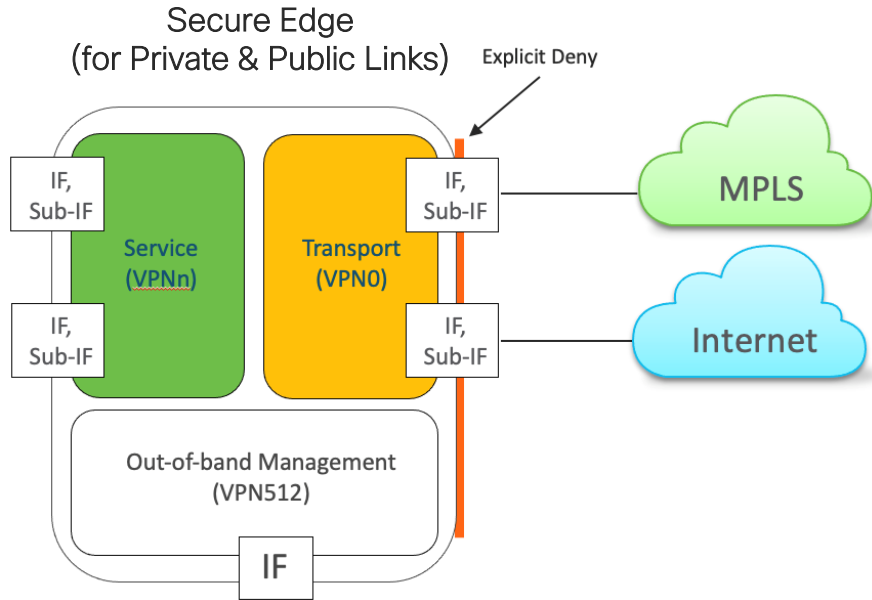
- IKE less IPsec (Key exchange using a controller, high scale)
- Key - Using RNG (NIST SP 800-90A)
- Key Rotation - 24hr Default
- Anti-Replay Protection



Least Access Principle

- Segmentation (VRF) - True VRF with separate route table & different topology each VRF
- Overlay Management Protocol (OMP)

Perimeter protection



- Explicit Deny
- Zones Based Architecture
- No Open Ports
- DDOS Mitigation
- VPNs are isolated from each other, each VPN has its own forwarding table
- Reachability within VPN is automatically advertised by the OMP

Cisco trustworthy technologies



Secure Boot of Signed Images

- Prevents malicious code from booting on a Cisco platform
- Automated integrity checks
- Monitors startup process and shuts down if compromised
- Faster identification of threats



Trust Anchor module (TAm)

- Tamper-resistant chip with X.509 cert installed at manufacturing
- Provides unique device identity and anti-counterfeit protections
- Secure, non-volatile on-board storage and RNG/crypto services
- Enables zero-touch provisioning and minimizes deployment costs

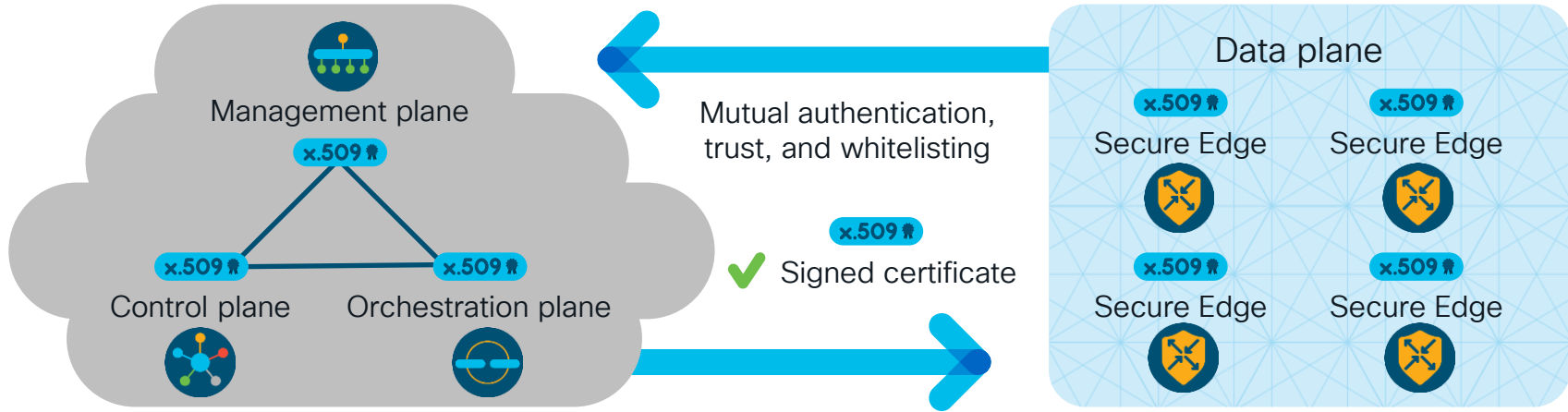


Runtime Defenses (RTD)

- Protects against injection of malicious code into running software
- Makes it harder for attackers to exploit vulnerabilities in running software
- Runtime technologies include ASLR, BOSC, and X-Space

Trustworthy technologies enhance the security and resilience of Cisco solutions

Fabric with Zero-Trust authentication



- ✓ Mutual certificate-based authentication
- ✓ Validator validates Controller and Manage certificate serial numbers against authorized white-list

- ✓ Embedded device identity (TPM)
- ✓ AES 256-GCM-based encryption
- ✓ Frequent key rotation (default: 12 hours)

Secure bring-up with approval



Chassis Number	Certificate Serial	Hostname	IP Address	Validate ↓
9391da23-f0d1-4259..	0334D73E5EC036F87ABE...	DataCenter	1.1.1.5	invalid staging valid
4de0b85f-a2ae-42ec...	585A0084DEA8396DD77B..	RemoteSite	1.1.1.4	invalid staging valid
5f05358a-bef7-4e15...	248792F938E6EA8BEE6FD..	AWS	1.1.1.6	invalid staging valid

- Single stage (Zero Touch Provisioning) – Identity is automatically trusted
- Two stage (One Touch Provisioning) – Identity is not automatically trusted. Requires administrator validation.
- Staging Mode – Identity is automatically trusted for control, but not for data. Requires administrator validation.

