Secure SD-WAN Operational Excellence

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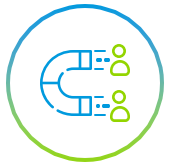
VERSA NETWORKS

Running Networks Efficiently & Securely

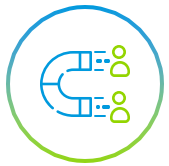
Headend management

Secure all components from bad actors

Configuration management of the whole network



Prioritize and apply path policies



Find anomalies in the network

Different deployment scenarios and topologies

Monitor network performance

Monitor application performance

Stay up to date with latest security, OSS pack, and software

Disaster recovery

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Headend Management

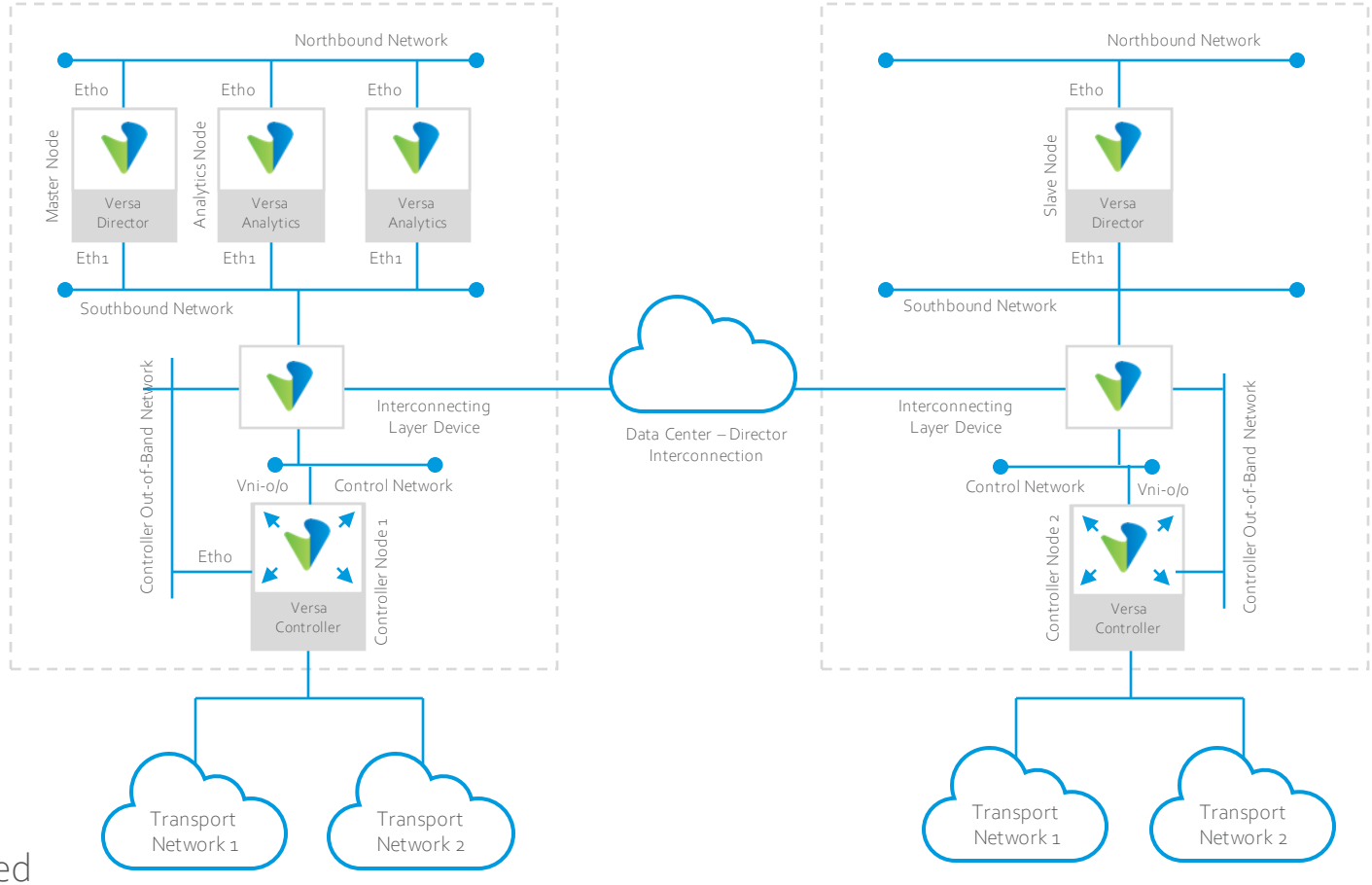
Getting the "Brains" of the Network Correct

- Chose right hardware required based on your scaling requirements

  Refer to sizing guidelines https://docs.versa-networks.com/Getting_Started/Deployment_and_Initial_Configuration/Headend_Deployment/Headend_Basics/02_Hardware_and_Software_Requirements_for_Headend

- Running on bare-mental vs virtual environments

- Concerns for running on private virtual cloud
  - Over subscription of CPU and memory
  - Disk I/O not optimized
  - Issues with hyperthreading enabled on hypervisor
  - Virtual NIC issues
  - Not using light weight and production quality hypervisors. Hypervisors may not be optimized for packet forwarding



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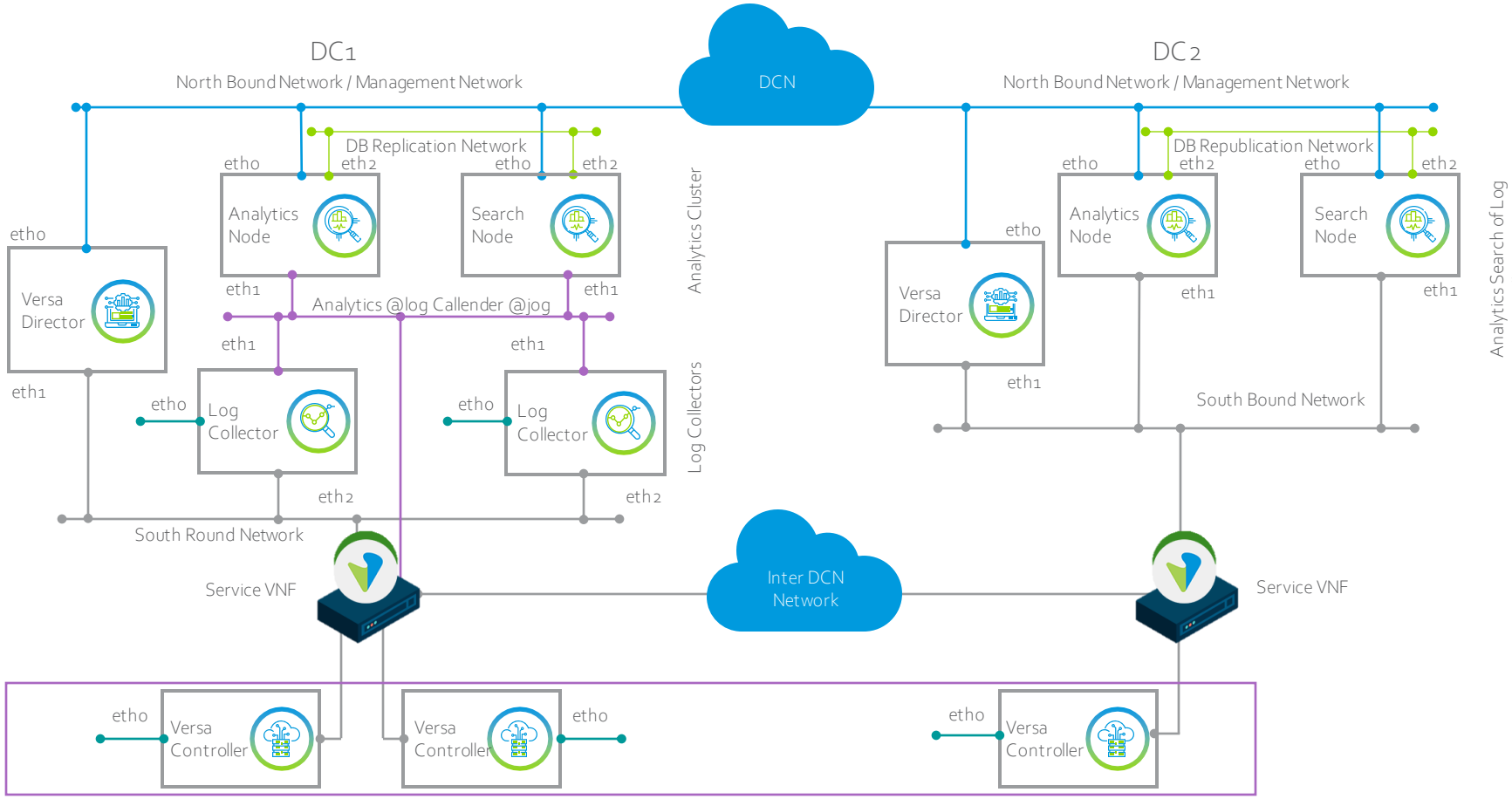
Headend Management

Getting the "Brains" of the Network Correct



- Run headend components in HA to avoid single point of failure
- Ensure the connectivity between two HA components is stable and reliable
- Monitor headend components
  - Stream alarms of headend components over syslog
  - Monitor memory, CPU, disk
  - Use external tools like Grafana

