The bridge to possible

Segmentation with Cisco Catalyst SD-WAN and ISE

Steve Penland – Solutions Engineer

BRKENT-2166

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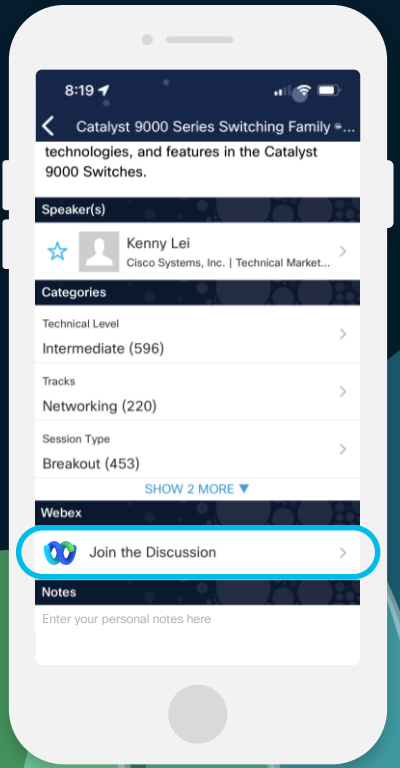
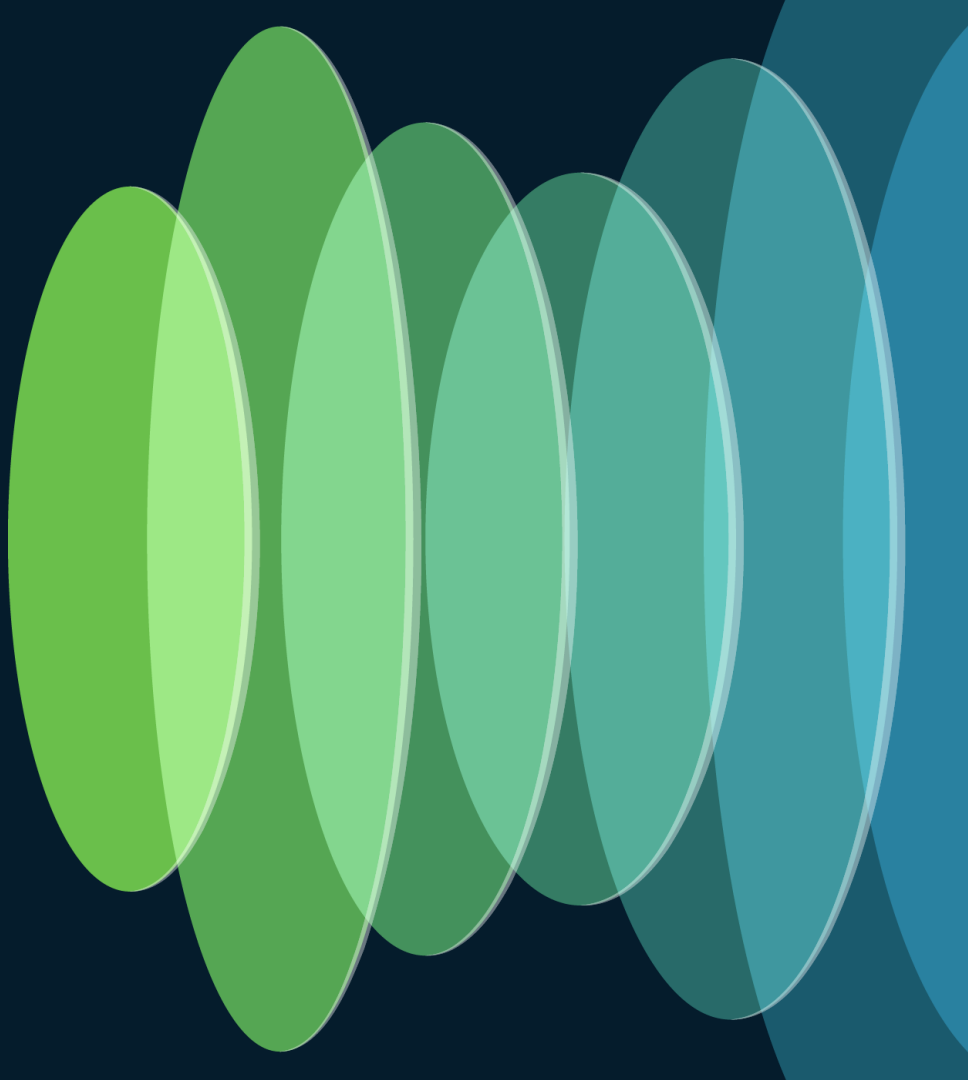


Agenda

- Introduction
- Macrosegmenation
- Microsegmentation
- Demo
- Identity Based FW Rules
- Conclusion

Introduction



Why is network segmentation important?

Advancing Zero Trust Maturity Throughout the Network and Environment Pillar

Executive summary

After gaining access to an organization's network, one of the most common techniques malicious cyber actors use is lateral movement through the network, gaining access to more sensitive data and critical systems. The Zero Trust network and environment pillar curtails adversarial lateral movement by employing controls and capabilities to logically and physically segment, isolate, and control access (on-premises and off-premises) through granular policy restrictions.

https://media.defense.gov/2024/Mar/05/2003405462/-1/-1/0/CSI-ZERO-TRUST-NETWORK-ENVIRONMENT-PILLAR.PDF

The fundamentals of segmentation

- Identify device/user and determine access to network
  - Is the user trusted and on a managed device?
  - If unmanaged is the device allowed on the network?
  - Is the device patched and in compliance?
- Assign to segment
  - VLAN, VRF, SGT
- Create and enforce policy
  - Which segments are allowed to communicate with each other and over what protocols?

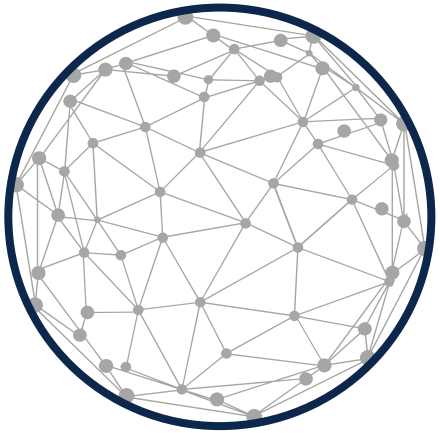
Challenges of creating end to end segmentation

- VLANs and ACLs
  - Traditionally static and managed per device
  - IP based
- VRF
  - Multi VRF over private transport can be expensive
  - Multi VRF over internet requires an overlay with complex configuration
- SGTs
  - Maintaining SGT markings end to end can be challenging
  - IP to SGT binding scale

ISE and SD-WAN enable segmentation

Policy engine

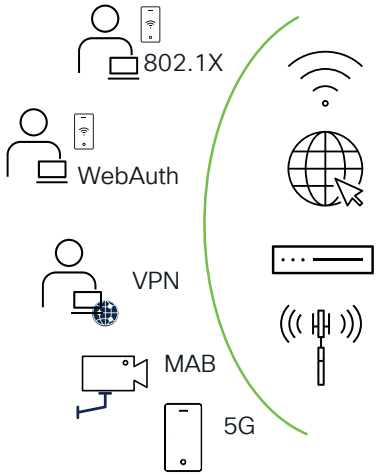
Catalyst SD-WAN

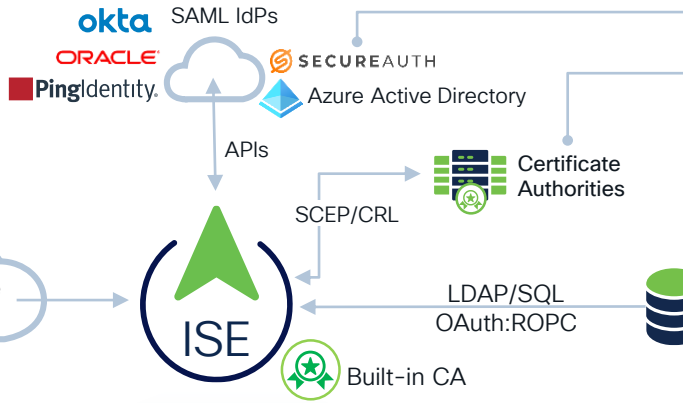


Transport and enforcement

ISE Secure Access Control Options

Native Supplicants | Cisco Secure Client





Up to 50 distinct AD domain support

Authentication Methods

Passive Identity
- MAC Authentication Bypass
- Easy Connect ®

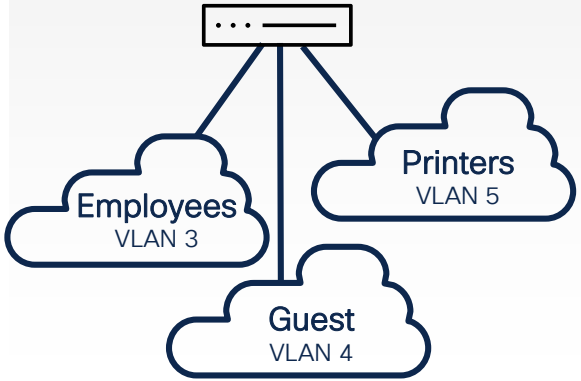
Active Identity
- IEEE 802.1X
- Web Authentication
  - Central WebAuth
  - Local WebAuth