Next-Gen Firewall in SD-WAN

NGFW in SD-WAN

NGFW in SD-WAN

Secure Branch to Branch, Branch to Internet



Firewall

Stateful & App-aware NGFW
IPv6 support



Segmentation

Micro & Macro Segmentation



Intrusion Prevention System

(IPS) - Enhanced throughput
with Snortv3



TLS Decryption

TLS encrypt/decrypt for
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Secure Malware Analytics



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DNS Layer Security



Live Signature



Cisco ISE Integrations



Unified Logging



Dynamic Core Allocation

SD-WAN Integration with Cloud Security (SSE)



Tunnel Automation



Simplified Configuration



Layer-7 Health Check



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Cisco SASE Integration Secure Branch to Internet



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Access



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FIPS 140-2

Monitoring & Visibility



SD-WAN Manager
SecOps Dashboard



Microsoft Sentinel



splunk



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Next-Gen Firewall in Catalyst / Meraki

Meraki MX

Simplified Operations

Industry pioneers in cloud management and simplicity with hitless updates to threat detection engine, as-a-service

Catalyst WAN

Extensive Capabilities

Our Combined industry leading and most extensive routing capabilities powered by Cisco security ecosystem



Talos Threat Intelligence



Snort3 IPS



Secure Client



Secure Connect (SASE)



eXtended Detection and Response



ThousandEyes



Identity Services Engine



Duo Posture and Multifactor Authentication



NBAR & SD-AVC



Secure Access (SSE)



Malware Analytics



Splunk

Full stack network, observability, security and AI

Superior Security, Independently Verified

BETTER
TESTING

Uniquely designed to match
real-world conditions instead
of a lab environment

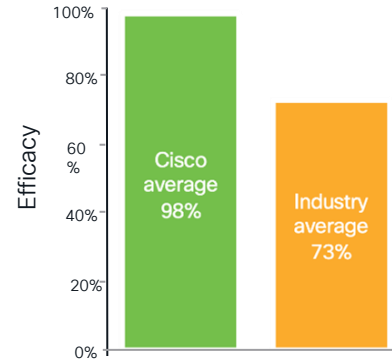
98% EFFECTIVE

Cisco malware efficacy across
11 real-world exploit categories

25% BETTER

Cisco malware efficacy
compared to the industry
average

Miercom
Independent malware efficacy testing



Exploits tested

- ! Active threat
- ! Advanced evasive threat
- ! Advanced persistent threat
- ! Backdoor exploit
- ! Bot network exploit
- ! Legacy malware
- ! Modified malware
- ! Malicious docs
- ! Polymorphous zero +1 day
- ! Remote access trojan
- ! Tor trojan exploit

- External link <https://miercom.com/cisco/>



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Security efficacy & performance

Up to 186%

Increase in throughput on average

98%

Next-Generation Firewall (NGFW) Security Efficacy

100%

Efficacy for URL-Filtering*

EMIX Traffic Profile (DIA+ZBFW+IPS+URLF+AMP)

Enhanced Security Throughput

Large Branch



C8300-2N2S-4T2X



C8300-1N1S-4T2X

Medium Branch



C8200-1N-RT

Small Branch



ISR 1161X

Release 20.9

1750 Mbps

165%

4640 Mbps

7%

4950 Mbps

Release 20.12.3

1470 Mbps

48%

2178 Mbps

33%

2900 Mbps

328 Mbps

130%

757 Mbps

30%

980 Mbps

75 Mbps

240%

260 Mbps

11%

290 Mbps

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Catalyst SD-WAN- NGFW

Area	Functionality	Cisco (FTD)	SD-WAN Security Engine (Current)	SD-WAN Security Engine (New)
Firewalling	L3-L4 Firewalling	Yes	Yes	Yes
	Identity Firewalling (User/Groups)	Yes	No	Yes
	Dynamic Attributes	Yes	No	Yes
	Time based AC rules	Yes	No	Yes
	Geolocation	Yes	Yes	Yes
	FQDN & Wildcard FQDN	Yes	Yes	Yes
	Destination List (IP, URL, Port)	Yes	No	Yes
Threat Protection	Security Intelligence (IP & URL)	Yes	No	Yes
	ApplD	Yes	Yes	Yes
	Content Filtering (Cat & Rep)	Yes	Yes	Yes
	Deep Packet Inspection (IPS)	Yes	Yes	Yes
	Protocol Inspection (Network Analysis Policy)	Yes	No	Yes
	Malware Protection (AMP)	Yes	Yes	Yes
	Malware Dynamic Analysis (TG)	Yes	Yes	Yes
Encrypted Traffic	Decryption Policy	Yes	Yes	No
	Encrypted Visibility Engine	Yes	No	No
Networking	Static and Dynamic Routing	Yes	NA	No
	NAT	Yes	NA	No
	QoS	Yes	NA	No
VPN	Site-to-Site VPN	Yes	NA	No
	RA-VPN	Yes	NA	No

Improved SecOps experience

Firewall Rule table Expert view

Cisco Catalyst SD-WAN

Search Cloud Help Notifications Alexander Business Corp, Inc

Collapse

Monitor

Configuration

Tools

Maintenance

Administration

Workflows

Analytics

Report

← NG Firewall

Test 1

Additional settings

Search 3 items

+ Add zone pair policy

Source zone: VPN_10_zone / Destination zone: Untrusted 1

Search Has Add rule

#	Rule name	Action	Log	Advanced inspection profile	Source	Destination	Protocol	Application	
1	Rule1	Inspect		URLF IPS AMP	Geo Africa object_name_XYZ object_name2 Show more	Data 10.0.0.0/15 Port 50	echo ace-svr name_1 name_2 name_3 name_4 Show more	test_app App_list1 App_list3	
2	Rule2	Drop			Data 10.0.0.0/14	Geo USA	Any	Any	
3	Rule3	Inspect		URLF AMP	Port 80	Data 10.0.0.0/15	Any	App_list4	
4	Rule4	Pass			Any	Any	Any	Any	
5	Rule5	Pass			Any	Any	Any	Any	