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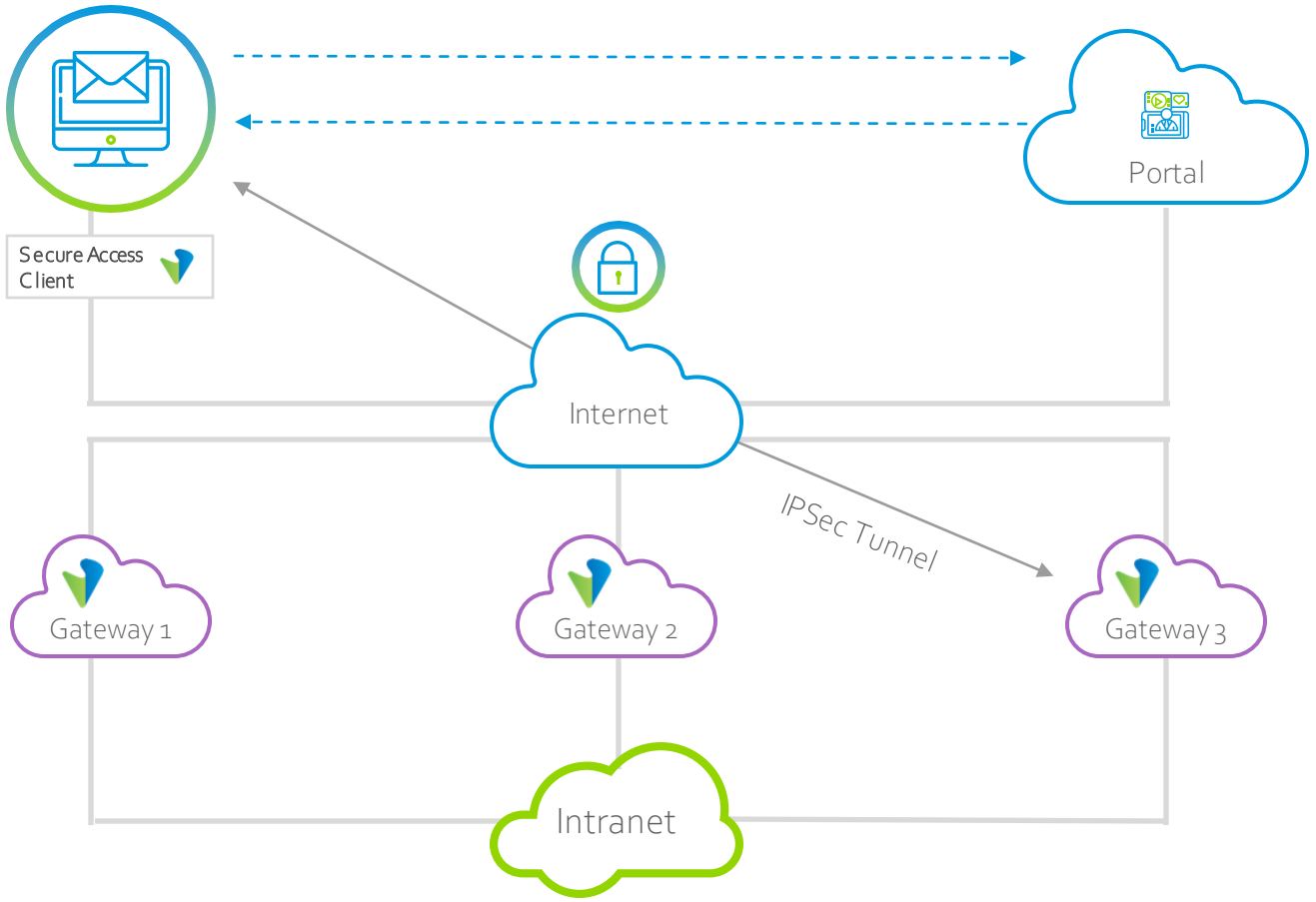
Secure All Components from Bad Actors



- Change default password
- Enable external authentication for GUI, API, and SSH access
- Enable only required ports and disable all remaining ports
  Refer to the following Firewall requirements for which ports to open - https://docs.versa-networks.com/Getting_Started/Deployment_and_Initial_Configuration/Deployment_Basics/Firewall_Requirements
- Services must be activated only on required interfaces
- Enable API access via OAuth
- Run Director HA and Analytics cluster communication via southbound private network for better security practices

Secure All Components from Bad Actors

- Install valid certificate for https access to Versa Director and Analytics
- Configure SSH banner on all components
- Configure NTP and DNS
- Enable stronger encryption, hash for SSH and IKE/IPsec for example AES256 SHA512 and higher
- Set complex passwords for GUI access, Rest API access, and SSH access
- Use Versa Advanced Security Tool (VAST) to security harden all the components automatically
  Refer to Versa Automation Hardening Doc https://docs.versa-networks.com/Solutions/System_Hardening/Perform_Automated_System_Hardening

Configuration Management of the Entire Network

Templates

- Identify use cases
- Build templates for use cases and re-use them
- Generate templates from workflow
- Build service templates for use cases not supported by workflow
- Use common shared template if same use case applies across multiple customers

Deploying Devices in Bulk

- Group devices based on use cases
- Create device group for each unique use case
- Assign template, service, and shared templates to device group
- Attach to device group
- Attach service templates directly to devices for one-off use cases
- Import bind variables to bulk deploy from CSV
- Use Rest APIs for bulk deploy or modify

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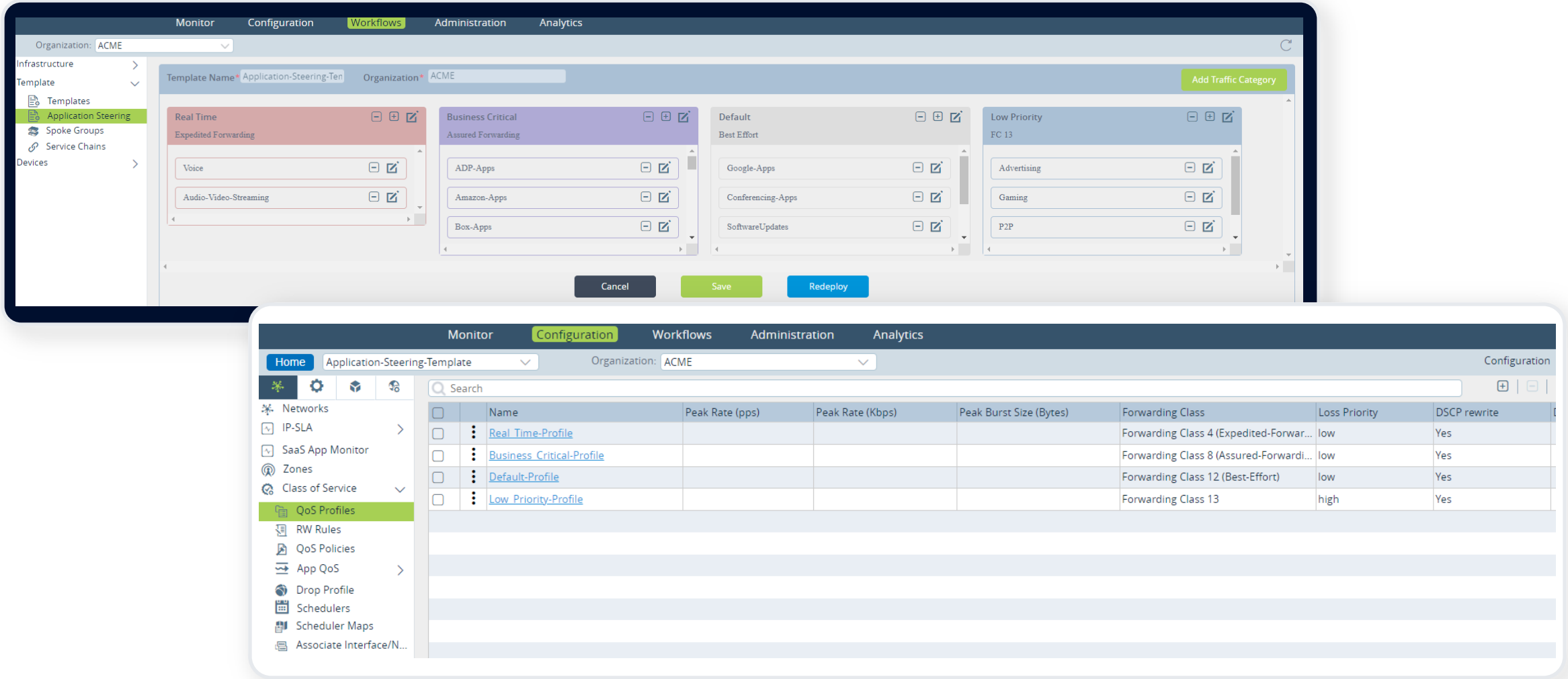
Prioritizing & Applying the Best Path Policies Based on Category of Traffic

It is very important to classify traffic, prioritize and chose best path to get best user experience for customer traffic.

Application Steering Templates contains following components to achieve this requirement:

- Classify traffic
  - Real time – Audio, video calls
  - Business Critical apps
  - Best Effort
  - Low priority
- Apply QoS
- Apply best path selection

Classify Traffic into Different Buckets



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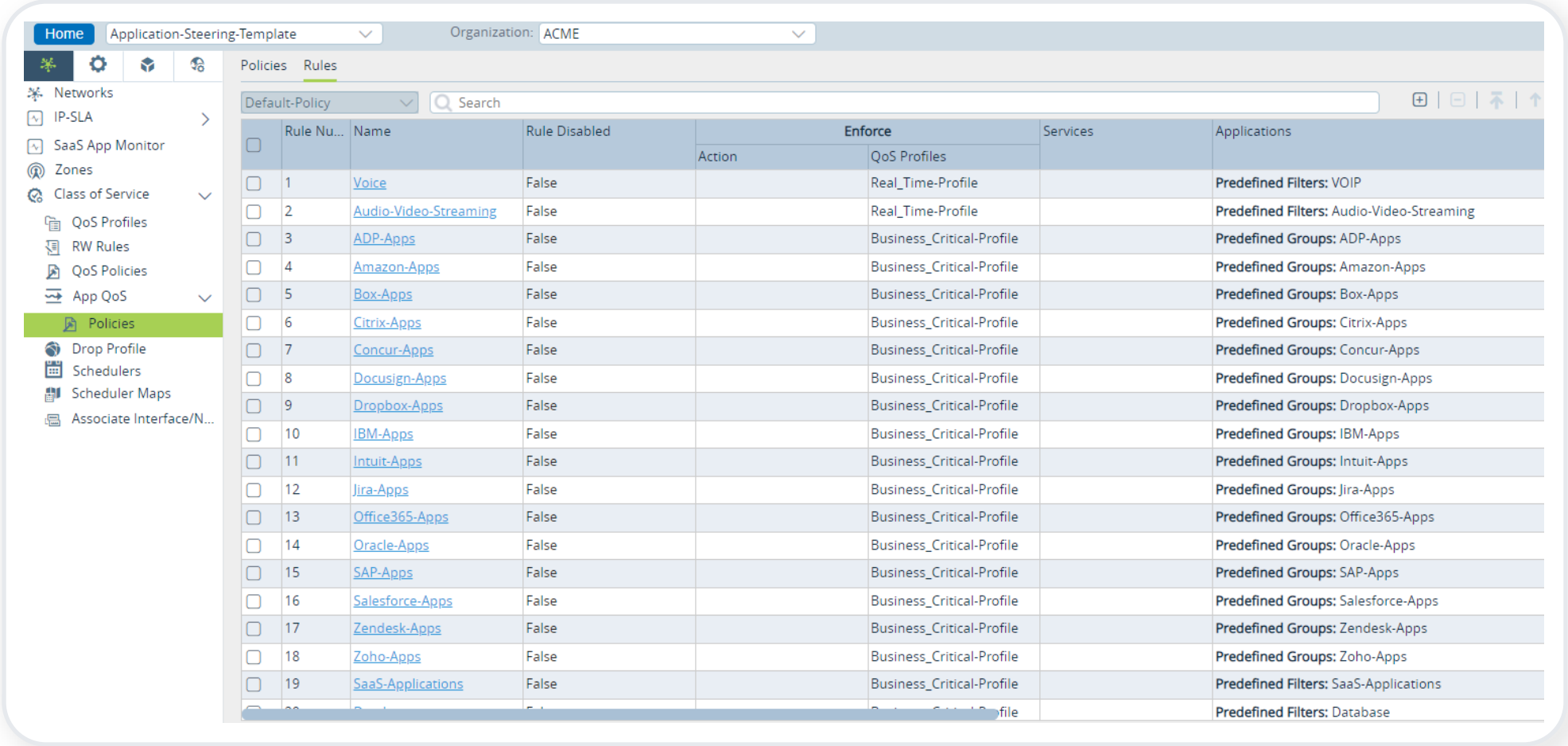
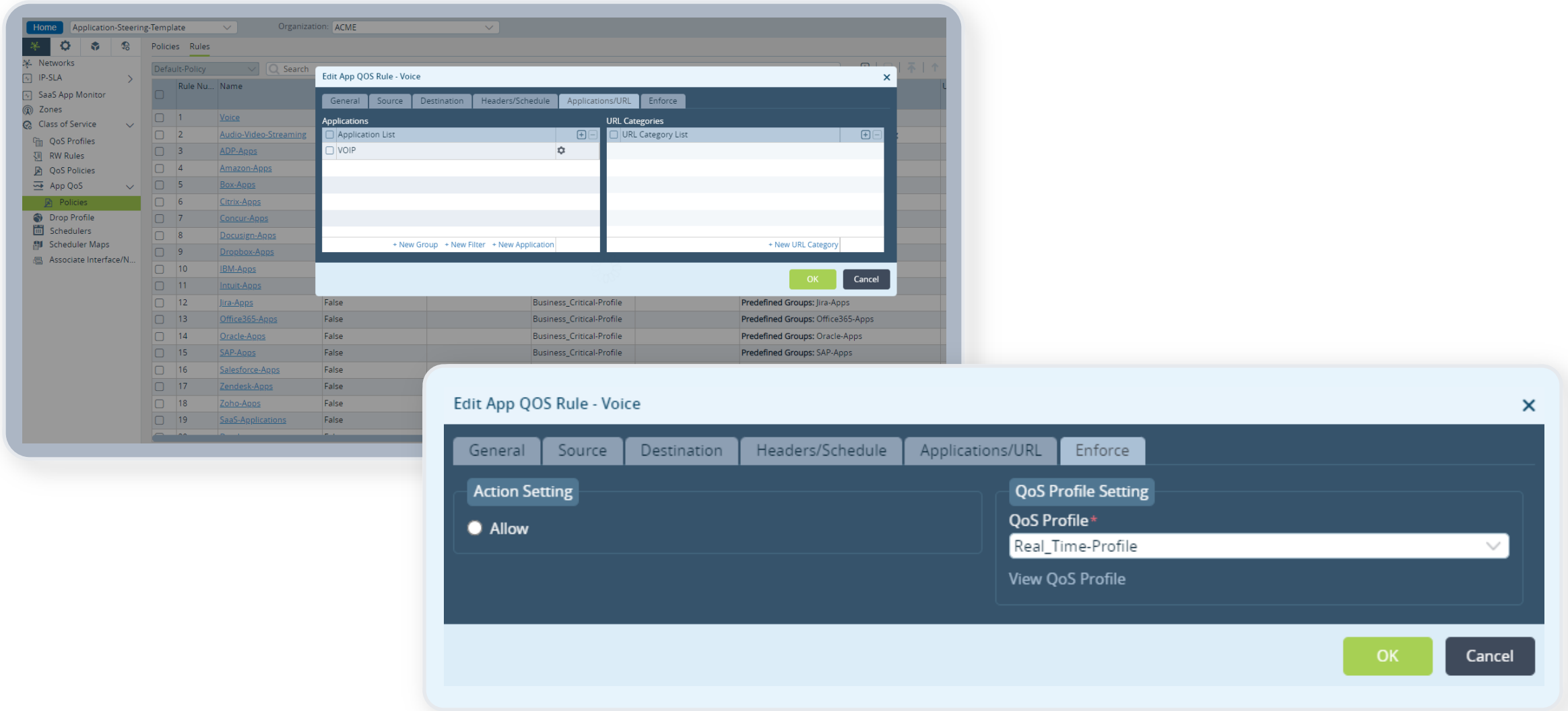
Apply QoS