Authorization Enforcement Options

Beyond RADIUS Access-Accept / Access-Reject

VLANs

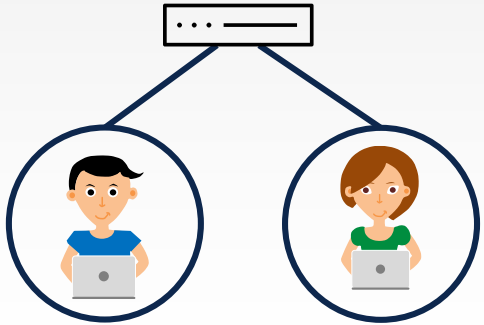
Dynamic VLAN Assignments



Per port / Per Domain / Per MAC

ACLs: DL, Named, DNS

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



Employee

```
permit ip any any
```

Contractor

```
deny ip host <critical>
permit ip any any
```

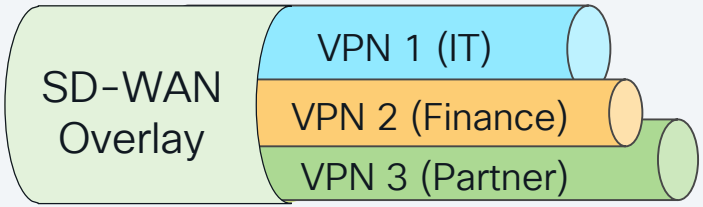
Security Group Tags

Cisco Group-Based Policy

16-bit SGT assignment and
SGT based Access Control

Segmentation is built into SD-WAN

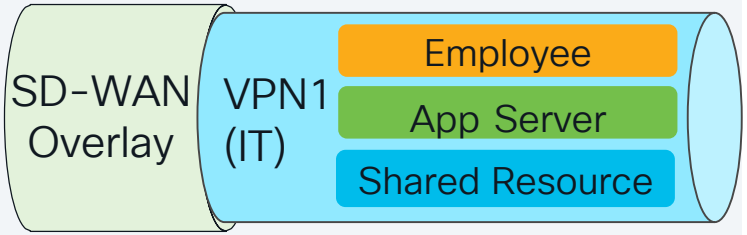
Macro Segmentation



VPN Level Segmentation

- IT VPN
- Finance VPN
- Partner VPN

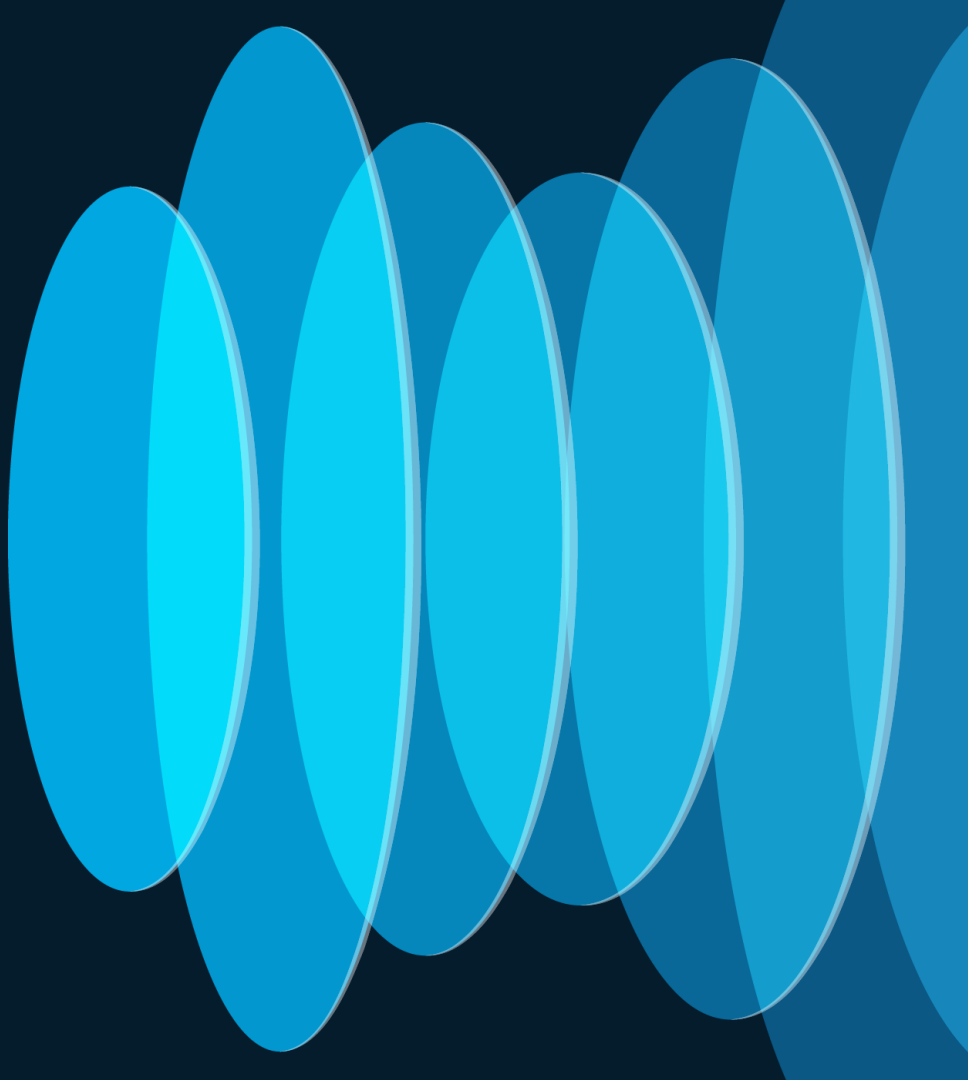
Micro Segmentation



Group Level Segmentation
Example: IT VPN

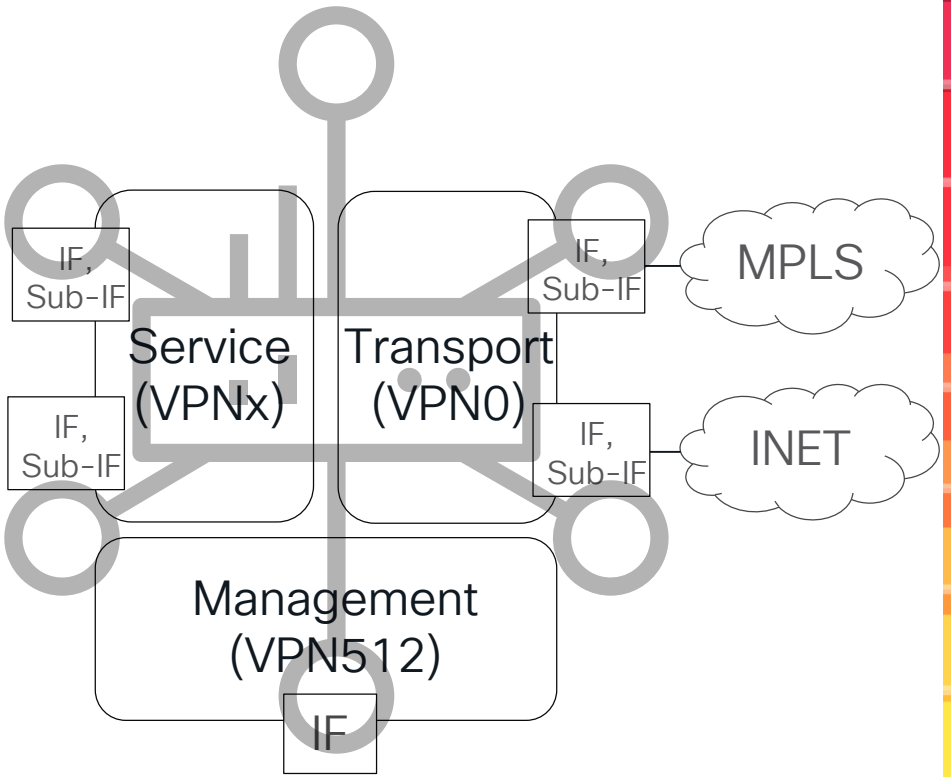
- Employee
- App Server
- Shared Resource

Macro Segmentation



What is a VRF or VPN?

- VRF and VPN both refer to the same thing.
  - Traditionally Cisco has used VRF
  - Catalyst SD-WAN uses the term VPN
- Separate routing domains
- By default, a device in one VPN cannot talk to a device in another VPN.

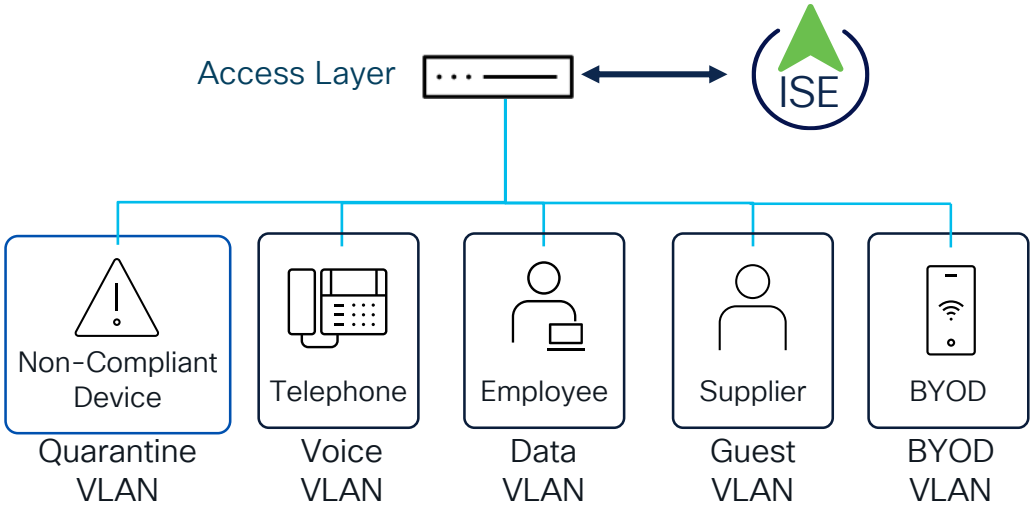


Common Uses

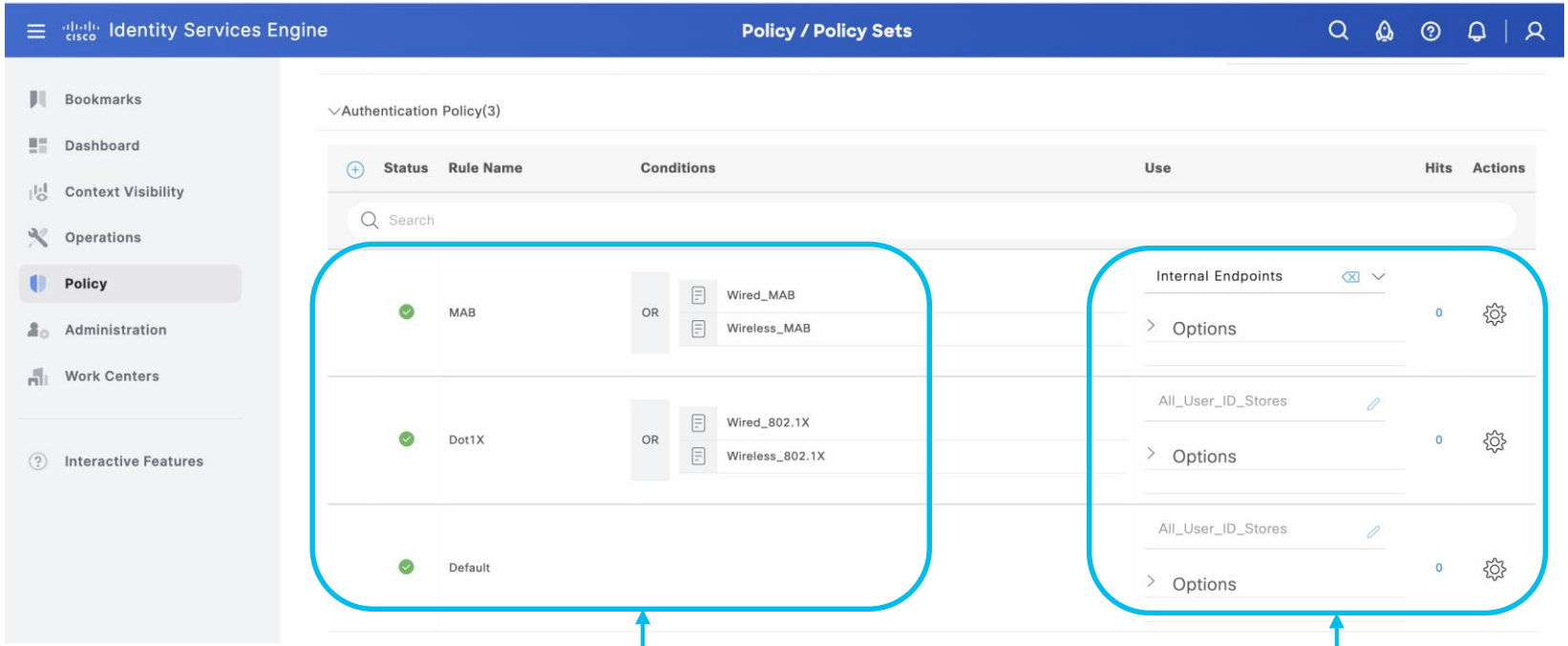
- Segmenting devices that should have very limited (controlled) needs to communicate outside their VPN.
  - Employees
  - Guest Users
  - IOT Devices
- Compliance – PCI DSS, HIPPA, NERC CIP, etc…
- Mergers and acquisitions

How are users/devices placed into the correct VPN

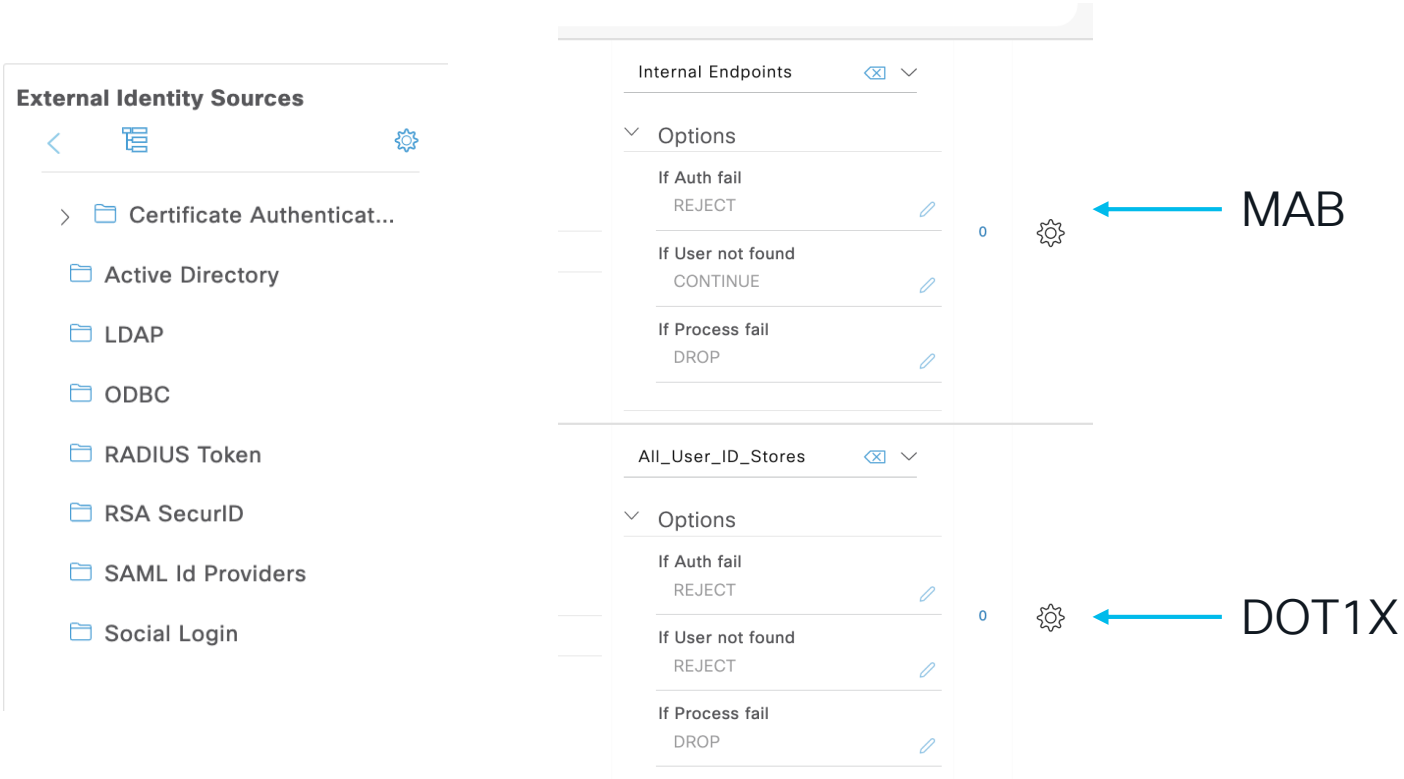
- Endpoint is attached to the network access device (NAD).
- NAD communicates with ISE (RADIUS) to authenticate the device.
- If authentication is successful ISE provides the NAD the dynamic VLAN assignment and dynamic ACL.