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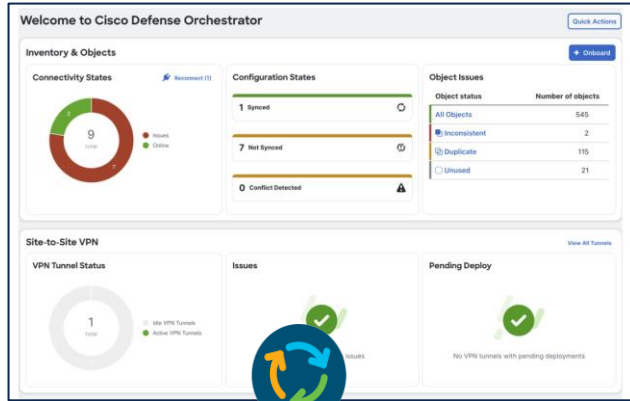
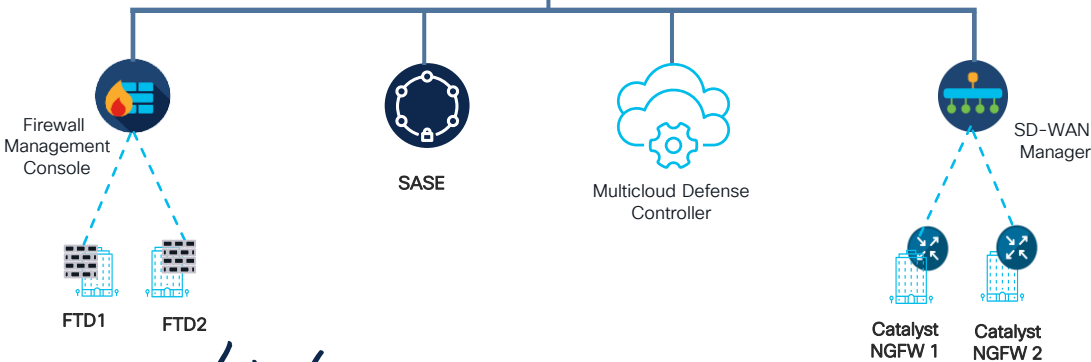
Source zone: VPN_13_zone / Destination zone: NA 1

Source zone: VPN_12_zone / Destination zone: NA 1

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Cisco Cloud Security Control



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- **Centralized Management:** Manage security policies and configurations across multiple Cisco devices from a single interface.
- **Policy Consistency:** Ensure consistent security policies across on-premises, cloud, and hybrid environments.
- **Automation and Orchestration:** Automate tasks and orchestrate workflows to improve efficiency and reduce errors.
- **Visibility and Reporting:** Gain comprehensive visibility and detailed reporting for compliance and auditing.
- **Simplified Operations:** Streamline operations with intuitive dashboards, policy templates, and guided workflows.
- **Integration:** Integrate with Cisco and third-party tools to enhance security posture and efficiency.

Secure Access Service Edge (SASE)



Secure Access Service Edge (SASE)

NGFW in IOS-XE

Secure Branch to Branch, Branch to Internet



Firewall

Stateful & App-aware NGFW
IPv6 support



Segmentation

Micro & Macro Segmentation



Intrusion Prevention System

(IPS) - Enhanced throughput
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Tunnel Automation



Simplified Configuration



Layer-7 Health Check



Traffic Load Balancing



Service Resiliency



Multi-Tunnel support

Cisco SASE Integration

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3rd Party Integration



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Encrypted

Control Plane



HW Based

Device Authentication (SUDI)



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Enhanced Security

Pairwise keys



DDoS Protection

Certification & Compliance

Industry standards, fostering trust



PCI-DSS



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C5



27001, 27017
27018, 27701



FedRAMP



FIPS 140-2

Monitoring & Visibility



SD-WAN Manager SecOps Dashboard



Microsoft Sentinel



SASE: Unifying networking & security services

Network as a service



Connect It

Network security as a service



Secure It

Market convergence

SASE



Secure SD-WAN Fabric*



Performance-based Internet Routing



On-prem Unified Threat Management

On-ramp into Public IaaS and Private Cloud*



SD-WAN Analytics (including Internet Intelligence)

SD-WAN



Cloud Access Security Broker (CASB)



Zero Trust Network Access (ZTNA)



Firewall as a Service (FWaaS)



Secure Web Gateway (SWG)