Prioritize the traffic by applying classified traffic with different priority queues

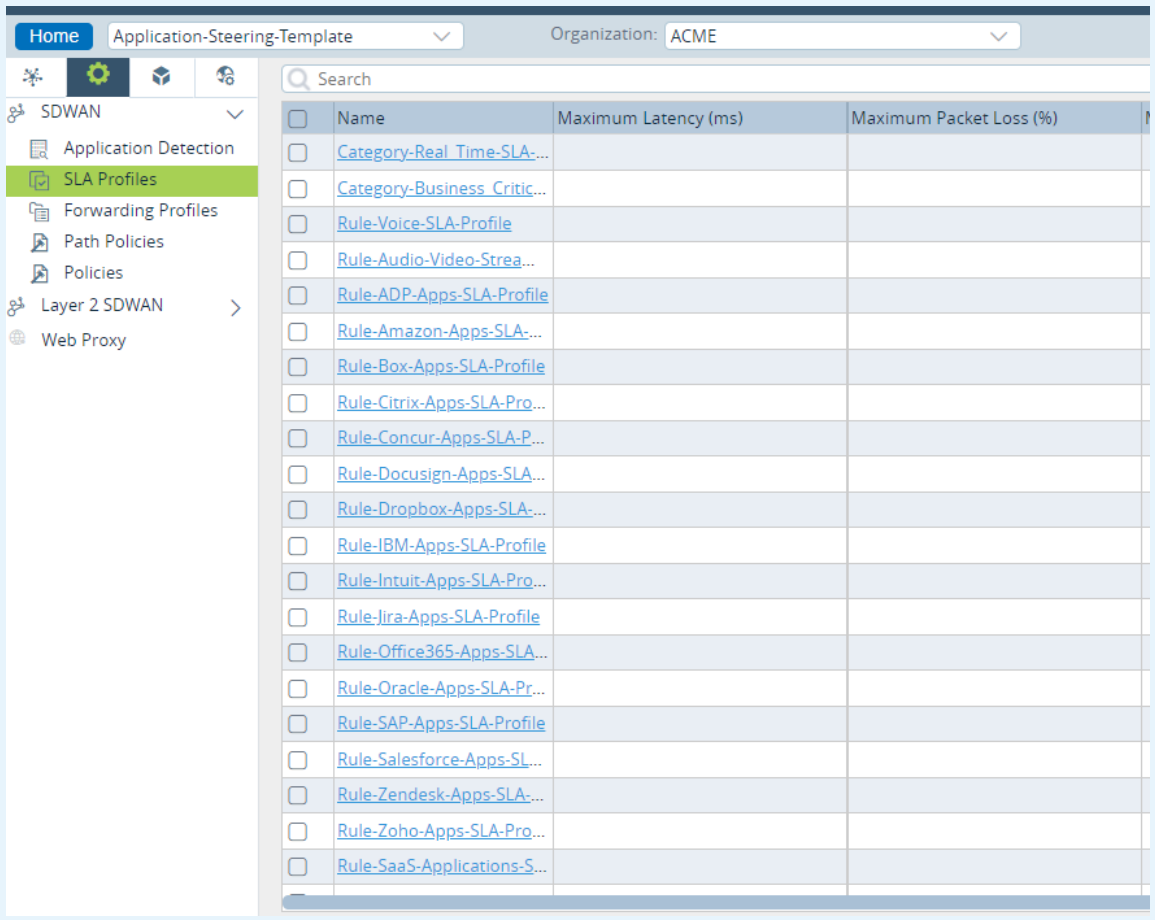


	Rule Nu...	Name	Rule Disabled	Enforce		Services	Applications
				Action	QoS Profiles		
	1	Voice	False		Real_Time-Profile		**Predefined Filters:** VOIP
	2	Audio-Video-Streaming	False		Real_Time-Profile		**Predefined Filters:** Audio-Video-Streaming
	3	ADP-Apps	False		Business_Critical-Profile		**Predefined Groups:** ADP-Apps
	4	Amazon-Apps	False		Business_Critical-Profile		**Predefined Groups:** Amazon-Apps
	5	Box-Apps	False		Business_Critical-Profile		**Predefined Groups:** Box-Apps
	6	Citrix-Apps	False		Business_Critical-Profile		**Predefined Groups:** Citrix-Apps
	7	Concur-Apps	False		Business_Critical-Profile		**Predefined Groups:** Concur-Apps
	8	Docusign-Apps	False		Business_Critical-Profile		**Predefined Groups:** Docusign-Apps
	9	Dropbox-Apps	False		Business_Critical-Profile		**Predefined Groups:** Dropbox-Apps
	10	IBM-Apps	False		Business_Critical-Profile		**Predefined Groups:** IBM-Apps
	11	Intuit-Apps	False		Business_Critical-Profile		**Predefined Groups:** Intuit-Apps
	12	Jira-Apps	False		Business_Critical-Profile		**Predefined Groups:** Jira-Apps
	13	Office365-Apps	False		Business_Critical-Profile		**Predefined Groups:** Office365-Apps
	14	Oracle-Apps	False		Business_Critical-Profile		**Predefined Groups:** Oracle-Apps
	15	SAP-Apps	False		Business_Critical-Profile		**Predefined Groups:** SAP-Apps
	16	Salesforce-Apps	False		Business_Critical-Profile		**Predefined Groups:** Salesforce-Apps
	17	Zendesk-Apps	False		Business_Critical-Profile		**Predefined Groups:** Zendesk-Apps
	18	Zoho-Apps	False		Business_Critical-Profile		**Predefined Groups:** Zoho-Apps
	19	SaaS-Applications	False		Business_Critical-Profile		**Predefined Filters:** SaaS-Applications
					file		**Predefined Filters:** Database