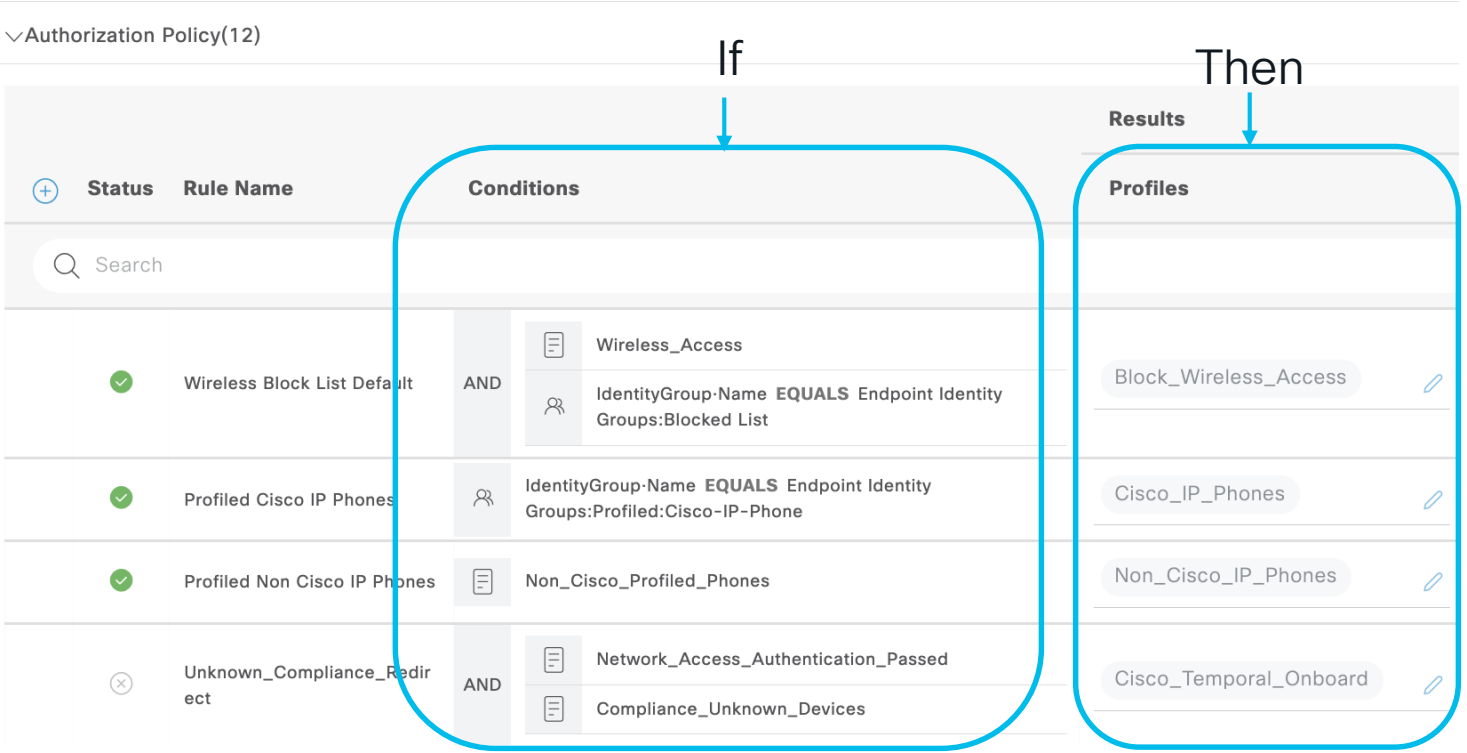
ISE Default Authentication Policy



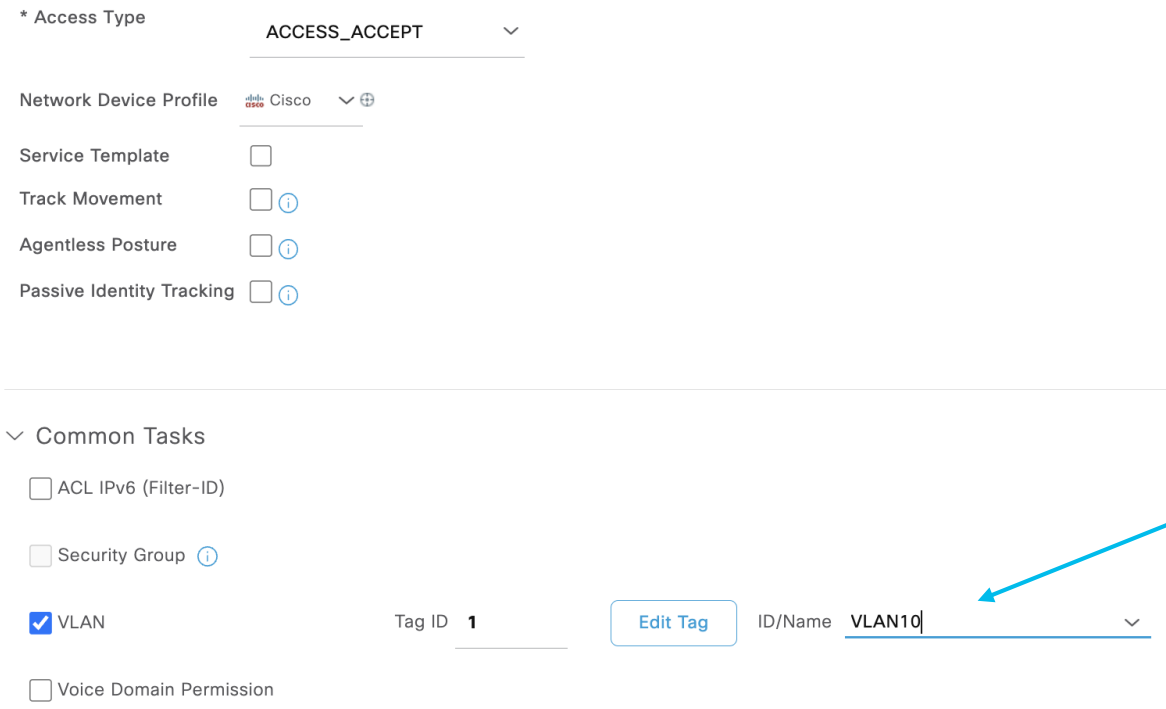
ISE Default Authentication Policy



ISE Default Authorization Policy



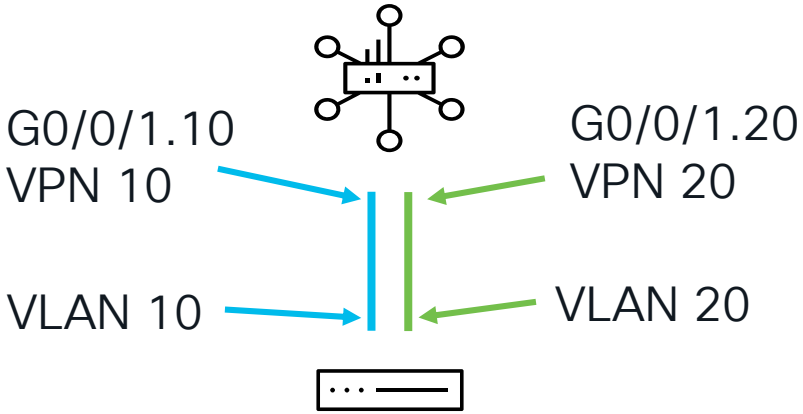
ISE Authorization Profile



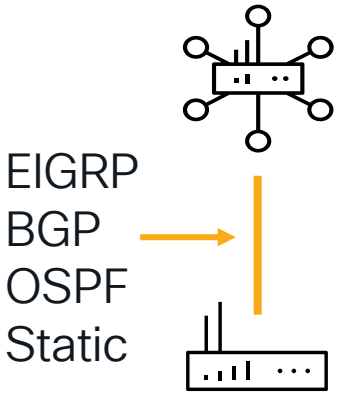
Assign VLAN

Connecting the LAN to the WAN

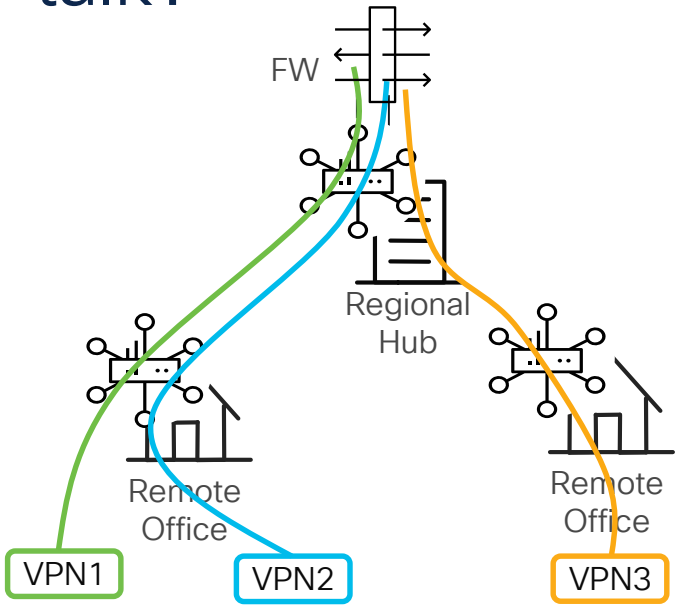
L2 trunk from LAN to WAN with router sub interfaces in different VPNs



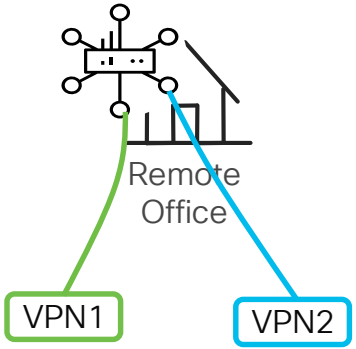
VRF aware routing protocol between LAN and WAN.



What if devices in two different VPNs need to talk?

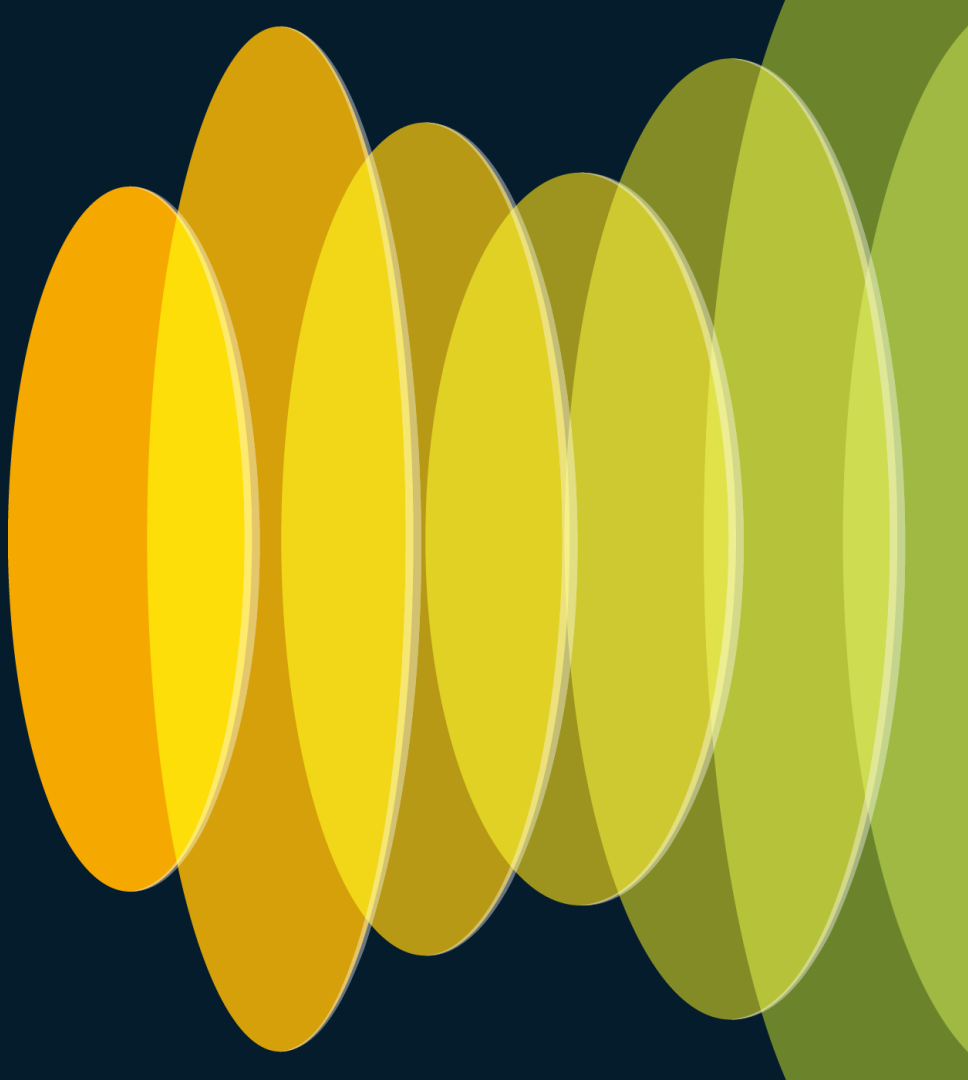


Route through aggregation point.



Local VPN leaking with built in NGFW capabilities.