SSE



Catalyst SD-WAN



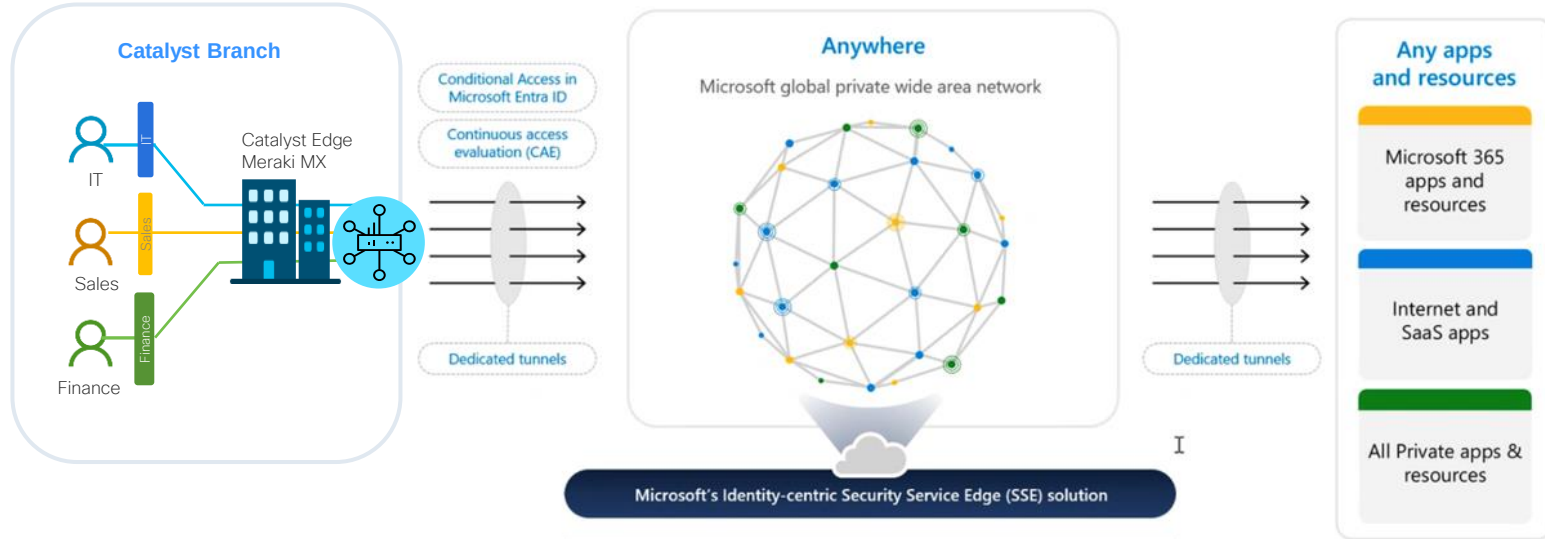
Catalyst SD-WAN & Cisco Secure Access

Seamless Secure Connectivity from Anywhere to Anything



	Available Today 2H CY2023	Summer 2H CY2024	Late Fall 2H CY2024
Use Case	Secure Direct Internet Access from Branches	Integrated Admin Experience Context Sharing for Segmentation	Secure Private Application Access Distributed Policy Enforcement
Key Capabilities	<ul style="list-style-type: none">Automation between Catalyst and SD-WANResilient connectivity to SSEHigher Bandwidth Connectivity (8 Gig)	<ul style="list-style-type: none">Seamless Network Context Sharing for Internet bound traffic (VPN and SGT)	<ul style="list-style-type: none">Seamless Private access connectivitySeamless Context Sharing for DIA & Private Access (VPN and SGT)Leverage Catalyst for policy EnforcementCross launch Catalyst Management portal from Secure Access dashboard and vice versa

Catalyst SD-WAN & Microsoft Entra



	Phase-1 (Branch Users)	Phase-2 (Identity based Security Policy) - TBD
Use Case	Secure Direct Internet Access (DIA) from Branches	Identity based Security policy
Key Capabilities	Manual Integration (June 2024) followed with Automated tunnels (Dec 2024) Simplified buying experience for customers - Cisco SD-WAN SKU on Microsoft Azure Marketplace - TBD	Context Sharing?

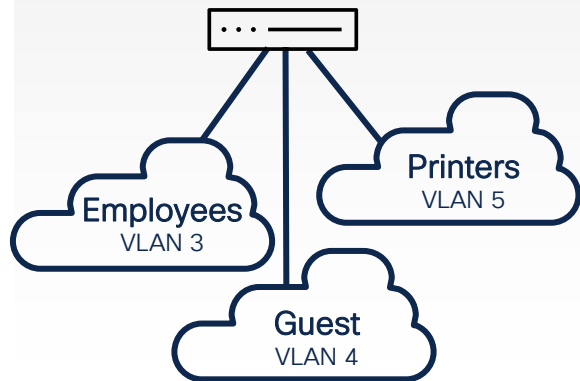
ISE Integration & Segmentation

Authorization enforcement options

Beyond RADIUS Access-Accept / Access-Reject

VLANs

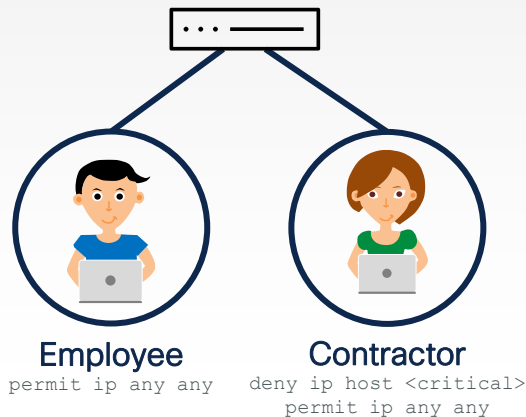
Dynamic VLAN Assignments



Per port / Per Domain / Per MAC

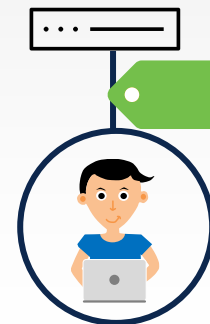
ACLs: DL, Named, DNS

Downloadable ACL (Wired) or
Named ACL (Wired + Wireless)