Apply QoS

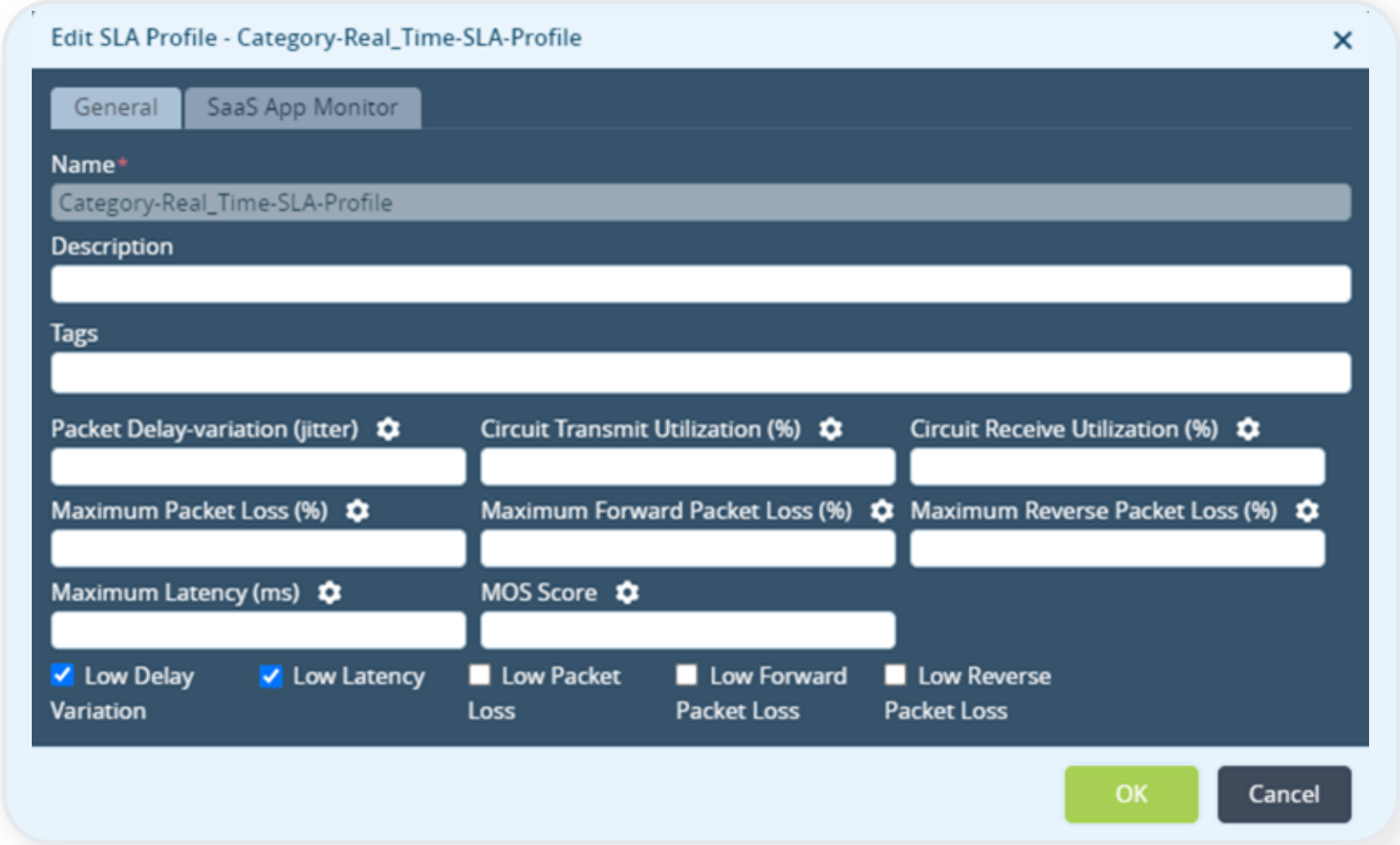


Apply Best Path Selection – Configure SLA Profiles



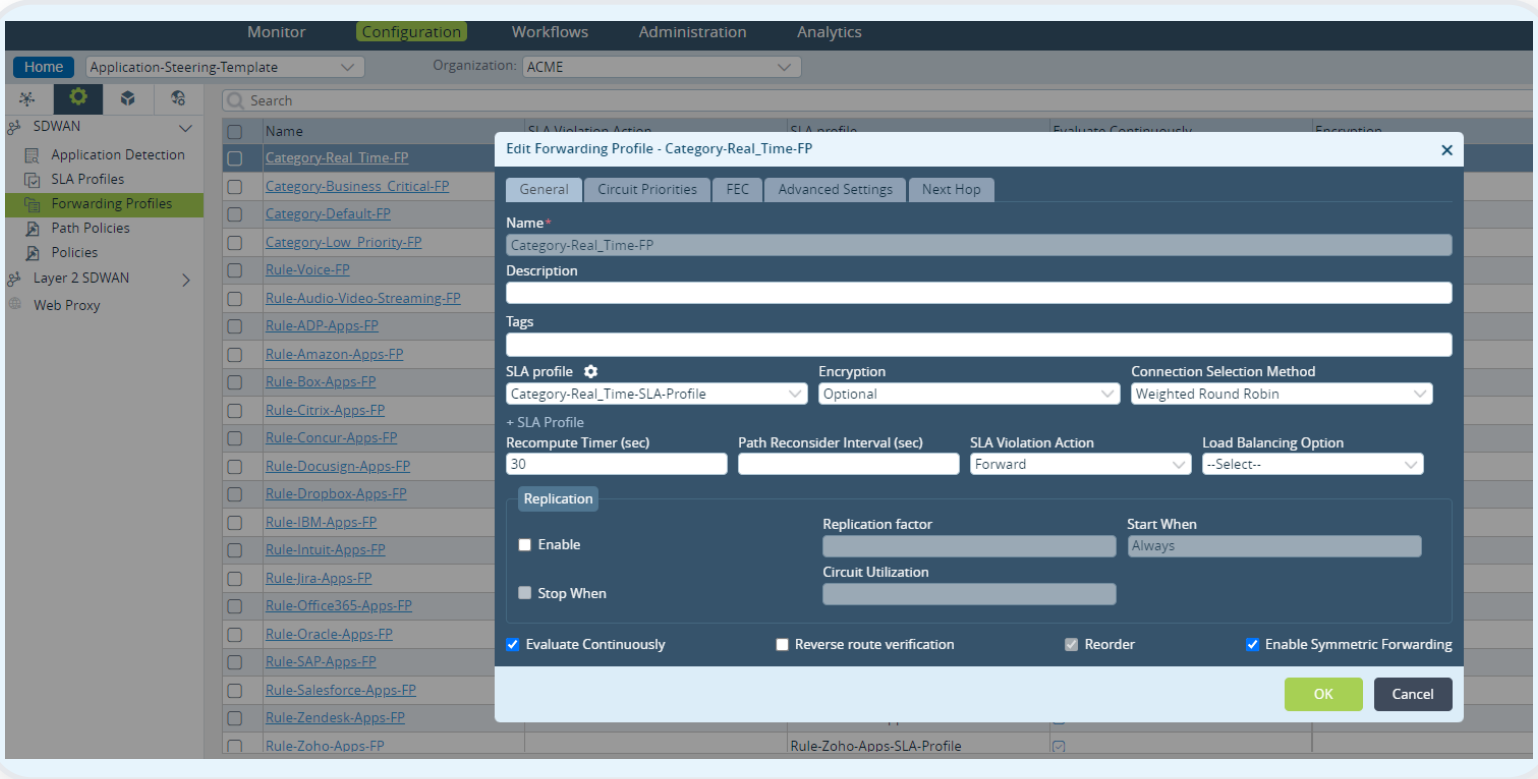
- The first step in configuring the best path selection is to create SLA profiles for each category of traffic.
- SLA profile defines latency, jitter, packet loss, MOS, bandwidth requirements

Configure SLA Profiles



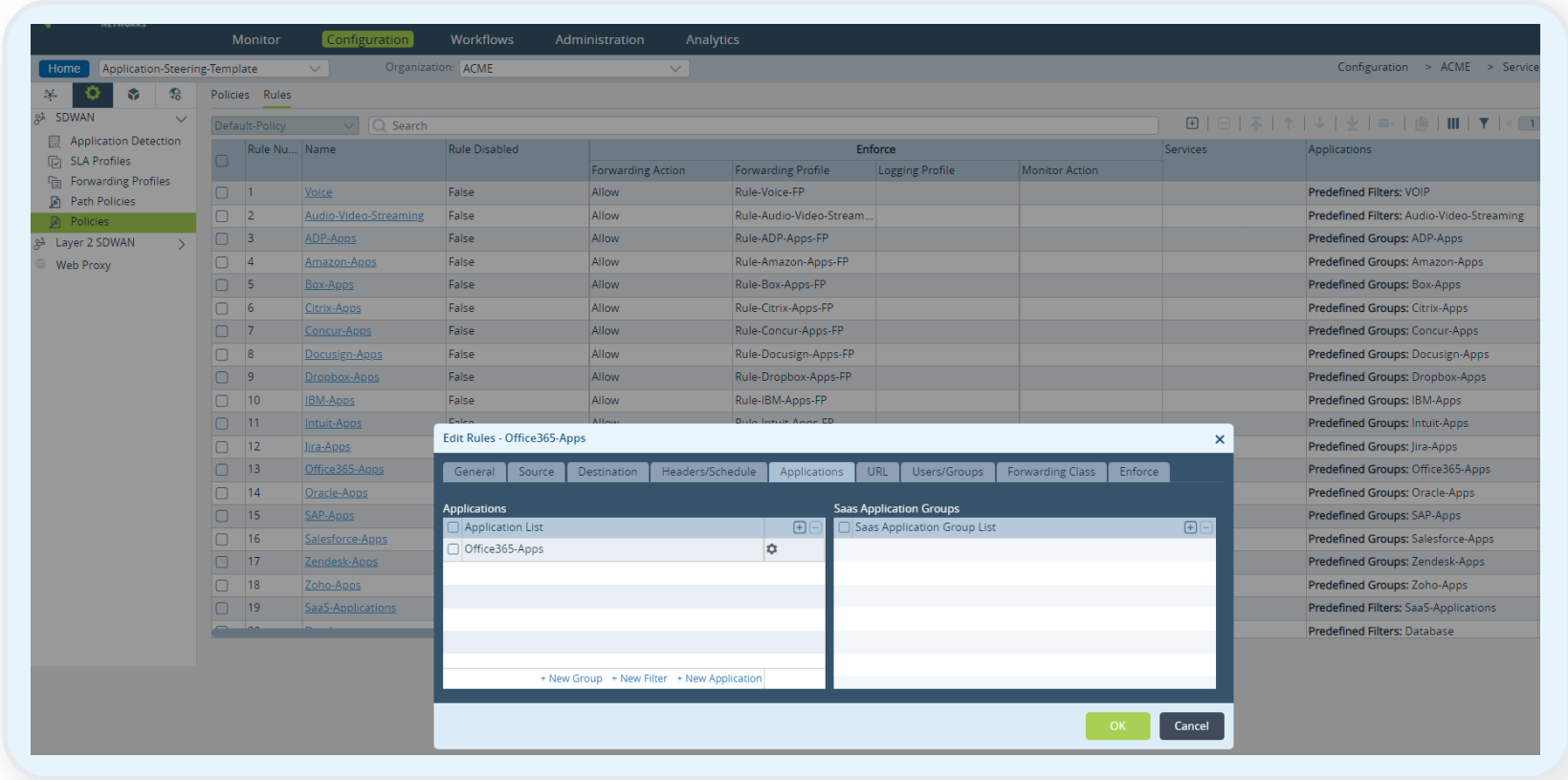
Configure Forwarding Profiles

Forwarding profiles defines the best path to be used based on requirements defined in SLA profiles



Configure SD-WAN Policies

SD-WAN polices is created to match traffic based on L2 to L7 and attaches forwarding profile. There will be SD-WAN policy created for each of customer traffic category.