Microsegmentation with SGTs



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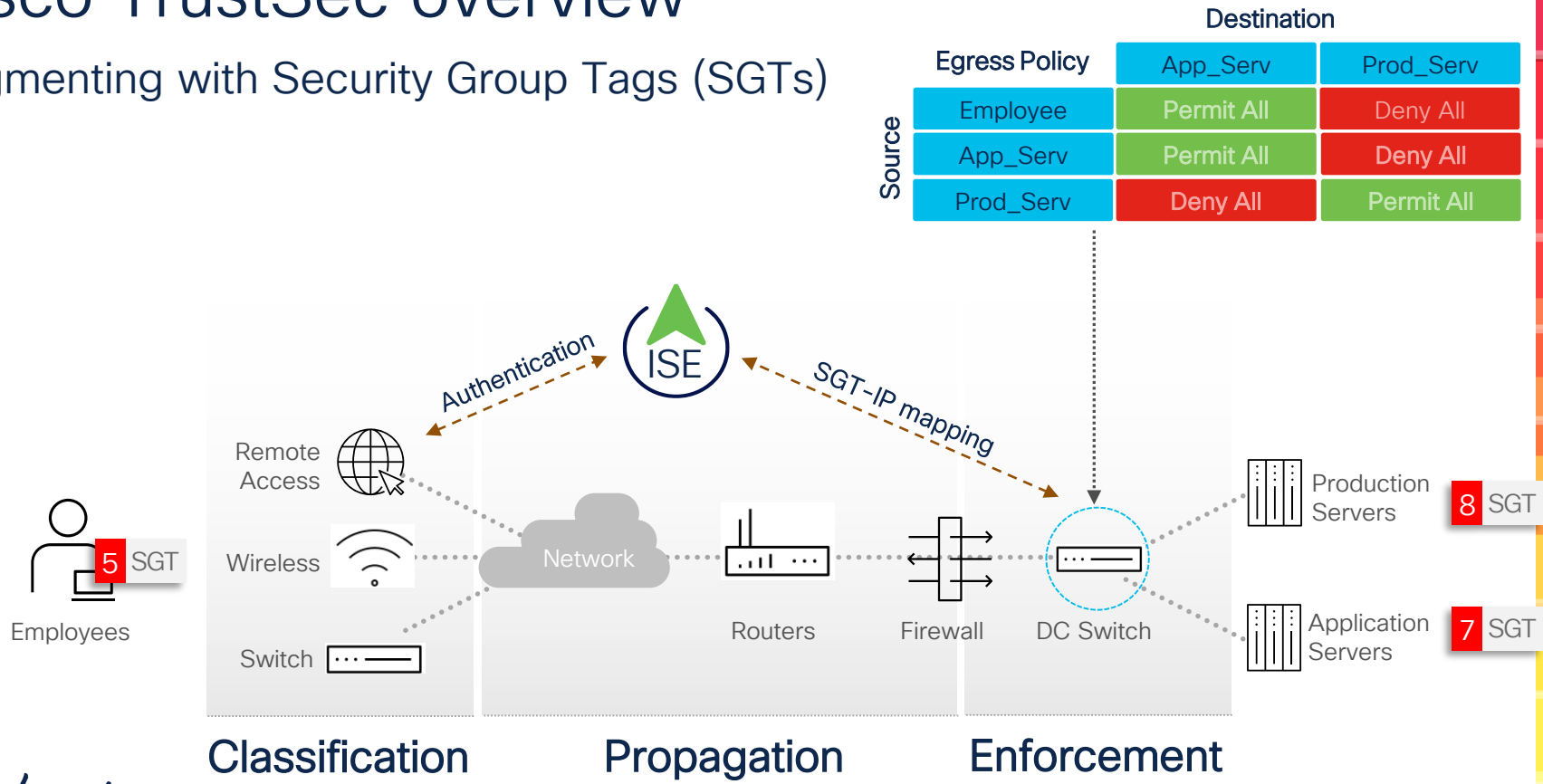
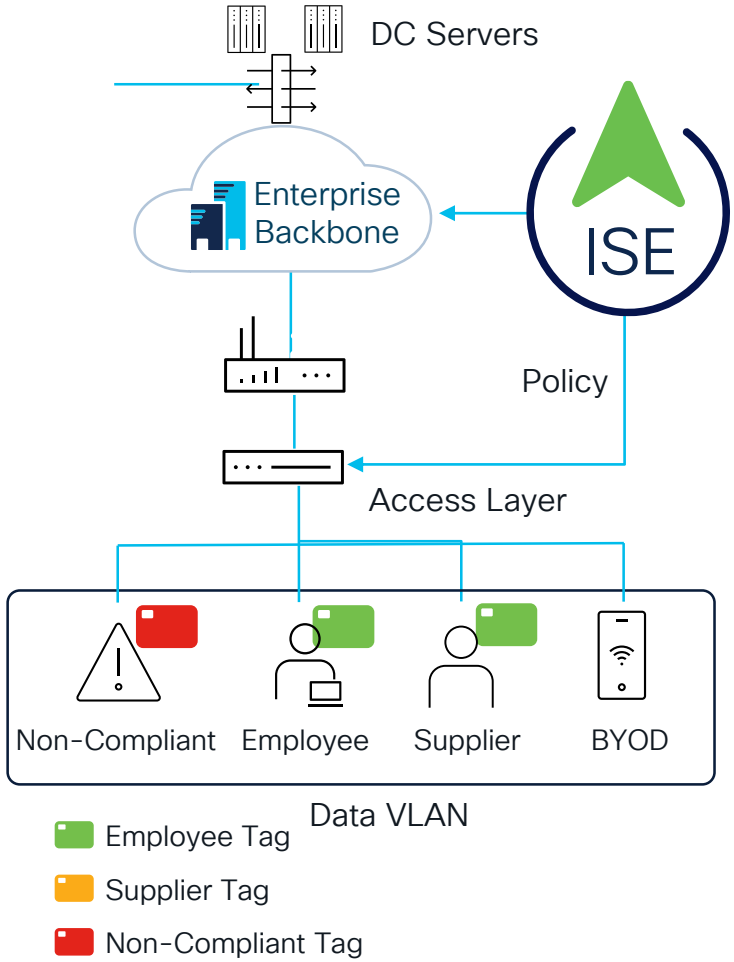
Cisco TrustSec overview

Segmenting with Security Group Tags (SGTs)



SGT Classification

- SGTs are assigned to devices as they are authenticated onto the network.
  - 802.1x
  - MAB
  - Web Portal
- No VLAN change
- No topology change
- Packets are marked on ingress.



SGT Authorization Policy

Authorization Policy(12)

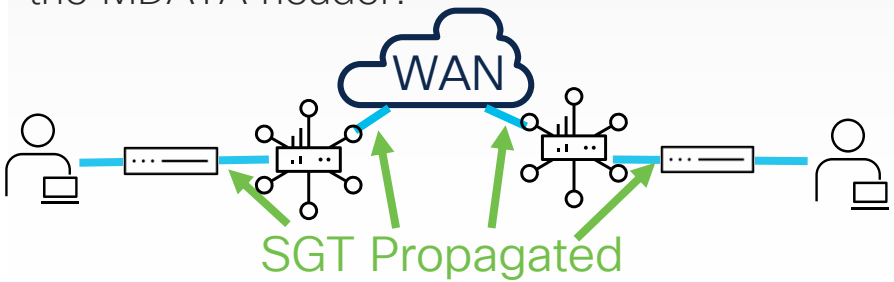
Status	Rule Name	Conditions		Results: Profiles	Results: Security Groups
		Search			
	NonCompliant_Devices_Redirect	AND	Network_Access_Authentication_Passed Non_Compliant_Devices	Cisco_Temporal_Onboard	Quarantined_Systems
	Compliant_Devices_Access	AND	Network_Access_Authentication_Passed Compliant_Devices	PermitAccess	Employees
	Employee_EAP-TLS	AND	Wireless_802.1X BYOD_is_Registered EAP-TLS MAC_in_SAN	PermitAccess	BYOD
	Employee_Onboarding	AND	Wireless_802.1X EAP-MSCHAPv2	NSP_Onboard	BYOD
	Wi-Fi_Guest_Access	AND	Guest_Flow Wireless_MAB	PermitAccess	Guests

Propagation Methods

Inline Methods

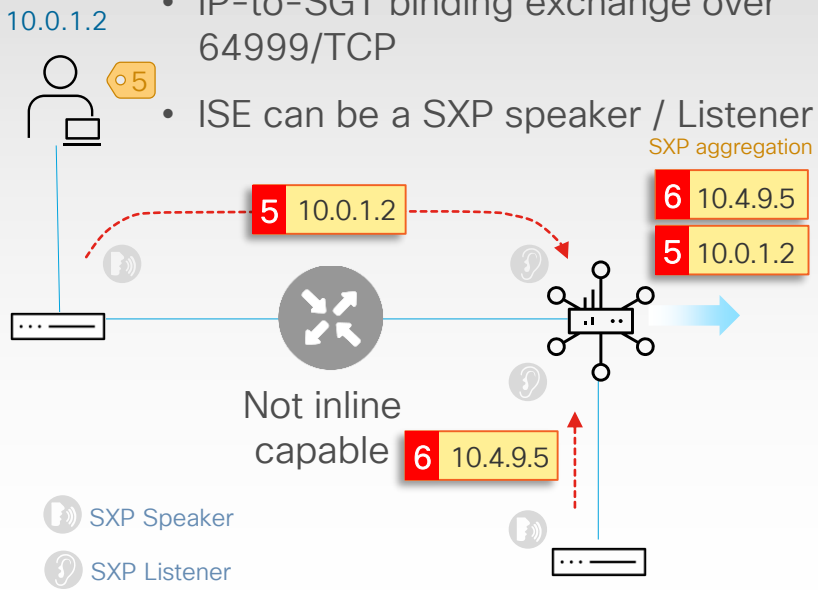
Ethernet Inline Tagging: (EtherType:0x8909) 16-Bit SGT encapsulated within Cisco Meta Data (CMD) payload.

SD-WAN: Edge router picks up the SGT from the Ethernet frame and encodes it into the MDATA header.

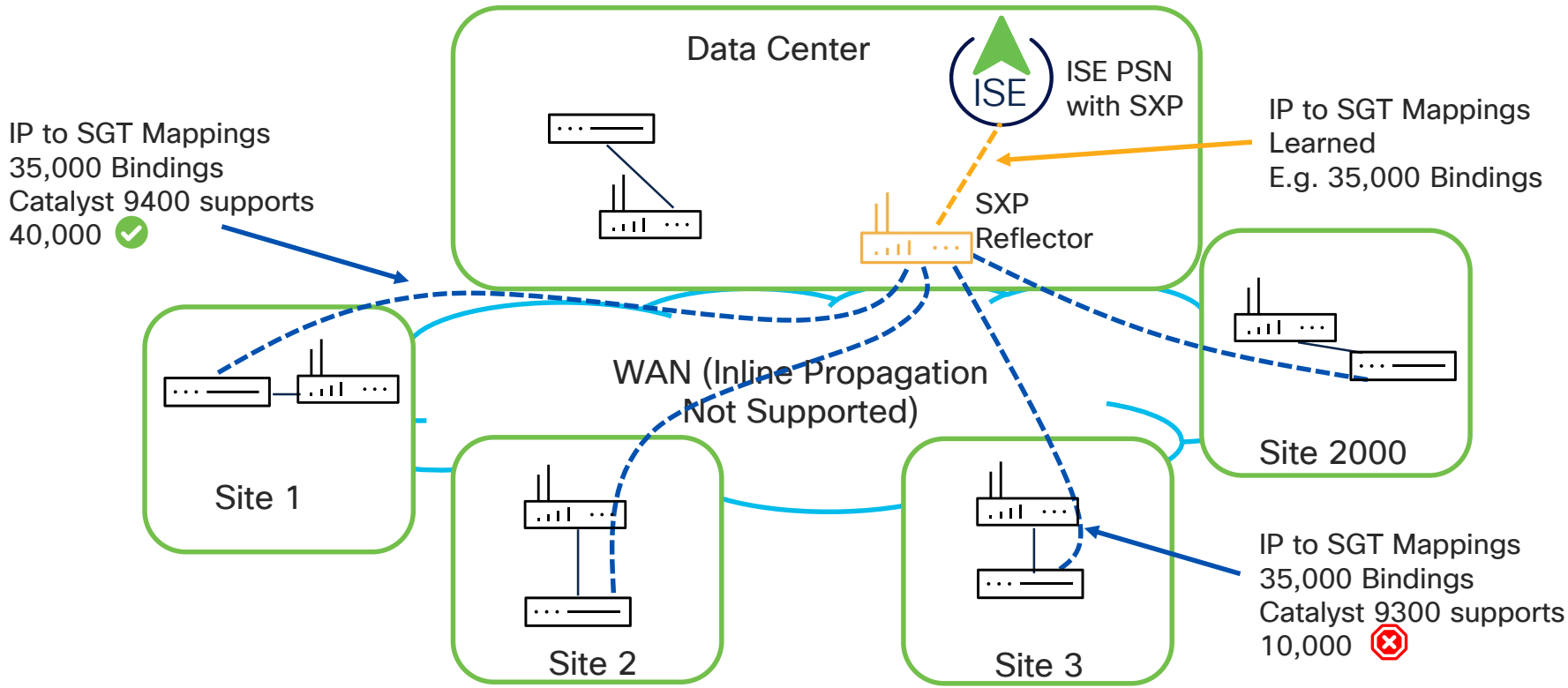


SGT Exchange Protocol (SXP)

- IP-to-SGT binding exchange over 64999/TCP
- ISE can be a SXP speaker / Listener



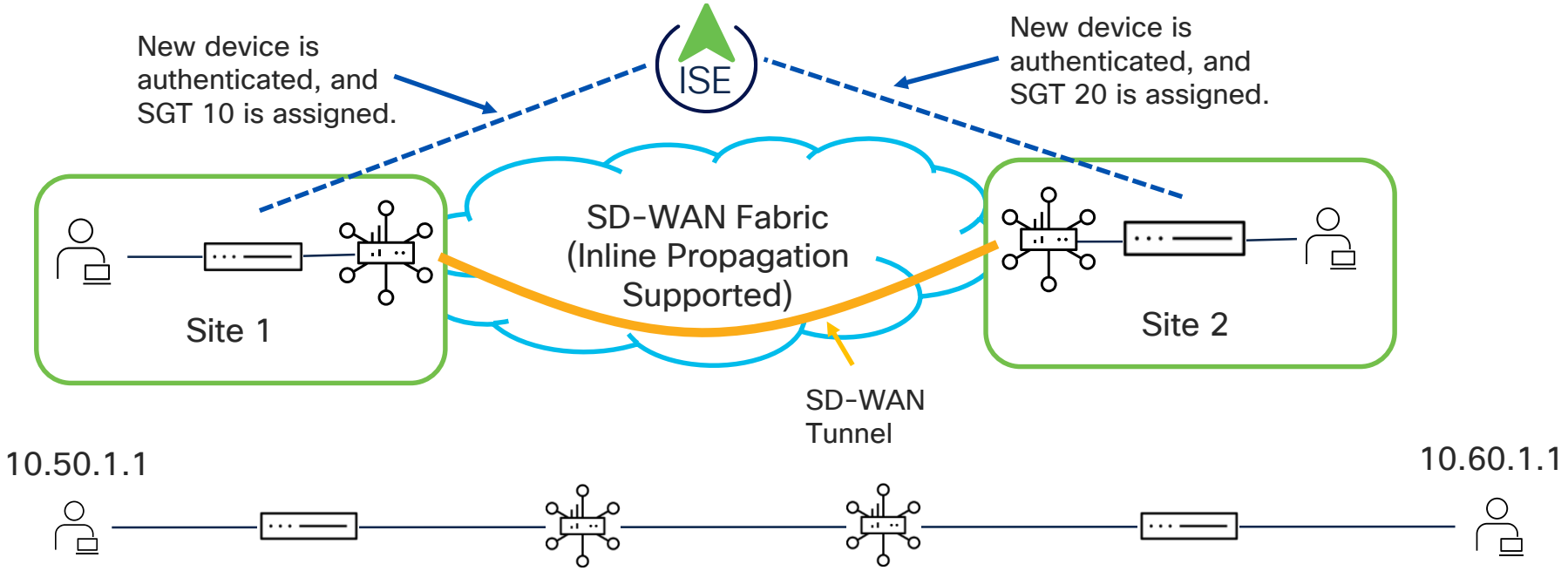
SXP Propagation Challenge



https://www.cisco.com/c/dam/en/us/solutions/collateral/enterprise-networks/trustsec/policy-platform-capability-matrix.pdf

https://www.cisco.com/c/en/us/td/docs/security/ise/performance_and_scalability/b_ise_perf_and_scale.html

SD-WAN inline propagation solves this problem.