Security Group Tags

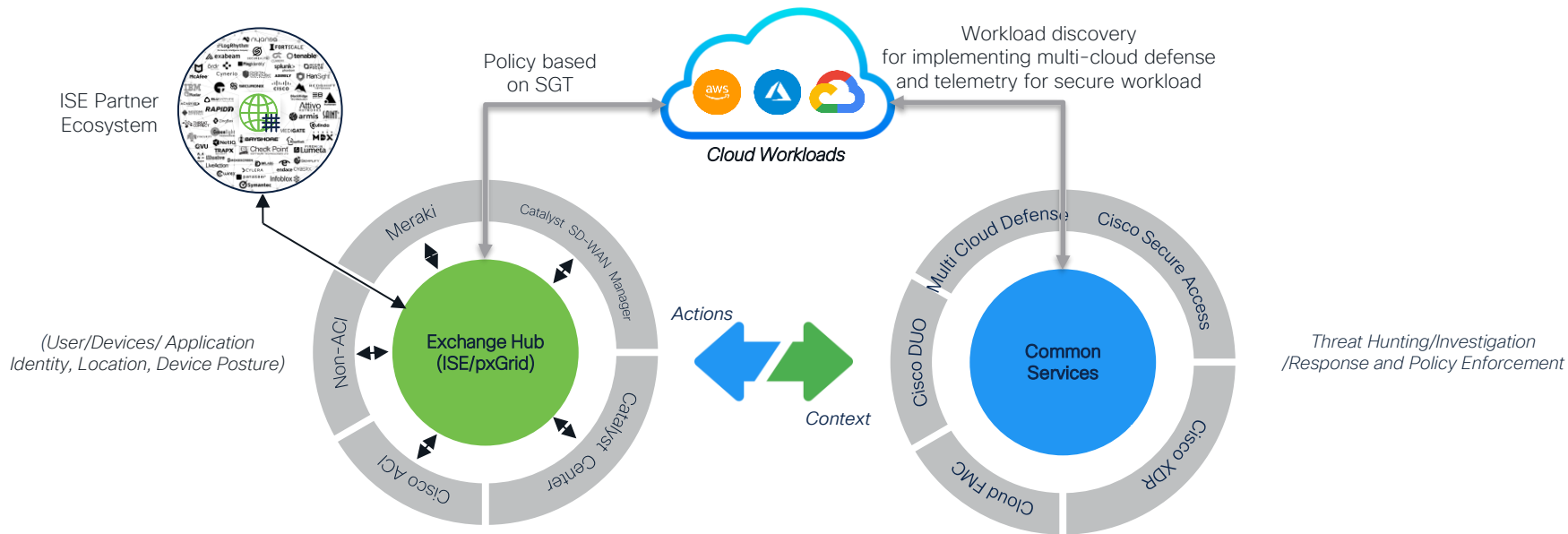
Cisco Group-Based Policy



16-bit SGT assignment and
SGT based Access Control

Common policy for Cisco Networking Cloud

Normalizing and sharing context across domains



- Modular approach to support on-prem and cloud use cases
- Enables consistent zero-trust policies for multi-domain environments (Campus, WAN, Data Center, Cloud)
- Simplifies configuration by moving away from cloud- and vendor-specific tags to a single Cisco-defined Security Group Tag (SGT)
- Differentiated experience with ability to scale, support full range of use cases

Cisco journey in Zero Trust with ISE integration

Why Zero Trust :

- ✓ Digital Landscape Expanding
- ✓ Hybrid workforce
- ✓ Need tighter network security control

Zero Trust Principles:

- ✓ Never assume trust
- ✓ Always verify
- ✓ Enforce least privilege

Source	Destination	Application	Action
IP-Subnet	Any	Any	Inspect
192.168.1.0/24	SGT-Printer	Print	Allow
User-Joe	HR-Server	HTTPS	Inspect
User-Group Cisco.com/Contractor	Geo-EU	Video-Streaming	Drop
SGT-Users-Partner	www.in.cisco.com	HTTPS	Inspect

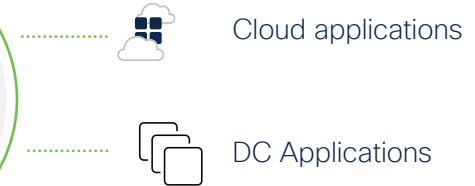
1 Identify the User/Device

- Cisco ISE is the **Identity Provider**
- ISE updates SD-WAN Manager



3a Continuously Check Posture

- ISE evaluates device **Security Posture**
- ISE updates **SGT** of device



2 Enforce Security Policy

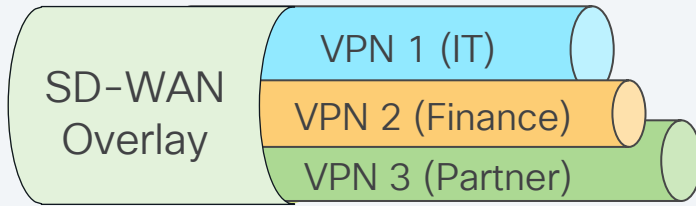
- SD-WAN Manager is the **Policy Engine**
- Policy created based on **Identity**

3b Respond to Change in Posture

- SD-WAN Manager learns of **change in security**
- Security policy is automatically updated