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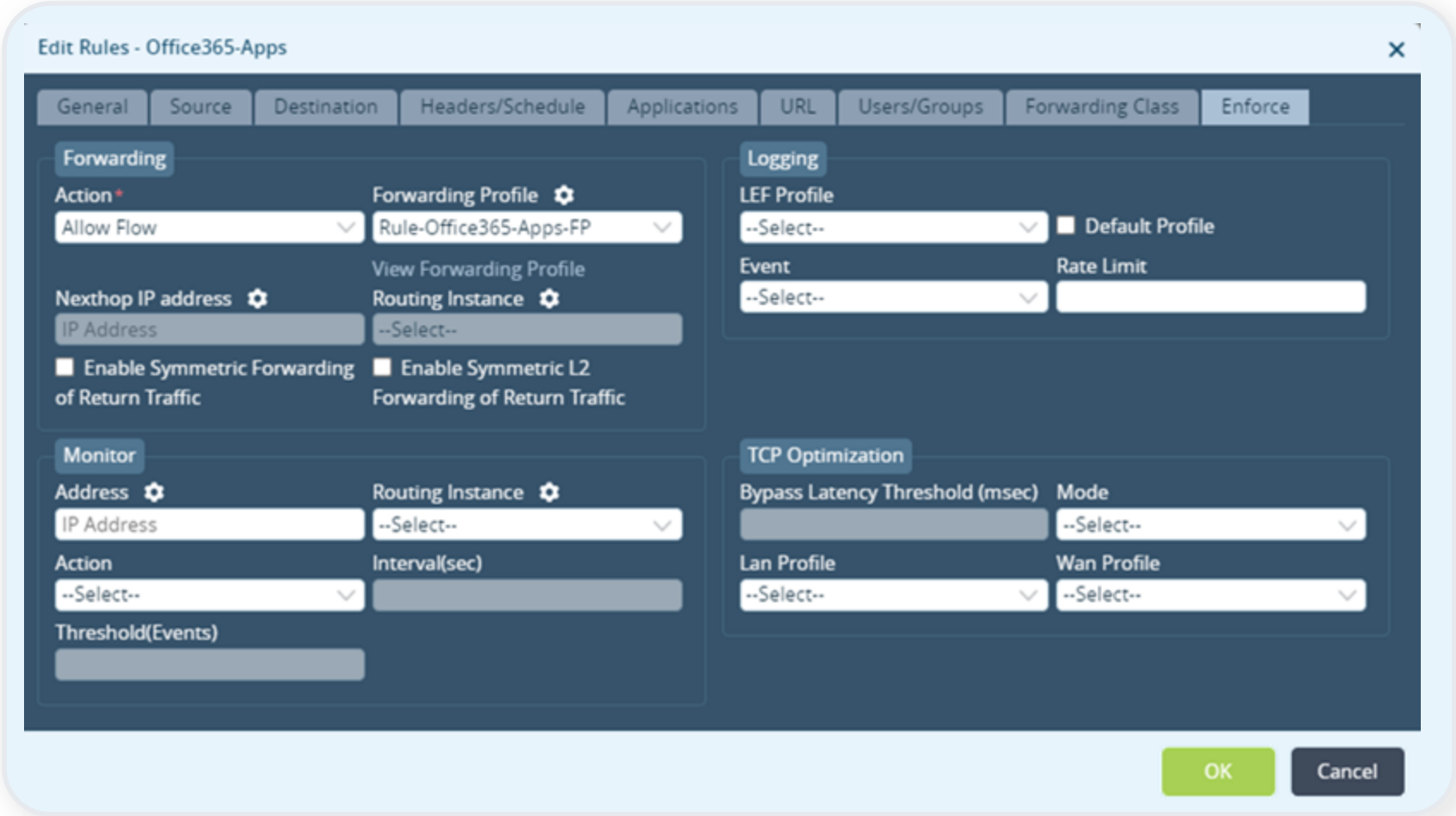
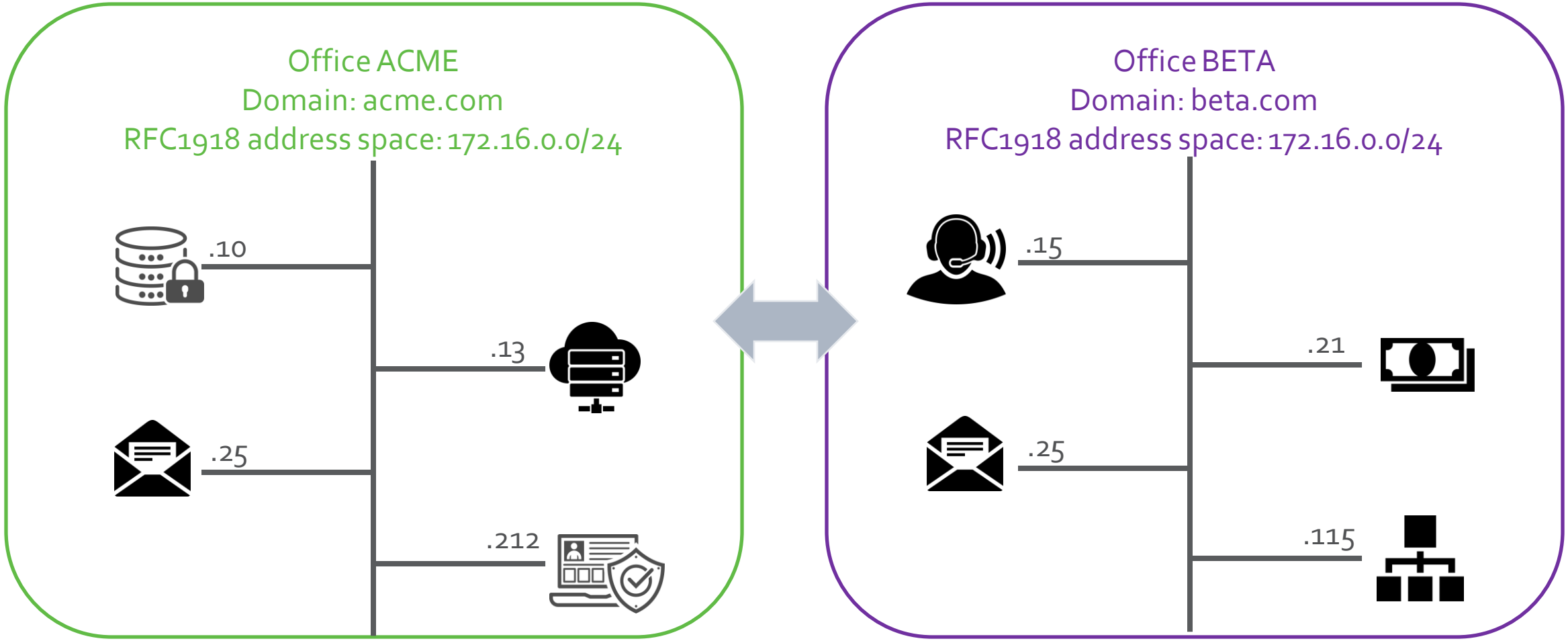
Configure SD-WAN Policies

Example of attaching forwarding profile to SD-WAN policy created for Office365 apps