Enable SGT propagation in SD-WAN

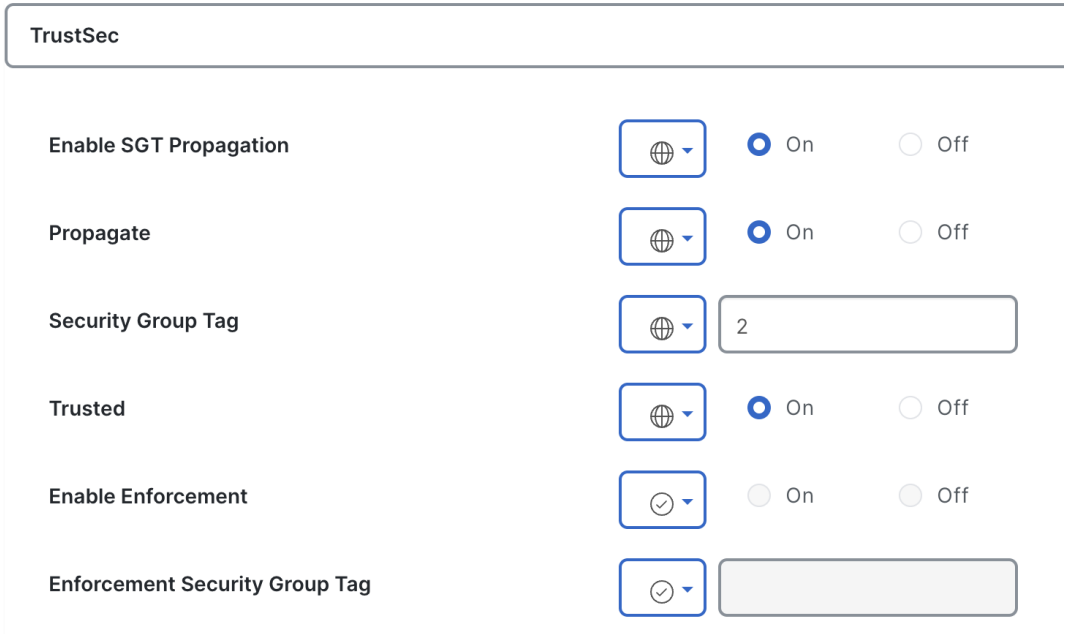
- WAN Interface
  - Enable CTS SGT Propagation for the tunnel.
  - No other changes to the WAN interface.


```
interface Tunnel1
 no shutdown
 ip unnumbered GigabitEthernet1
 no ip redirects
 cts manual
  exit
 tunnel source GigabitEthernet1
 tunnel mode sdwan
```

Enables CTS SGT Propagation (will momentarily flap the interface).

Enable SGT propagation in SD-WAN

- LAN (Service Side) Interface
  - Enable CTS SGT Propagation
  - Only L3 interfaces supported
  - Set SGT value to be assigned to untagged packets
  - Mark the interface trusted.



Enable SGT propagation in SD-WAN

LAN (Service Side) Interface Configuration

Enables interface for SGTs (will flap the interface and also increase the MTU by 8 bytes)

Trust SGTs received on the interface. If packet is received without SGT assign a source SGT of 2.

```
interface GigabitEthernet2
 no shutdown
 arp timeout 1200
 vrf forwarding 10
 ip address 10.10.10.1 255.255.255.252
 no ip redirects
 ip mtu 1500
 load-interval 30
 cts manual
  policy static sgt 2 trusted
 exit
```

TrustSec Policy

Production Matrix

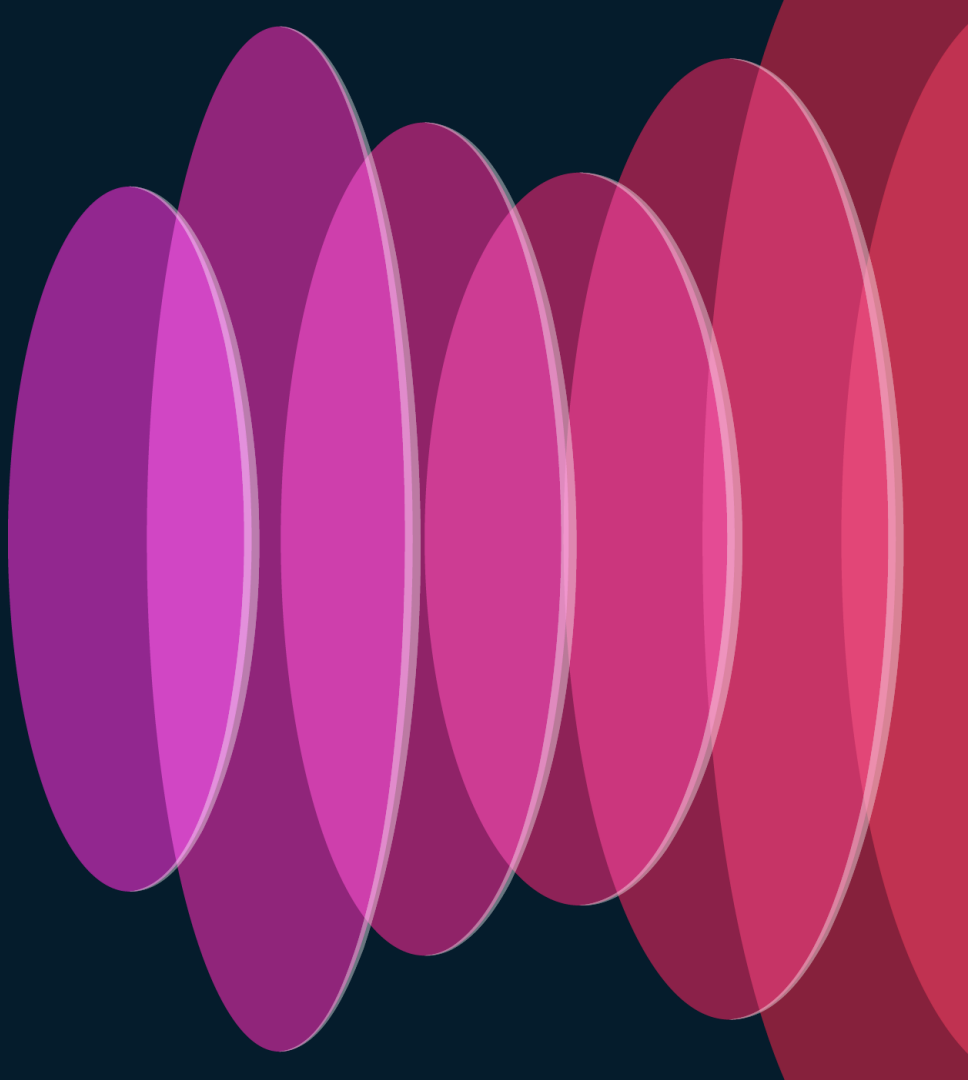
Populated cells: 53

Refresh

Edit | Add | Clear | Deploy | Verify Deploy | Monitor All - Off | Import | Export | View | All

Source \ Destination	BYOD 15/000F	Contractors 5/0005	Developers 8/0008	Development_Ser... 12/000C	Employees 4/0004	Guests 6/0006	Production_Serv... 11/000B	Quarantined_Sys... 255/00FF	TrustSec_Device... 2/0002	Unknown ?
BYOD 15/000F		Deny IP	Deny IP	Deny IP	Deny IP	Deny IP	permit_https	Deny IP		
Contractors 5/0005	Deny IP		Deny IP	Deny IP	Deny IP	Deny IP	permit_https	Deny IP	Deny IP	
Developers 8/0008						Deny IP		Deny IP		
Development_Ser... 12/000C						Deny IP		Deny IP		
Employees 4/0004				Deny IP			permit_https	Deny IP	permit_ssh	
Guests 6/0006	Deny IP	Deny IP	Deny IP	Deny IP	Deny IP		Deny IP	Deny IP	Deny IP	
Production_Serv... 11/000B				Deny IP		Deny IP		Deny IP		
Quarantined_Sys... 255/00FF	Deny IP	Deny IP	Deny IP	Deny IP	Deny IP	Deny IP	Deny IP	Deny IP	Deny IP	

Microsegmentation with SD-WAN Enforcement



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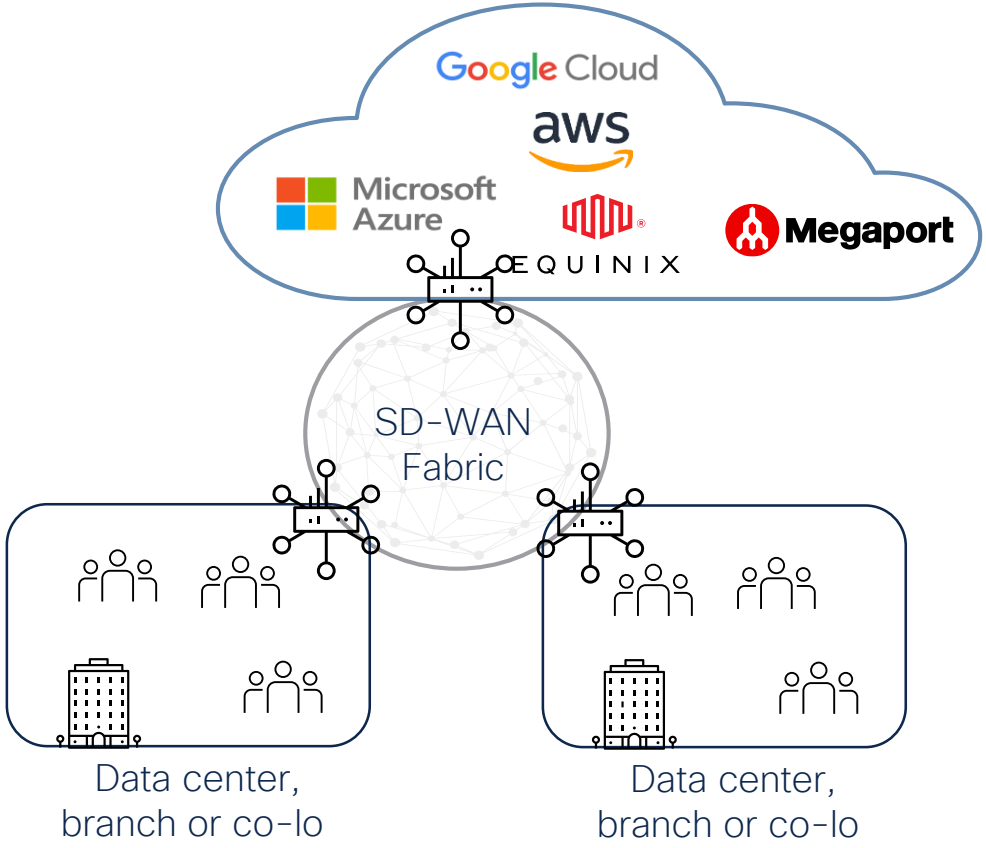
SD-WAN Router SGT Enforcement

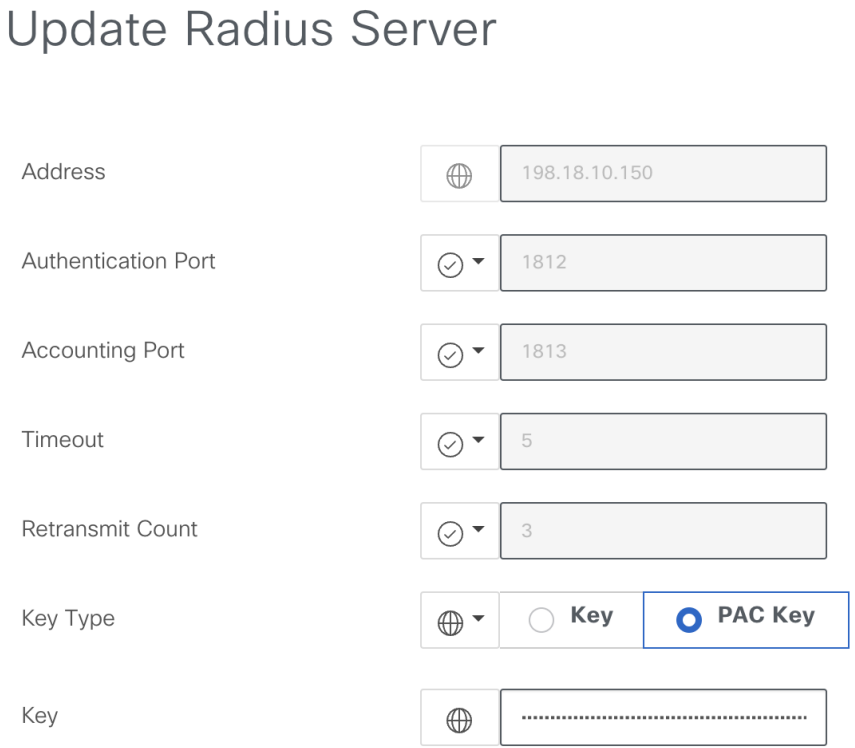
- Site uses access switches which are not capable of inline tagging or enforcement.
- Small site without switch.
- SGT enforcement in the cloud / SDCI.