Segmentation is built into SD-WAN

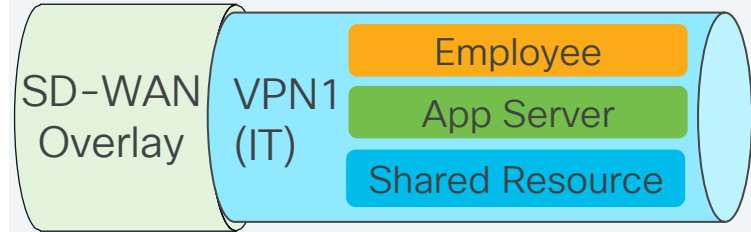
Macro Segmentation



VPN Level Segmentation

- IT VPN
- Finance VPN
- Partner VPN

Micro Segmentation



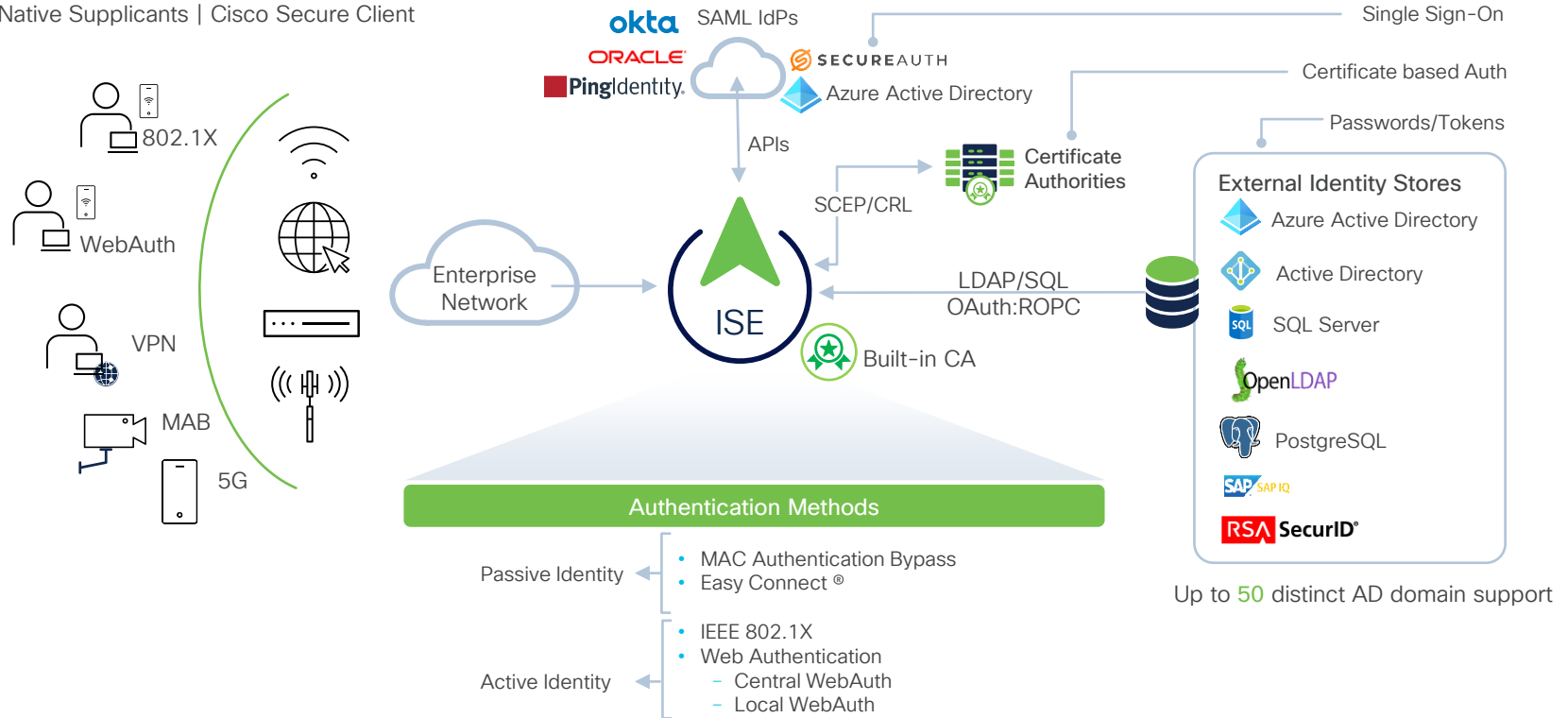
Group Level Segmentation

Example: IT VPN

- Employee
- App Server
- Shared Resource

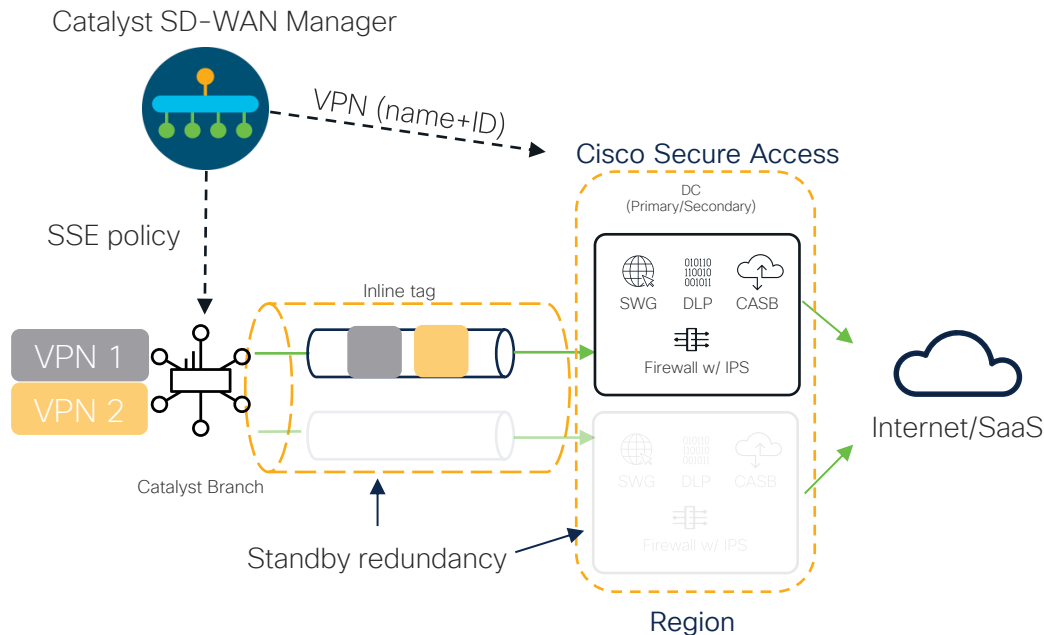
ISE Secure access control options

Native Supplicants | Cisco Secure Client



Context-Sharing: Extending VPN-id segmentation to Cisco Secure Access

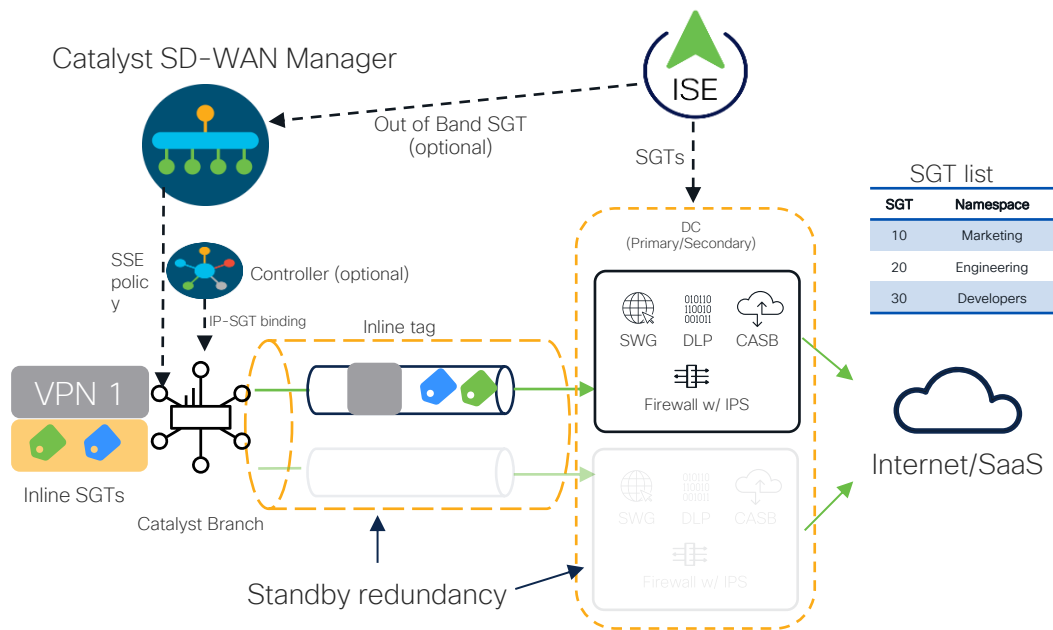
Catalyst SD-WAN + Cisco Secure Access



1. Catalyst Manager integrates with Cisco Secure Access using SSE cloud credentials.
2. Cisco Secure Access learns VPN identities using APIs (OOB)
3. In Catalyst SD-WAN Manager the Secure Service Edge policy group is configured to share VPN context in tunnels
4. Once tunnels are up, VPN identity is shared in the IPsec metadata header inline
5. VPN identities are leveraged in Secure Access internet access policies
6. Packets with VPN ID context are then subject to Secure Access policy match as source objects