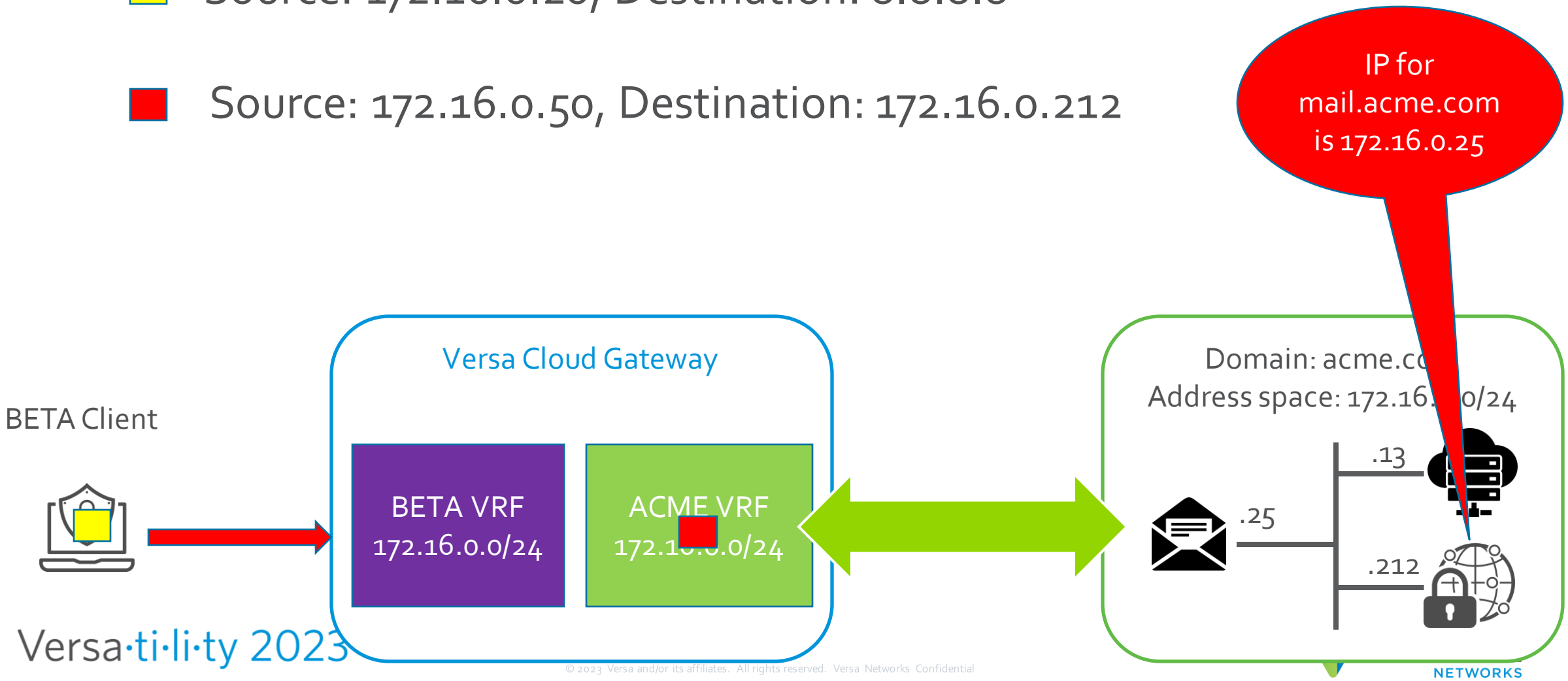
Company Merger

Acquisition of the Company BETA



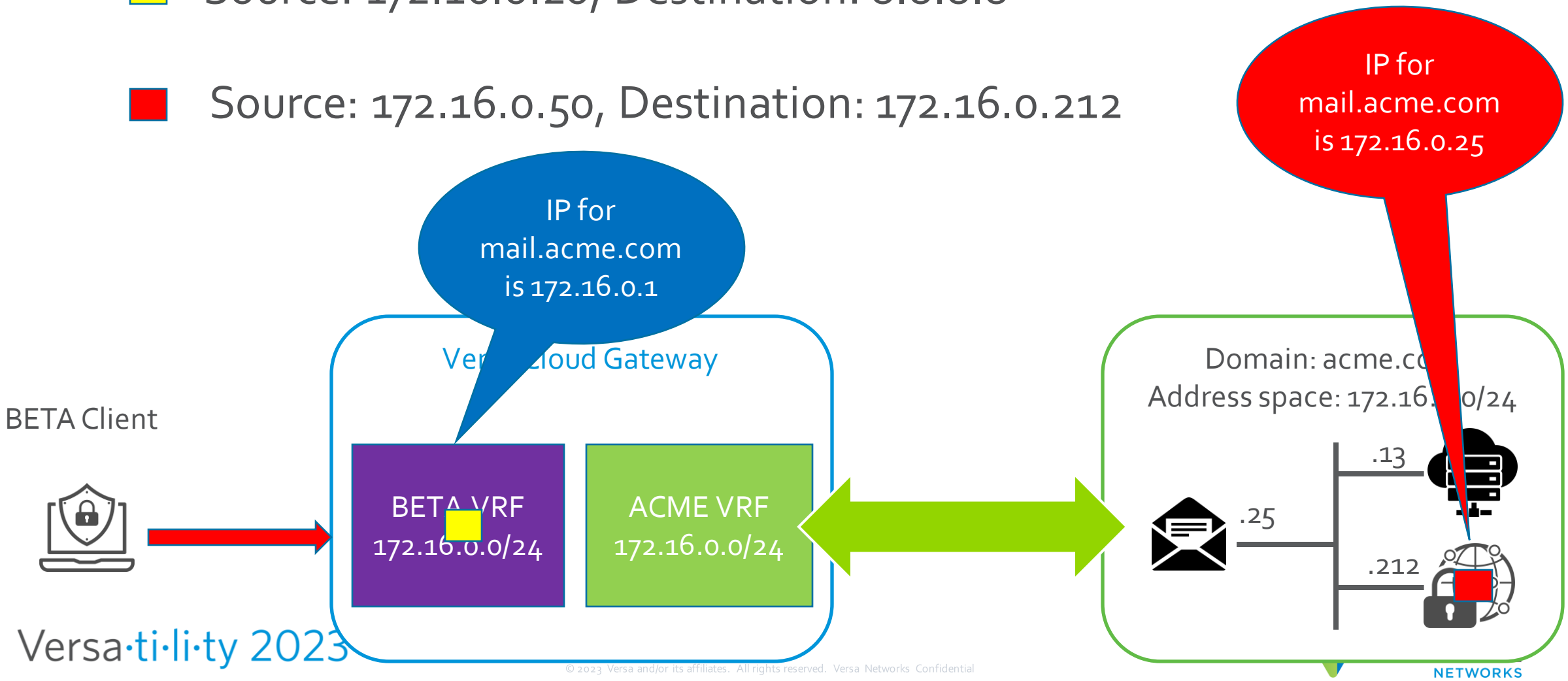
Company Merger

- Source: 172.16.0.20, Destination: 8.8.8.8
- Source: 172.16.0.50, Destination: 172.16.0.212



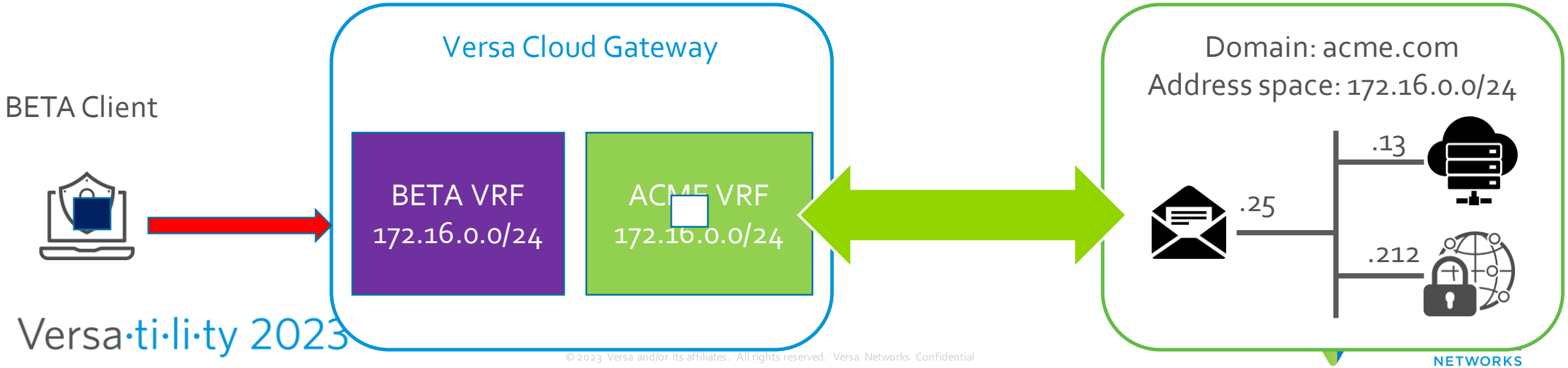
Company Merger

- Source: 172.16.0.20, Destination: 8.8.8.8
- Source: 172.16.0.50, Destination: 172.16.0.212

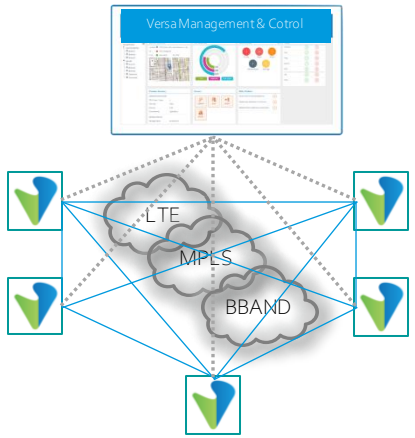


Company Merger

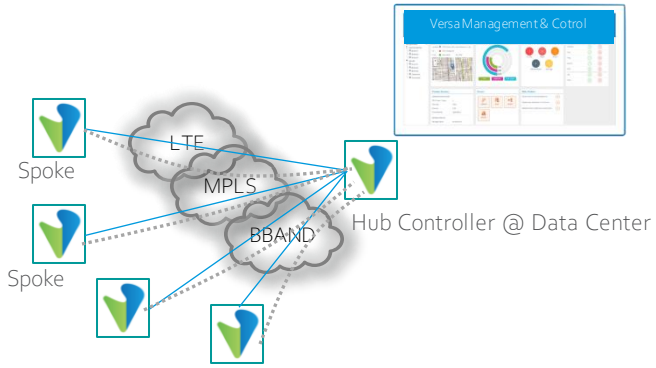
- Source: 172.16.0.20, Destination: 172.16.0.1
- Source: 172.16.0.15, Destination: 172.16.0.25



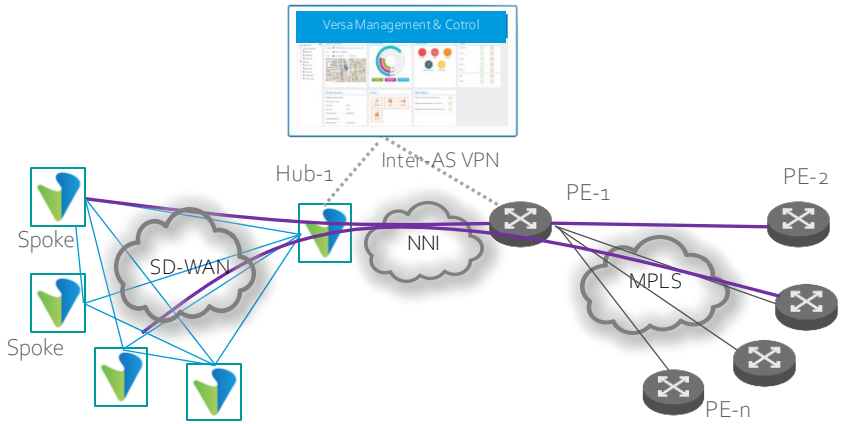
WAN Topology Examples



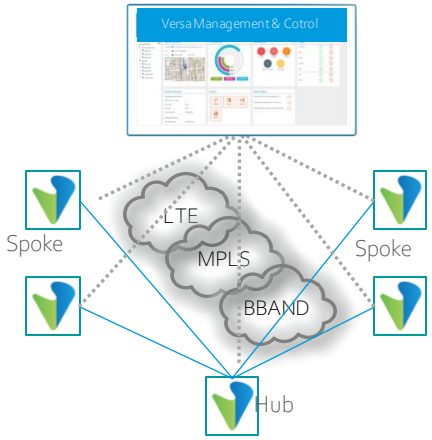
Full Mesh



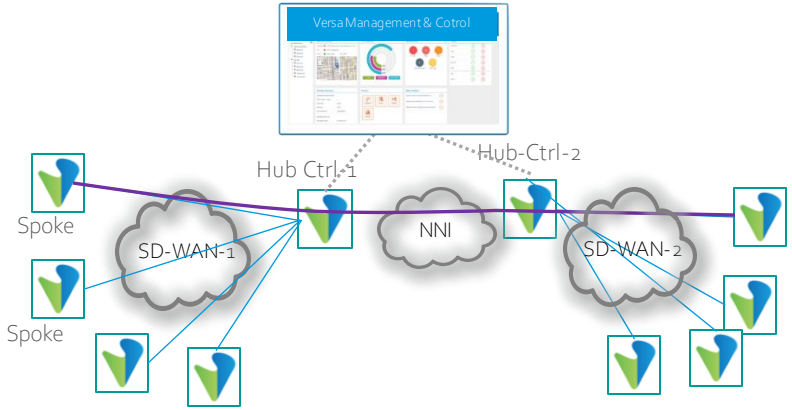
Controller & Hub Converged



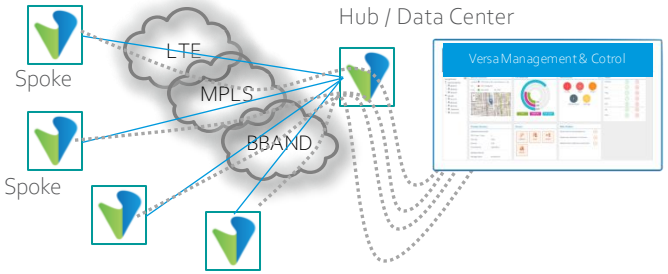
Inter-as Connectivity
(ie: Brownfield)