SD-WAN Router Setup

To allow SGACL download to the router RADIUS must be configured.

Start by creating one or more RADIUS servers.

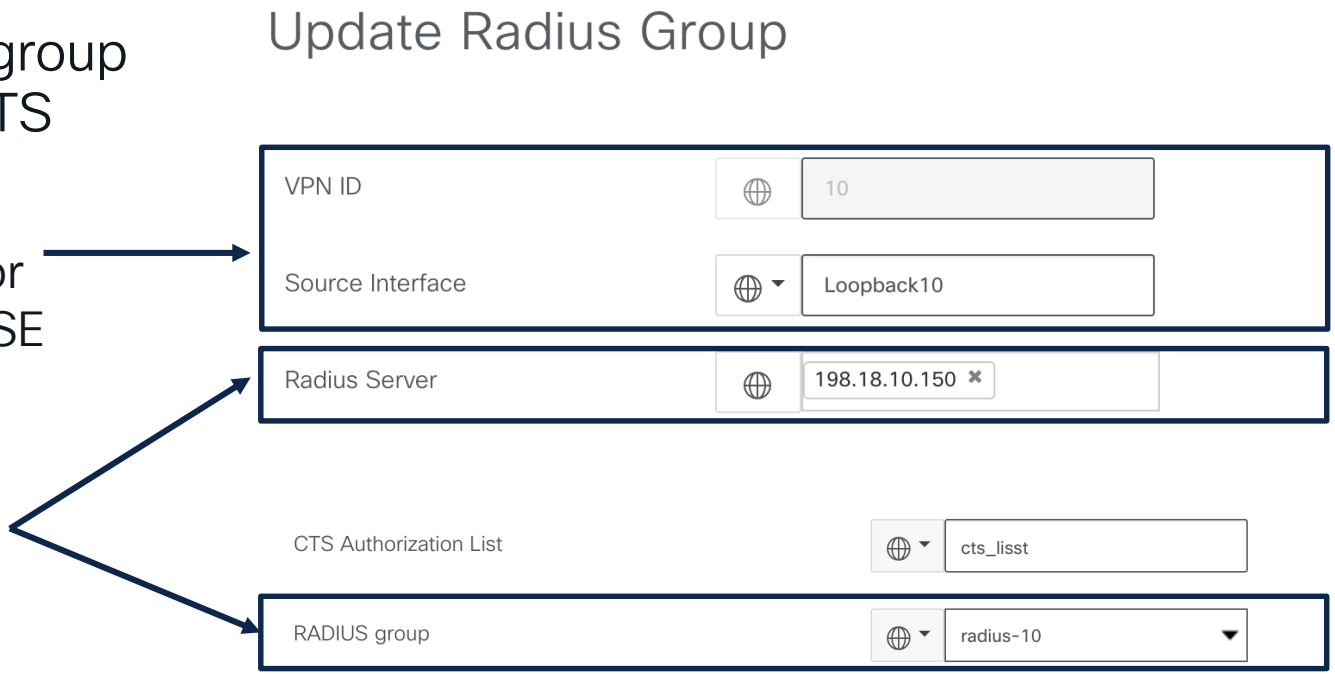


SD-WAN Router Setup Continued

Create RADIUS group and configure CTS

VPN and Source Interface used for router to reach ISE

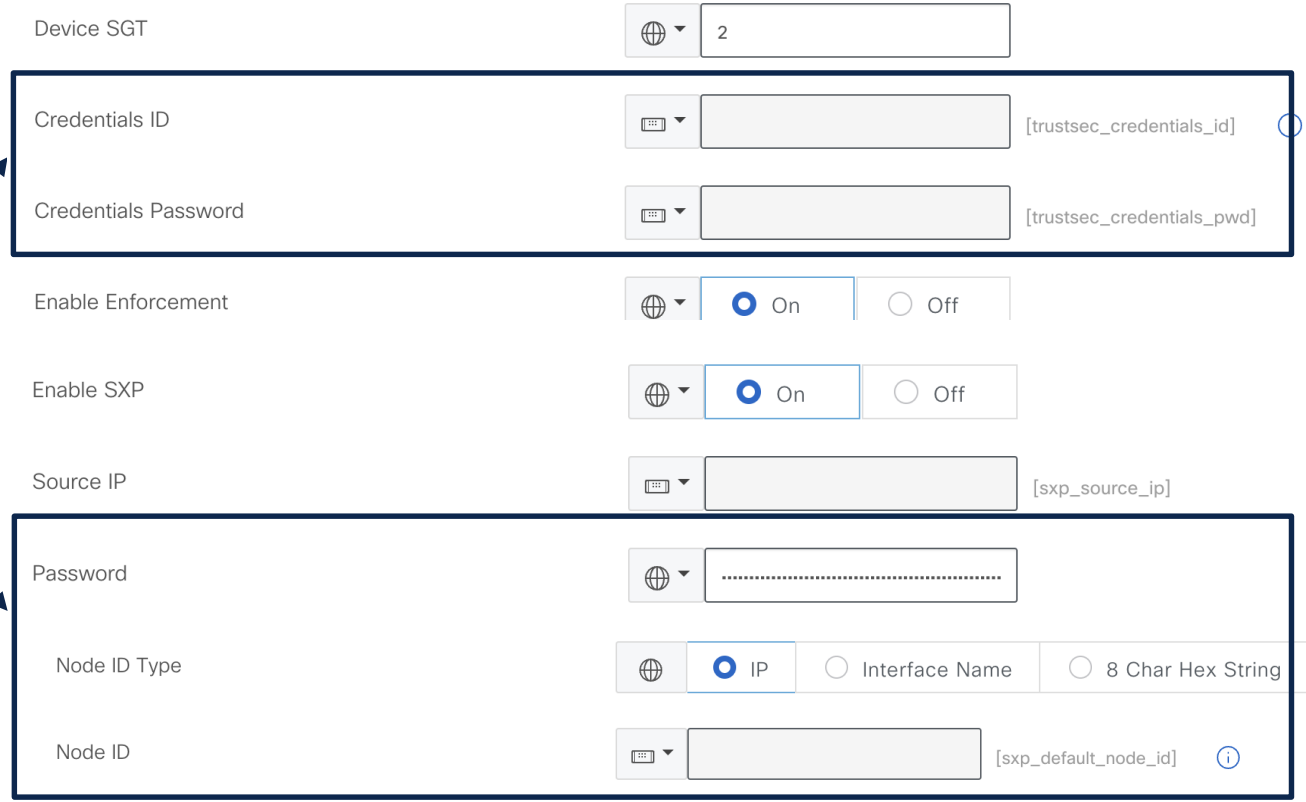
RADIUS server and RADIUS group created in previous step.