Context-Sharing: micro-segmentation (SGT) to Secure Access

Catalyst SD-WAN + Cisco Secure Access



1. Cisco Secure Access establishes a secure connection with ISE context-services to consume SGTs
2. Learned SGTs can be leveraged to define access policies for branch accessing Internet/SaaS applications
3. In Catalyst Manager the Secure Service Edge policy group is configured to share SGT context in tunnels
4. Once tunnels are up, SGT identities, learned from enterprise are shared inline in the IPsec meta data header towards Cisco Secure Access.
5. Packets with SGT ID context are then subject to SSE policy match as source objects in the
6. SGT to IP Mapping can be learn both using inline or using OOB catalyst SD-WAN Manager ISE integration. Inline tag preferred over OOB.
7. Both VPN and SGT can be shared together

Management and Reporting

SD-WAN manager SecOps dashboard

1 Firewall Rule counter
Overview of top rule hits within network with an ability to drill down to individual device level

2 Top Threats
Overview of the critical threats (IPS/AMP) in the network

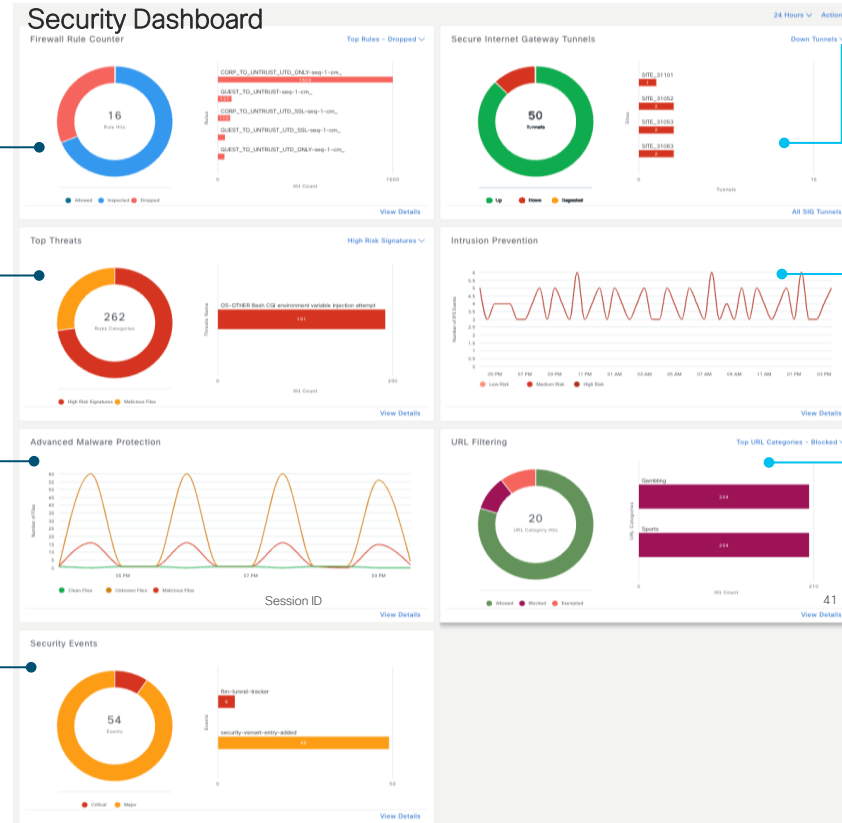
3 Advanced Malware Protection
Trend of incoming files in the network. Categorized into clean, unknown and malicious

4 Security Events
Displays raw events captured in the network

5 Secure Service Edge (Cisco Catalyst SD-WAN secure internet gateway – SIG)
Provides the status of each SIG tunnel hosted by the SD-WAN routers

6 Intrusion Prevention
Trend of IPS events in the network with an ability to view event details and associated devices

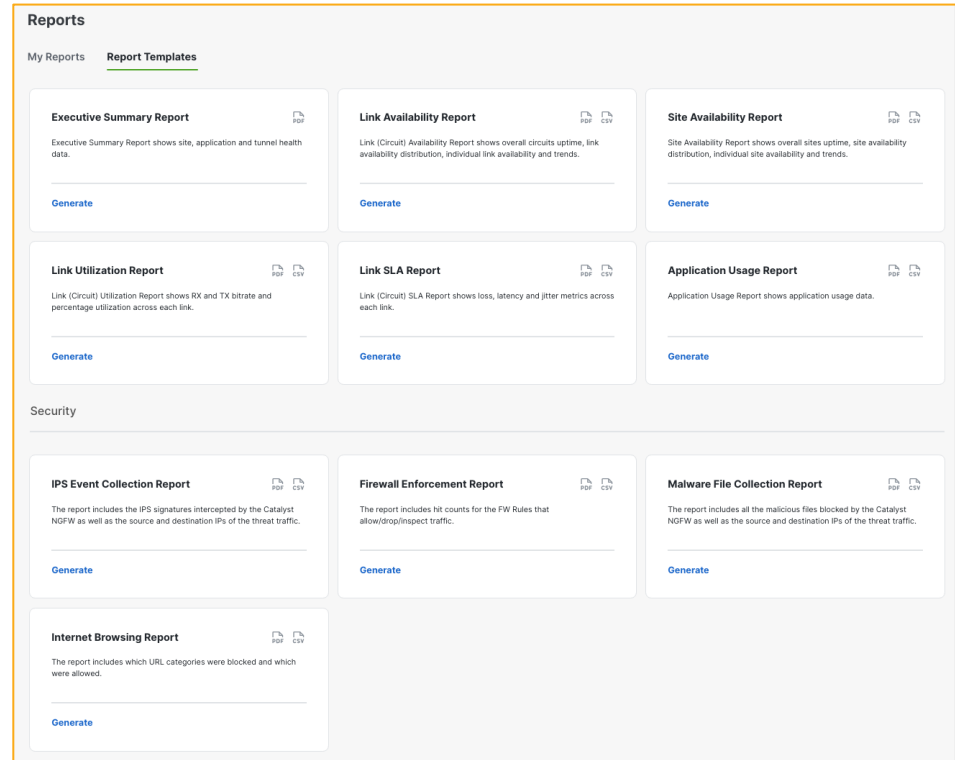
7 URL Filtering
Displays web categories accessed by the user