Hub-Spoke



Spoke-Hub-Hub-Spoke



Controller Behind Hub

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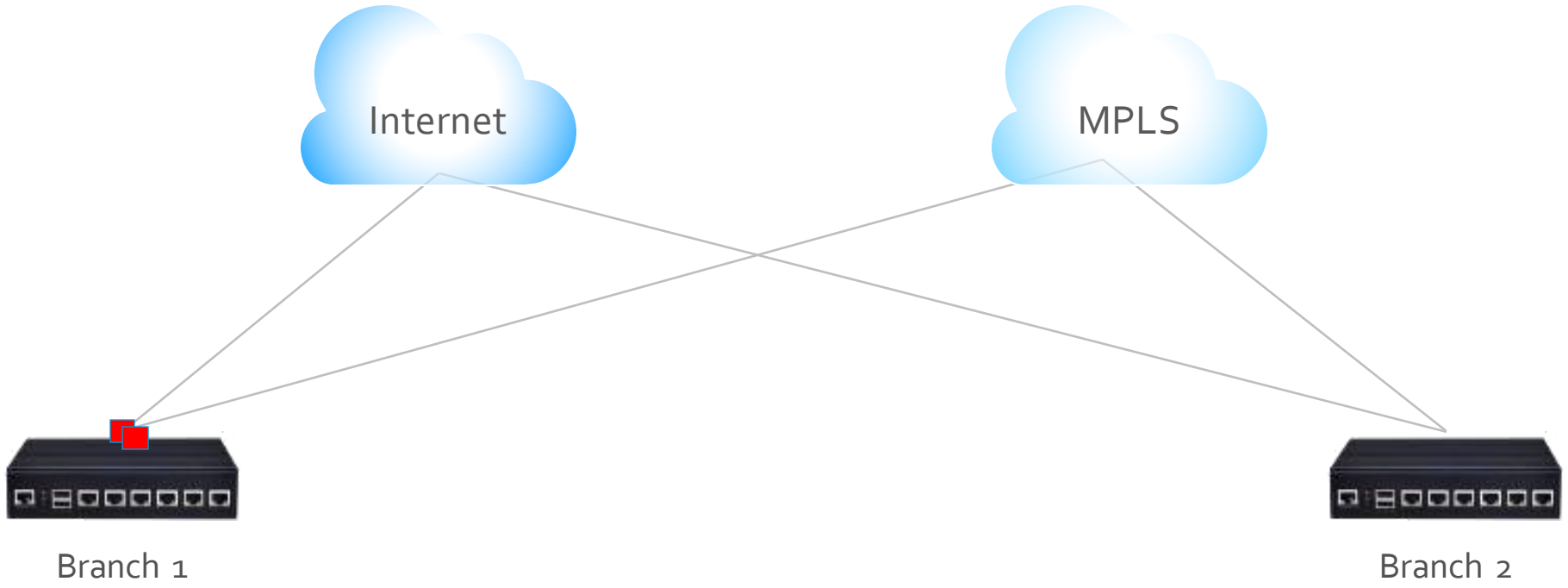
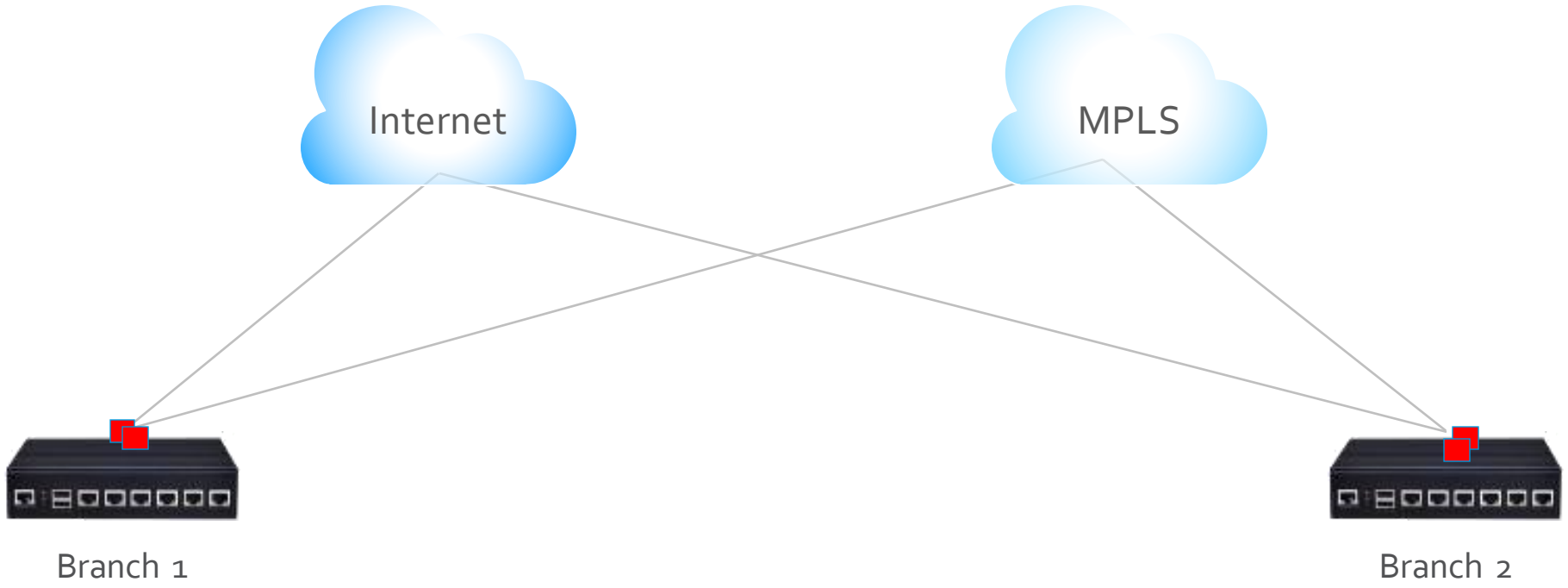
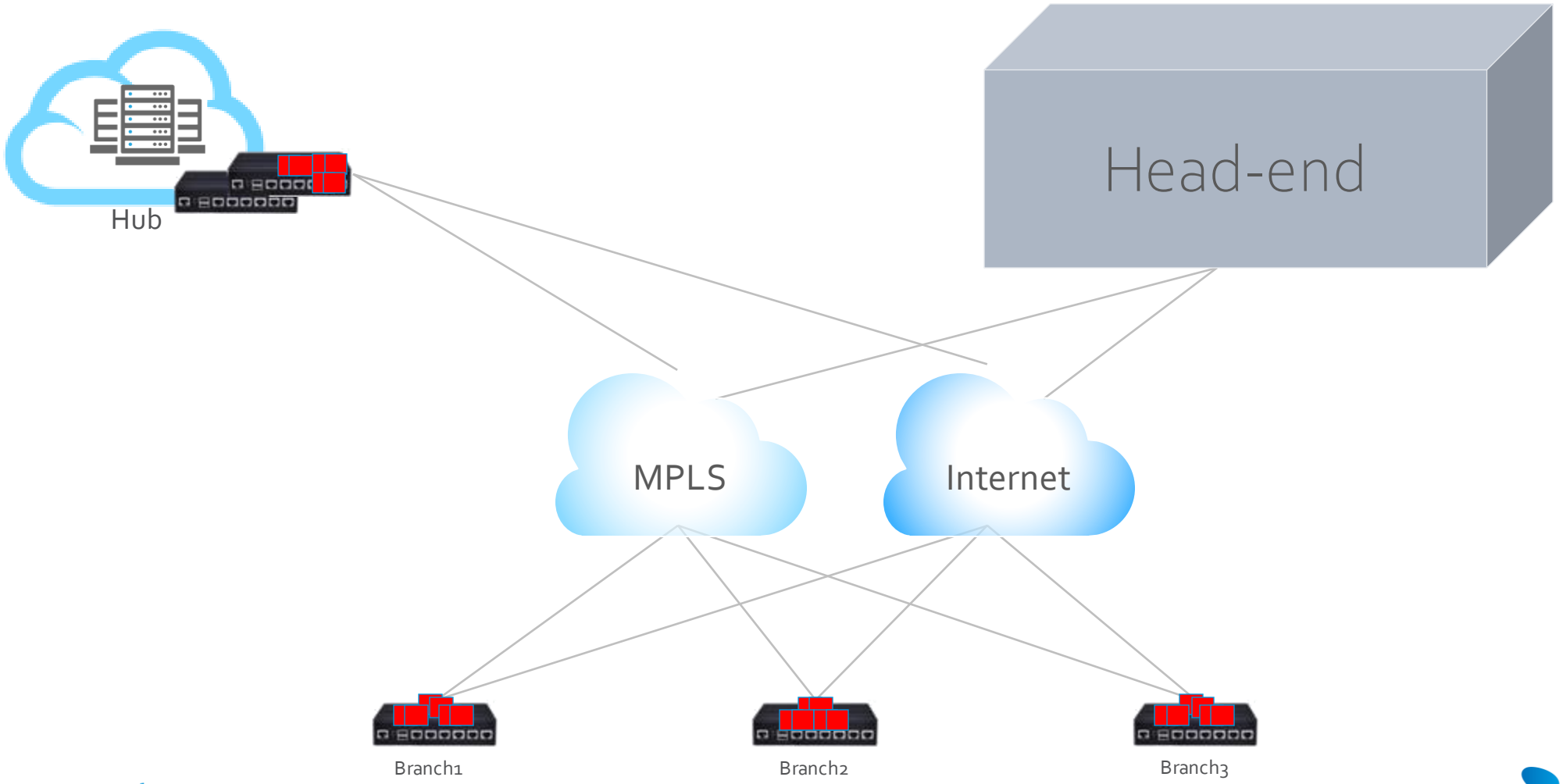
SLA Probes Between Branches