SD-WAN Router Setup Continued

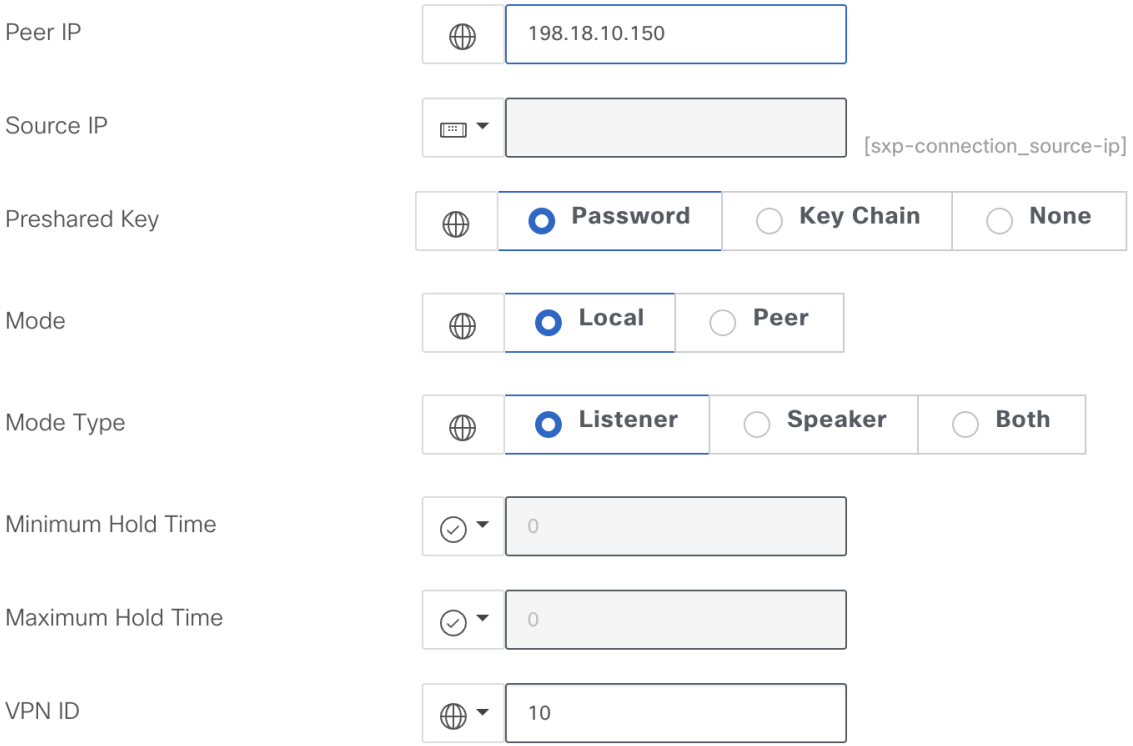
Configure SXP

Must match values in ISE



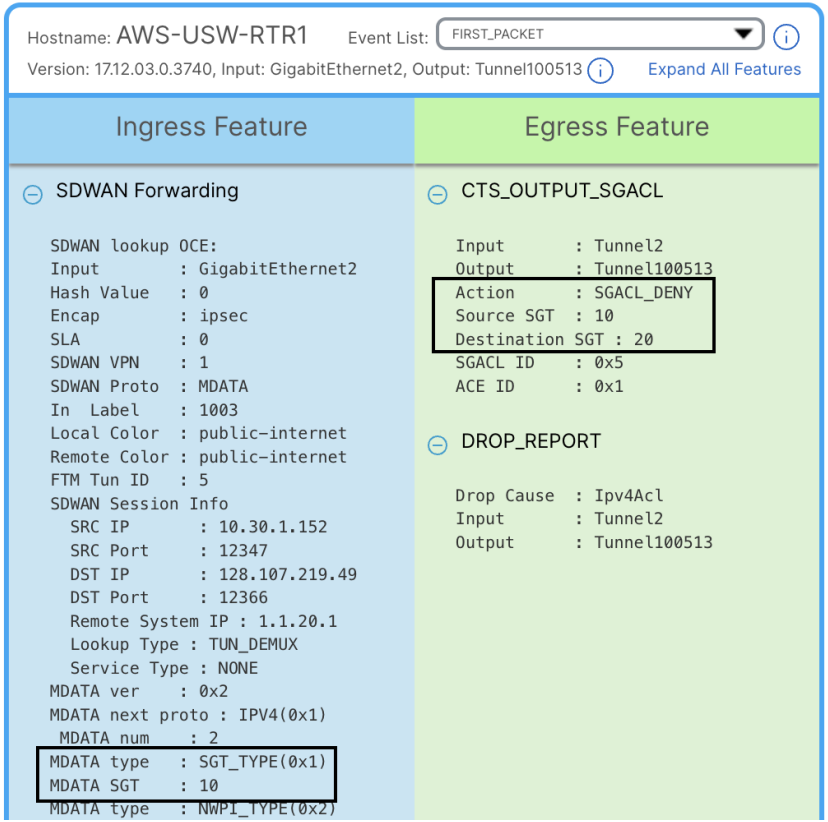
SD-WAN Router Setup Continued

Configure SXP Peer



SGT Enforcement Verification

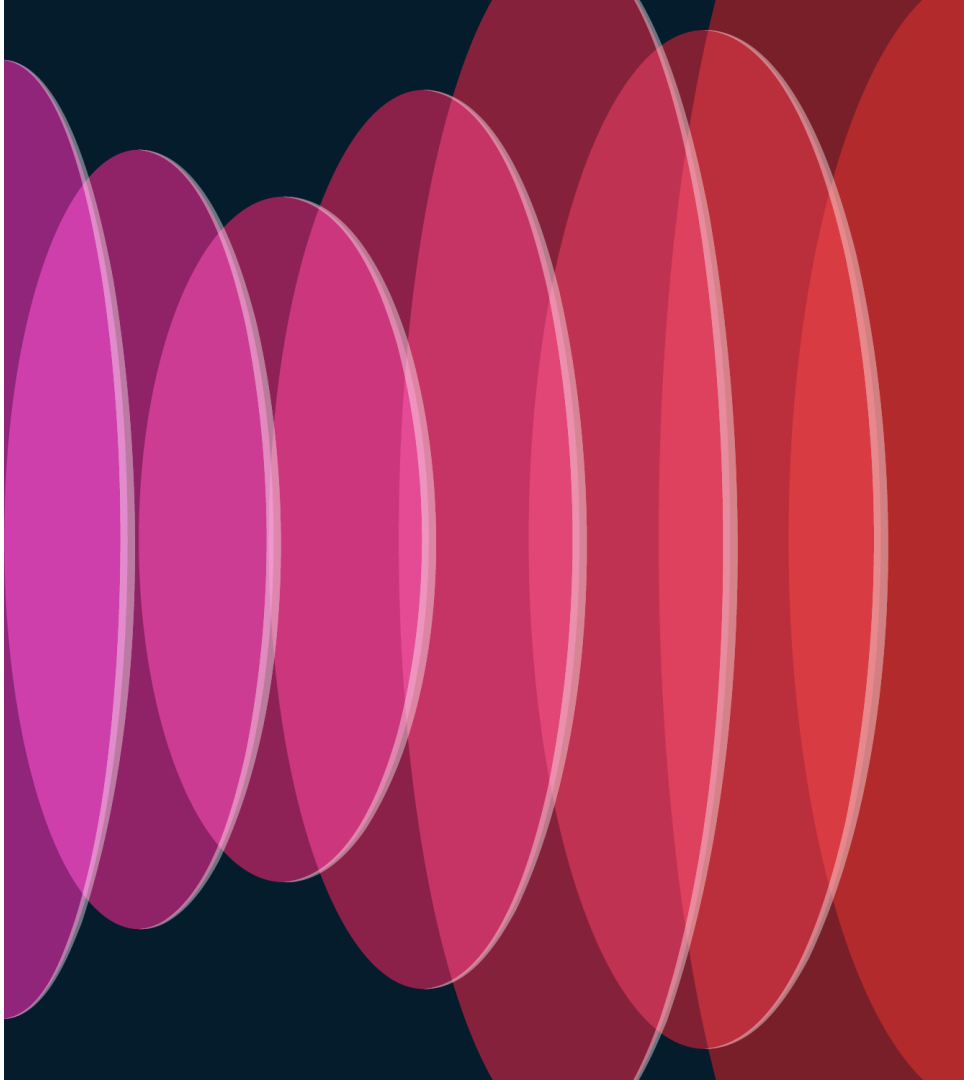
Network Wide Path Insights (NWPI) captures flow SGT information as well as SGACL enforcement.



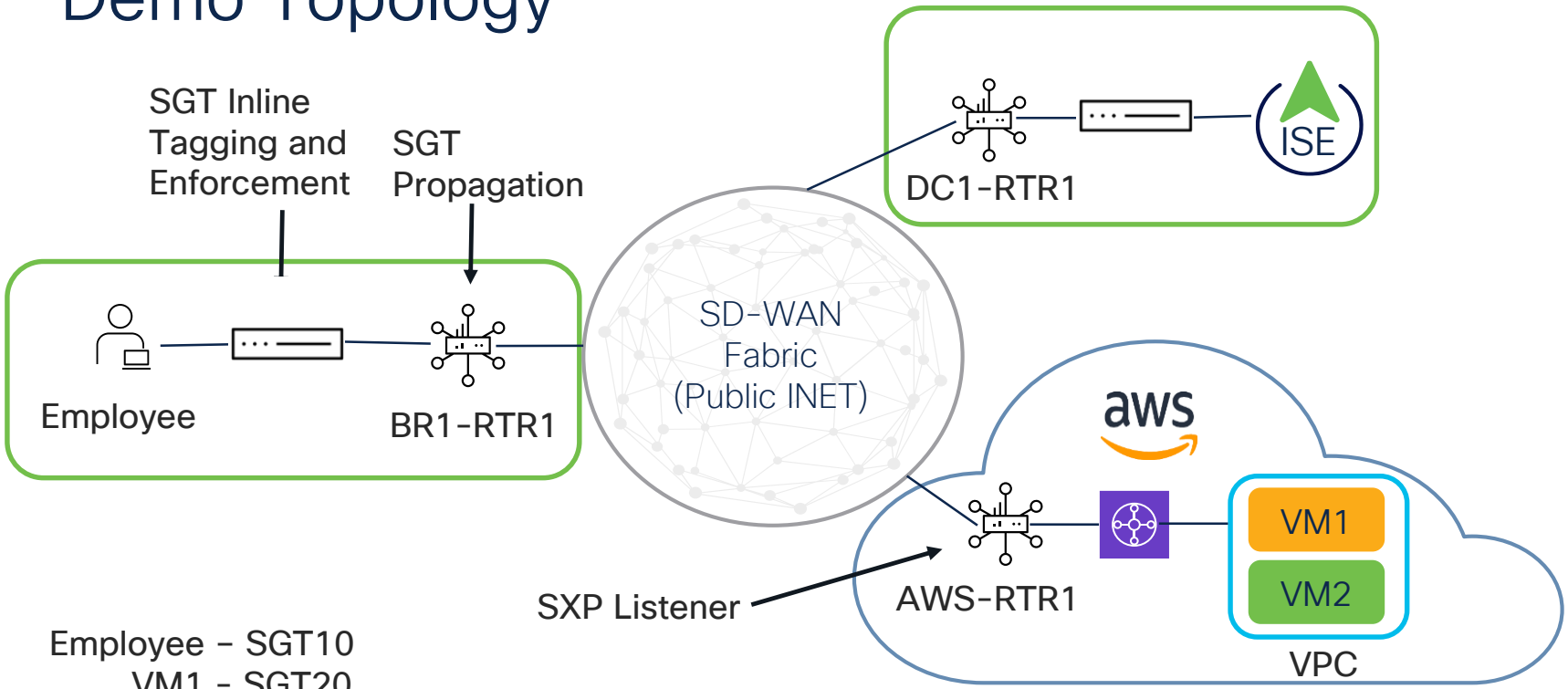
Useful Monitoring Commands

- show cts pac – *verify RADIUS*
- show cts environment-data – *verify CTS SGT download*
- show cts role-based sgt-map – *verify IP to SGT bindings*
- show cts sxp connections – *verify connection to SXP server*
- show cts role-based permissions – *veridy SGACLs*
- show cts role-based counters – *verify SGACL enforcement*

Demo

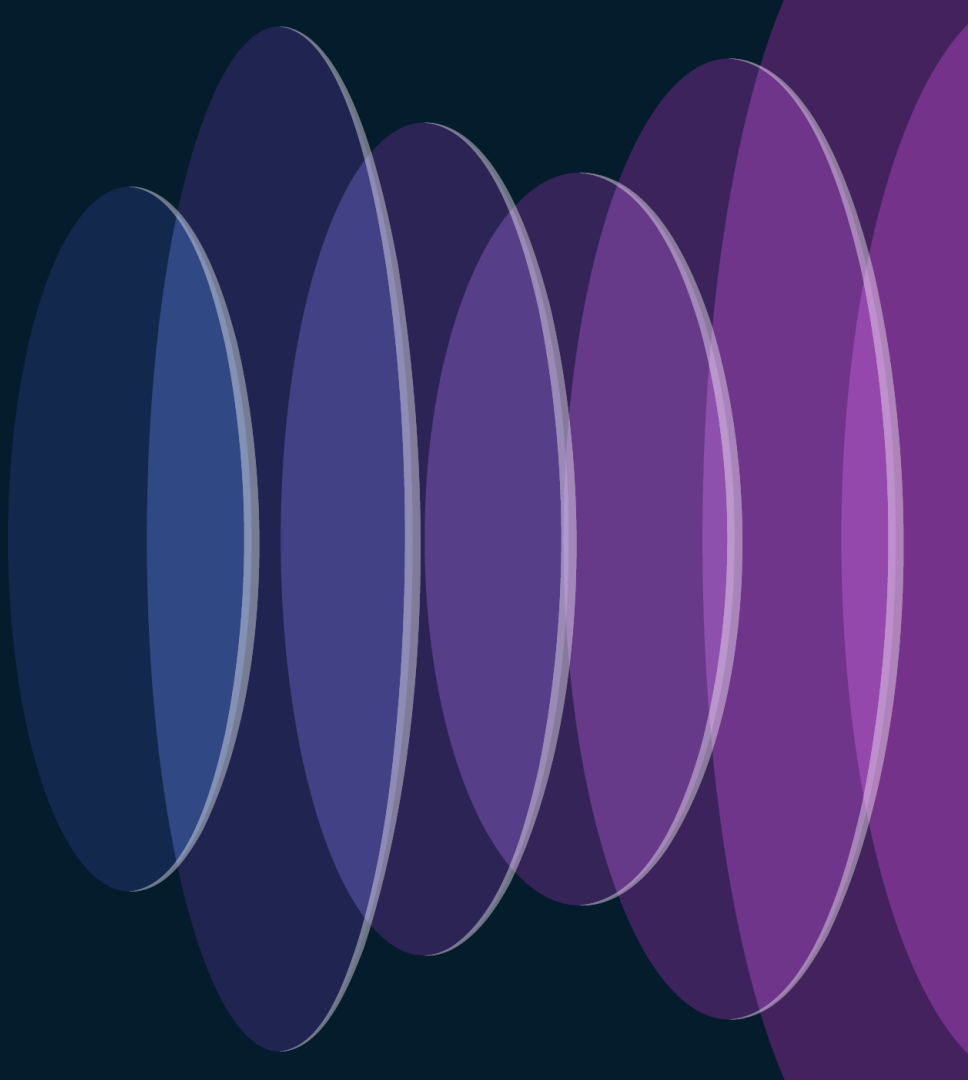


Demo Topology



Employee – SGT10
VM1 – SGT20
VM2 – SGT30

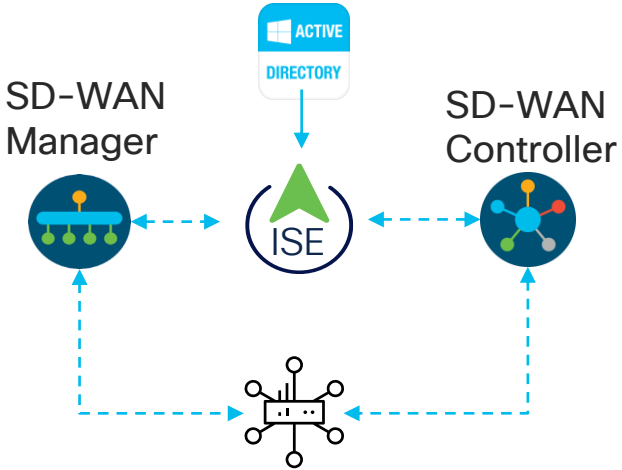
SD-WAN Identity based FW



Cisco SD-WAN NGFW Capabilities

- Built into the SD-WAN solution is a NGFW feature set.
- Managed centrally from SD-WAN Manager
- Build on Cisco Talos Threat Intelligence Group

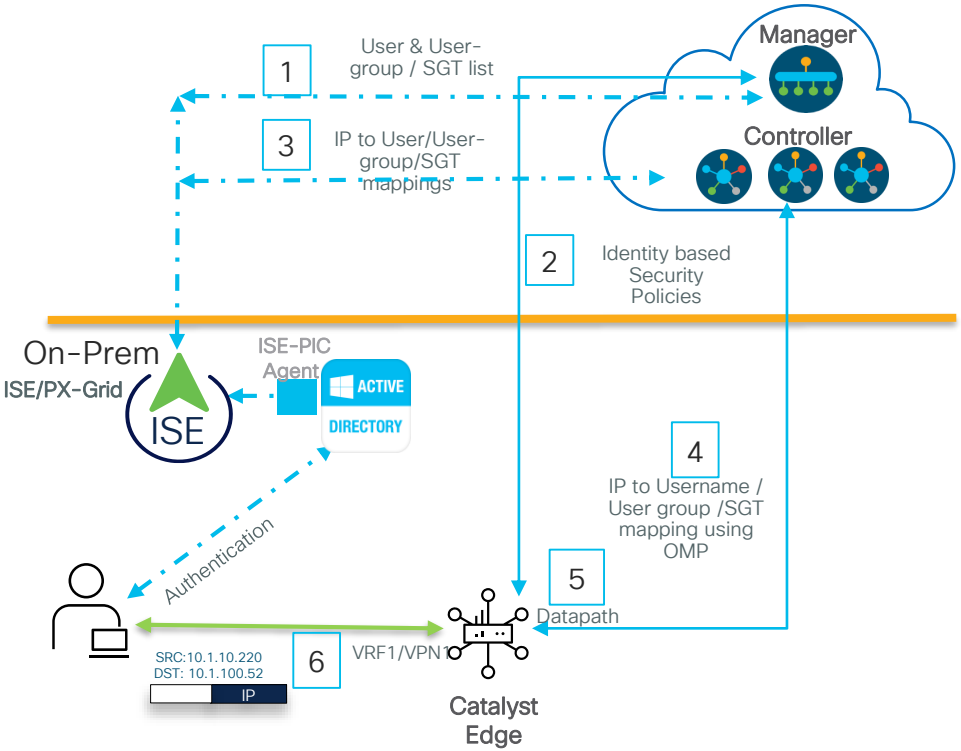
ISE/AD Integration for Identity based FW rules



Source	Destination	Application	Action
IP-Subnet1	Any	Any	Inspect
188.1.12.0/24	Geo-EU	Banking	Drop
Employees	Prod_SVR	Video Streaming	Inspect
SGT 12	Any	Video Streaming	Drop
Any	FQDN-1	Any	Inspect

- It is easier for any organization to define the Security policy based on Identities rather using IP addresses which provides the granular control over the users, groups, devices and applications.
- With Cisco ISE and AD Integration, Identity based Firewall rules can be defined under Security Policy. The Identity can be a User/User Group or Security Group tag (SGT)
- To support the Identity based Firewall rules, SD-WAN Controller and Manager works with ISE/pxGrid and Active Directory Services

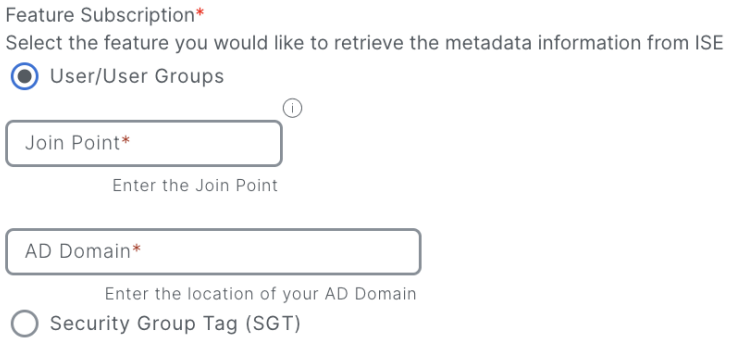
ISE/AD Integration – Hi-Level Architecture



- Management Plane
  - (1) Manager obtains the User/User-group information from ISE/PxGrid
  - (2) Admin authors security policies using Username/User-group. vManage sends policies to the device
- Controller Distribution
  - (3) Controller obtains IP to Username / User to User-group mappings from ISE/PxGrid when a user logs in (ie., a session is created).
  - (4) Controller pushes the IP to Username / User to User-group mappings to device (These IP-user bindings are for the active users)
- Device - Control and Data-plane
  - (2) Catalyst Firewall rules with username / user-group provisioned via Manager and pushed to device
  - (4) Edge Device learns IP to username / user to user-group mappings.
  - (5) IP-User-group received from Controller and programmed in data path
  - (6) Edge Device receives flows and enforces the configured username/user-group based policies
- Logging and Reporting
  - Device includes identity information in show commands
  - Manager connection events include User information as applicable.