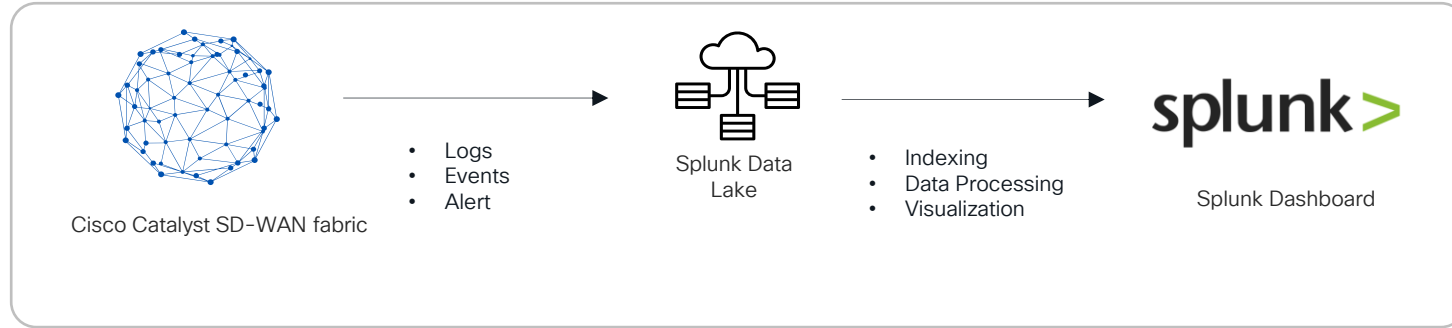
Customers can customize the dashboard on this security dashboard

Catalyst SD-WAN Manager Security Reports

- Configuration workflow for generating security-related reports is the same as configuring for site, tunnel, application, etc..
- Reports can be generated in either PDF or CSV format.
- Security reports can also be generated at a recurring interval with the option of email delivery.



Cisco Catalyst SD-WAN & Splunk integration



SoC Dashboard

- Holistic view of all security events
 - Top Threats & Policy Hits
 - Overall Application Traffic
- Drill down to device level from any security widget (user/sgt)

Flow Analysis

- View device network patterns
- Top applications accessed
- Top website domains visited
- Generate reports

Threat Management

- List all IPS events in the network
- List all Malware events in the network
- View which devices are impacted by threat events

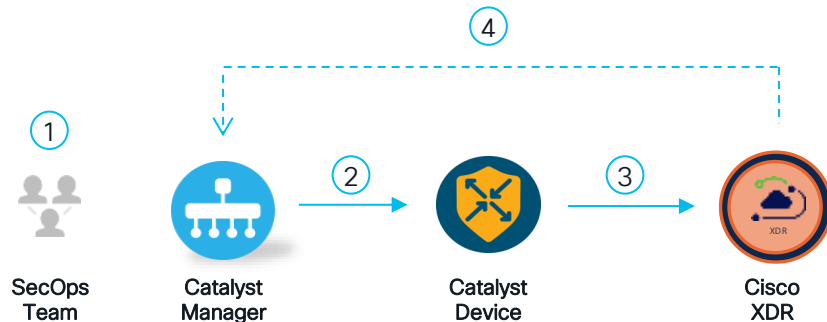
App URL: <https://splunkbase.splunk.com/app/6657>

App Add-on: <https://splunkbase.splunk.com/app/6656>

HSL Add-on: <https://splunkbase.splunk.com/app/6872>

Cisco eXtended Detection and Response (XDR)

Customer Journey



- 1 Purchase single SKU
- 2 Initiate workflow from Manager
- 3 Threat Incident analysis & correlation
- 4 Visualize analytics on Manager

Event Correlation

- Collect Telemetry from WAN, LAN and endpoints
- Correlate security events

Anomaly Detection

- Establish baseline for user/device behavior
- Detect anomalies and malicious events

Threat Remediation

- Security Incident creation
- Automatic threat remediation using AIOps

Microsoft Sentinel – SD-WAN security visualization

Comprehensive Visibility

- Visualize SD-WAN Security events
- Comb through Firewall rule data
- Drill down to device, user and flow levels

Microsoft Azure Fabric

- Strong Cisco / Microsoft Partnership
- 100+ customers already use Azure fabric
- Interconnect other MSFT Services

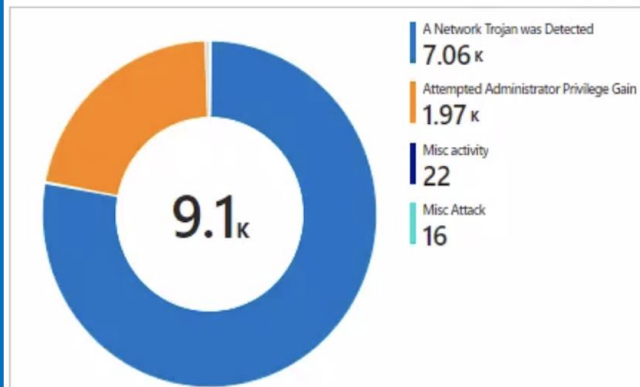
Act on the Threats

- Threat Hunting
- Execute Playbooks
- Analyze threats based on MITRE ATT&CK framework

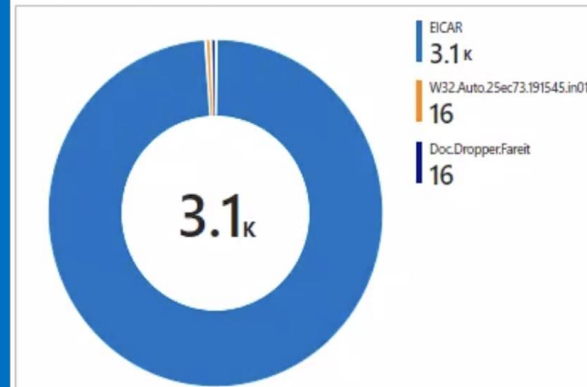
Asset Protection

- Visualize threat events captured by the SD-WAN Security Stack
- Comb through Intrusion attempts to your network entities
- Parse through all the malicious files captured in your network

Blocked Connections Over IPS event



Malicious Files by Malware



Keynote Deep Dives

Wednesday
10:30am – 11:30am



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