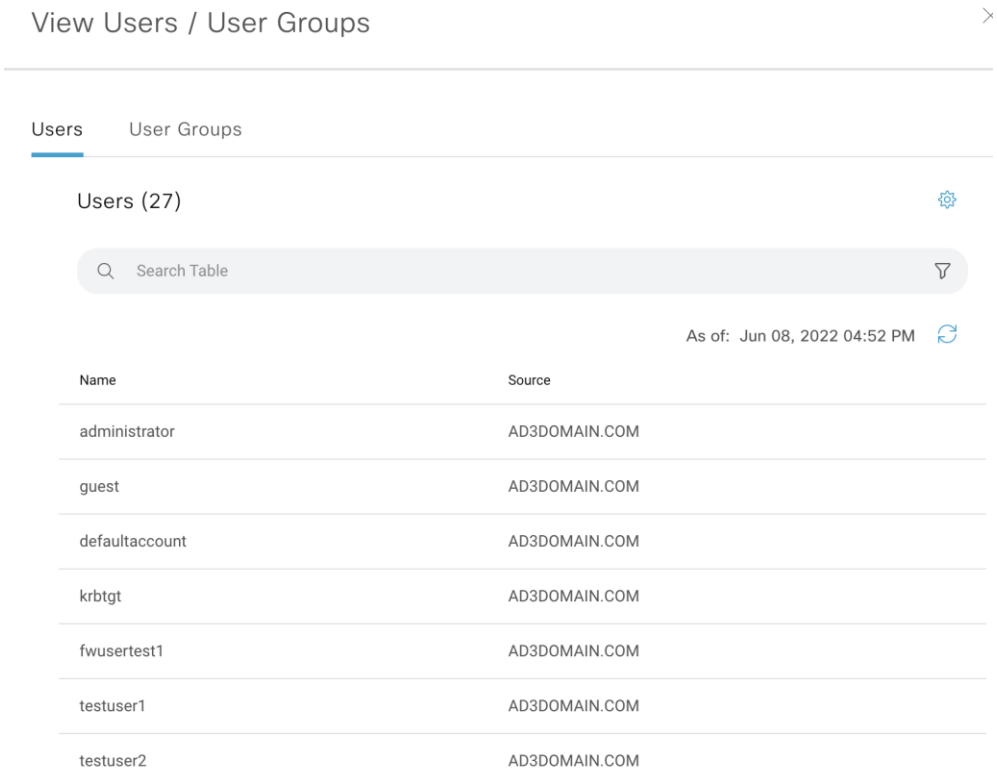
SD-WAN Manager / ISE Integration Setup

In Administration > Integration Management, add ISE server

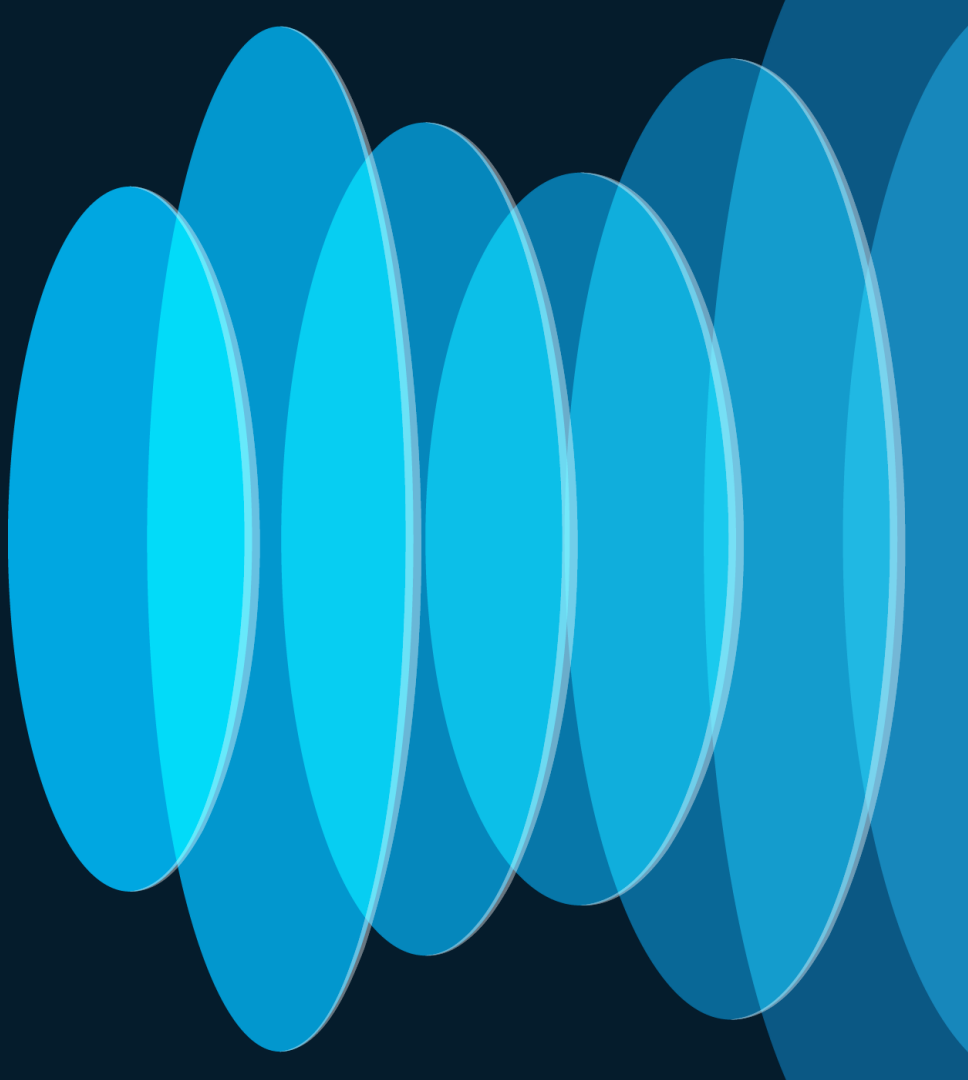


SD-WAN Manager / ISE Integration Setup

- Once integration is configured you can view the Users and User Groups.
- Firewall rules can then be built using these as source and/or destinations.

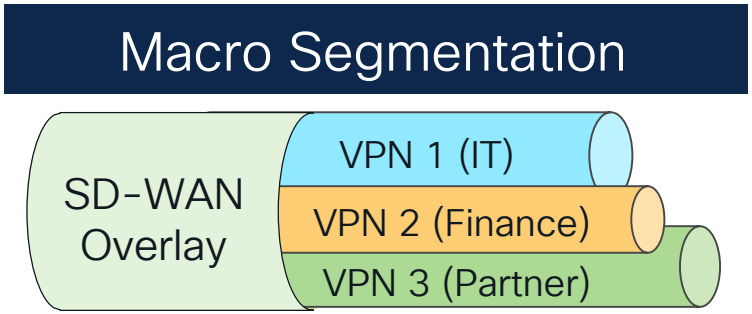


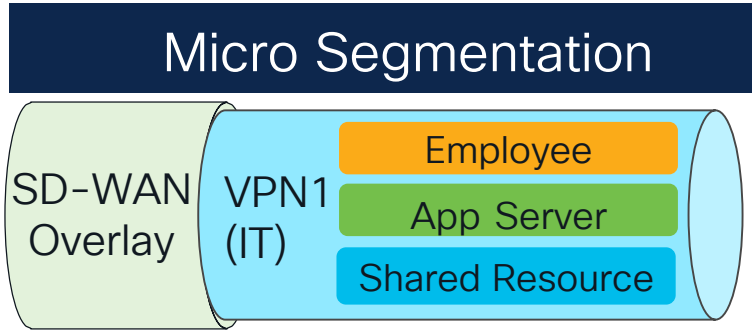
Conclusion



Closing Thoughts

- As network attacks continue to become more sophisticated, segmentation continues to grow in importance.
- ISE and SD-WAN provide the tools to help achieve network segmentation.
- Different options for different use cases. Understand your needs.





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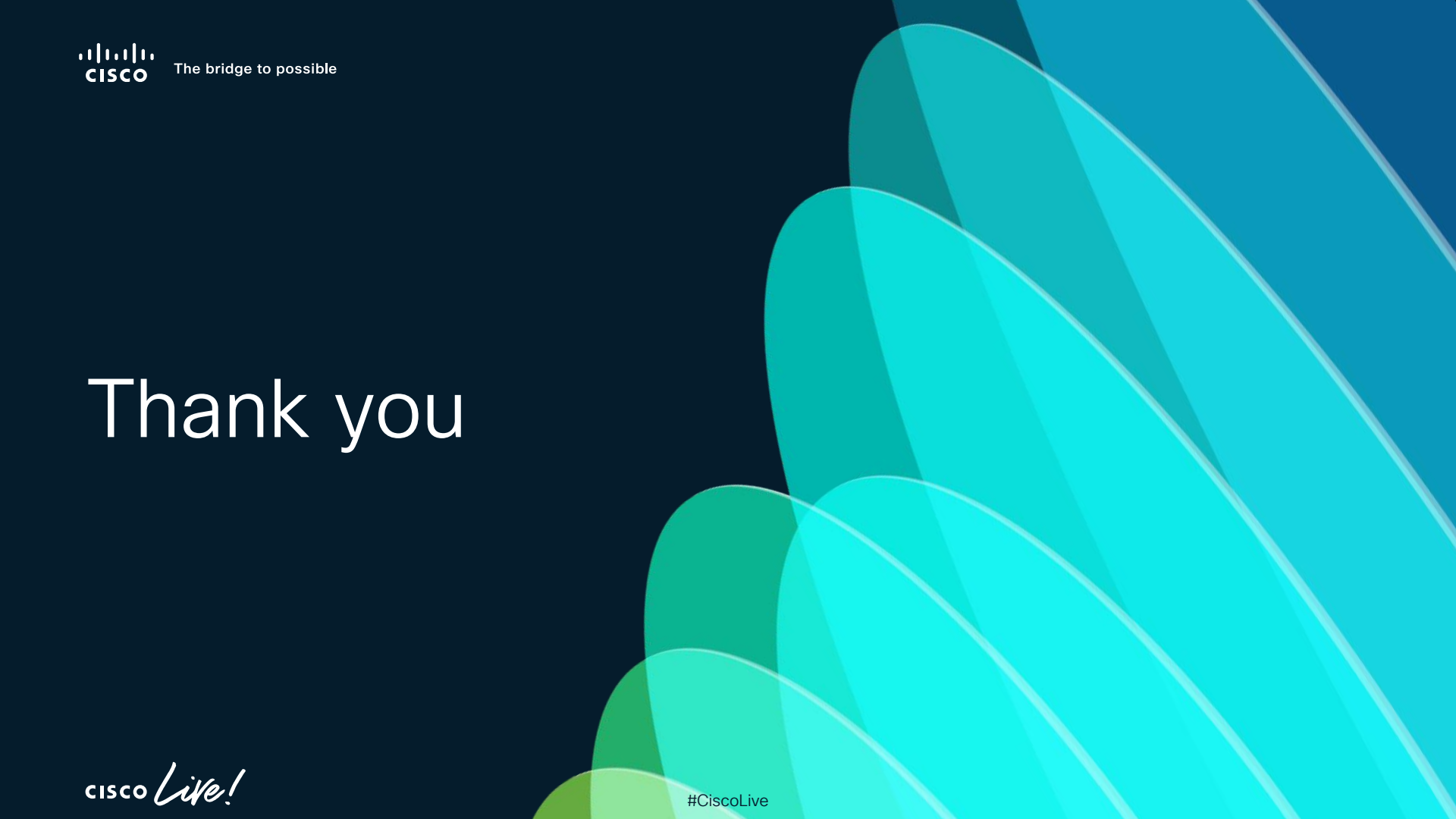
Contact me at: spenland@cisco.com


The bridge to possible
Thank you
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