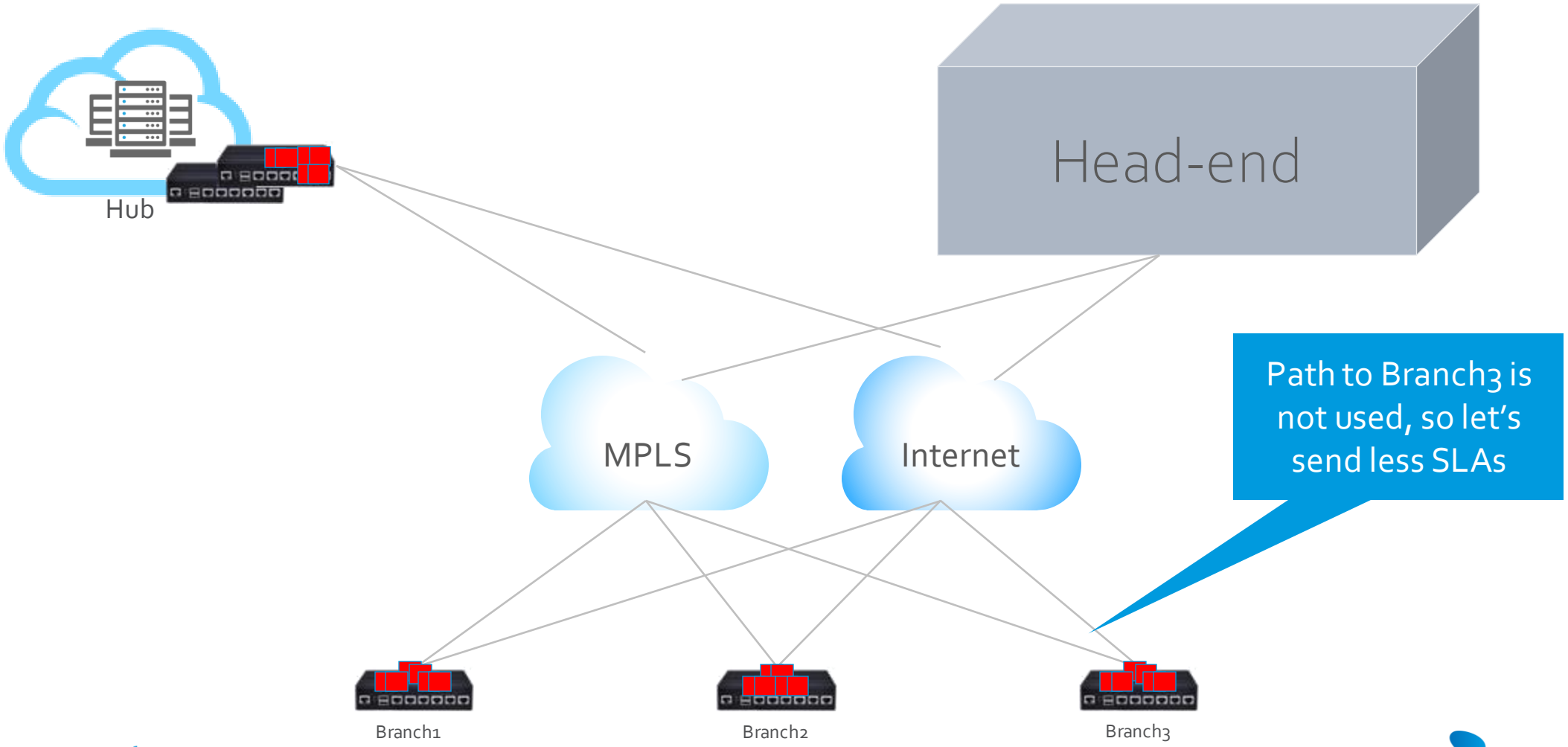
SLA Probes Between Branches



Adaptive SLA Monitoring



Adaptive SLA Monitoring

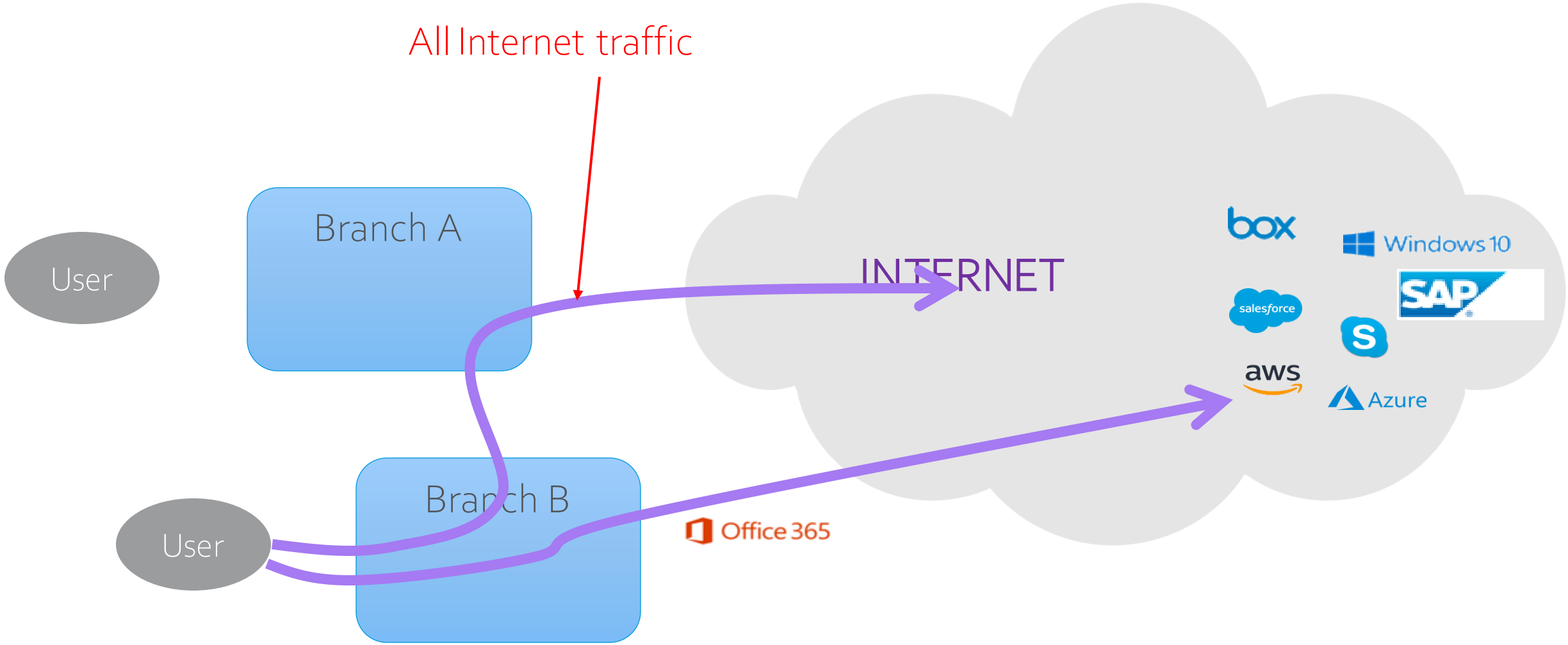


Adaptive SLA Monitoring

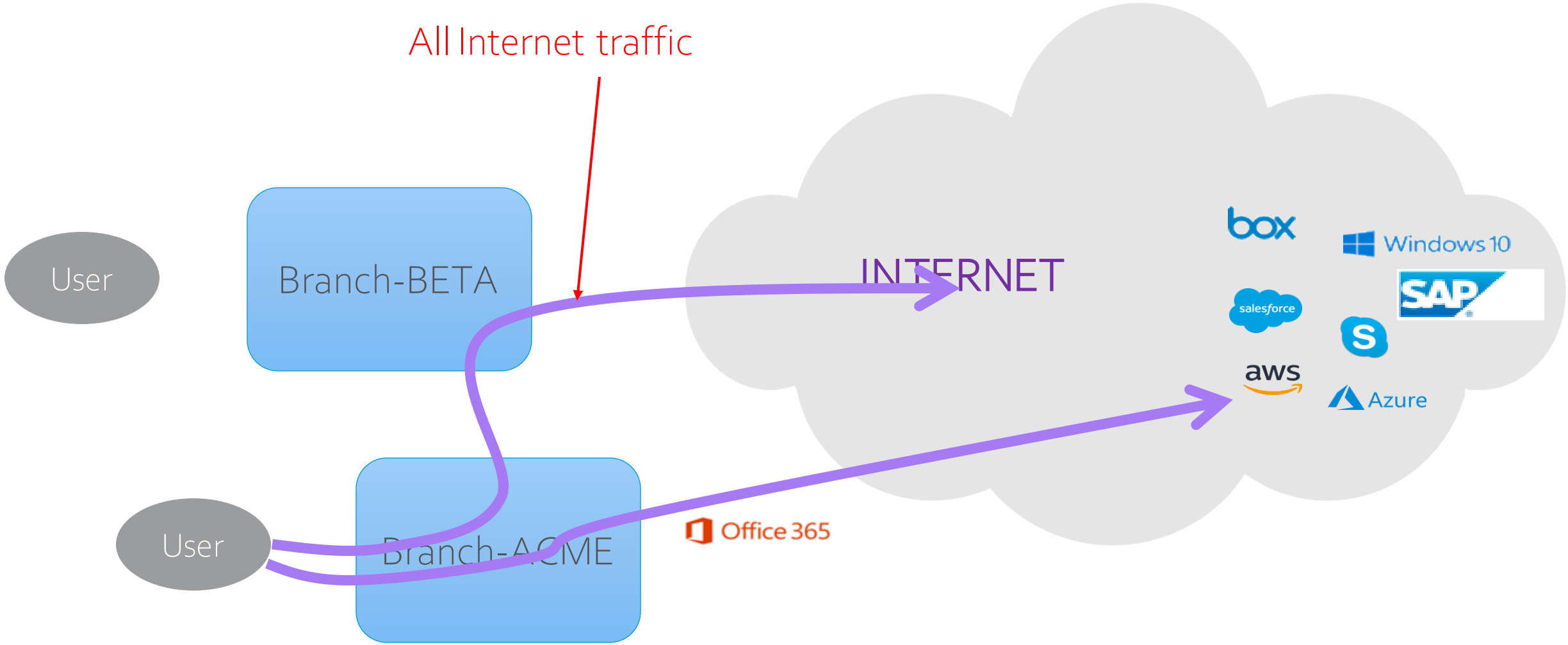
3 Configurable Parameters per SLA Probe:

- Inactivity interval (default: 300 seconds (5 min))
- Suspend interval (default: 30 seconds)
- Retries (default: 3 retries every 30 seconds)

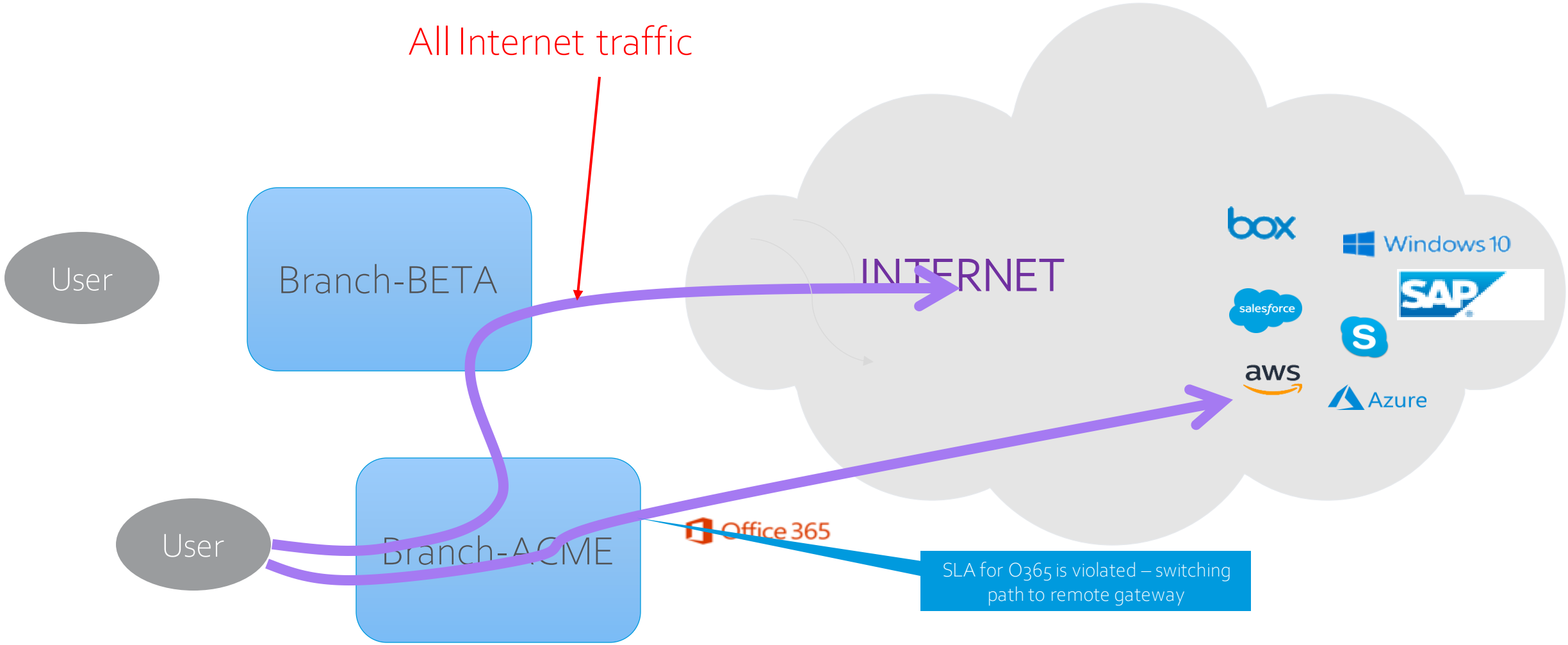
Selective Local DIA



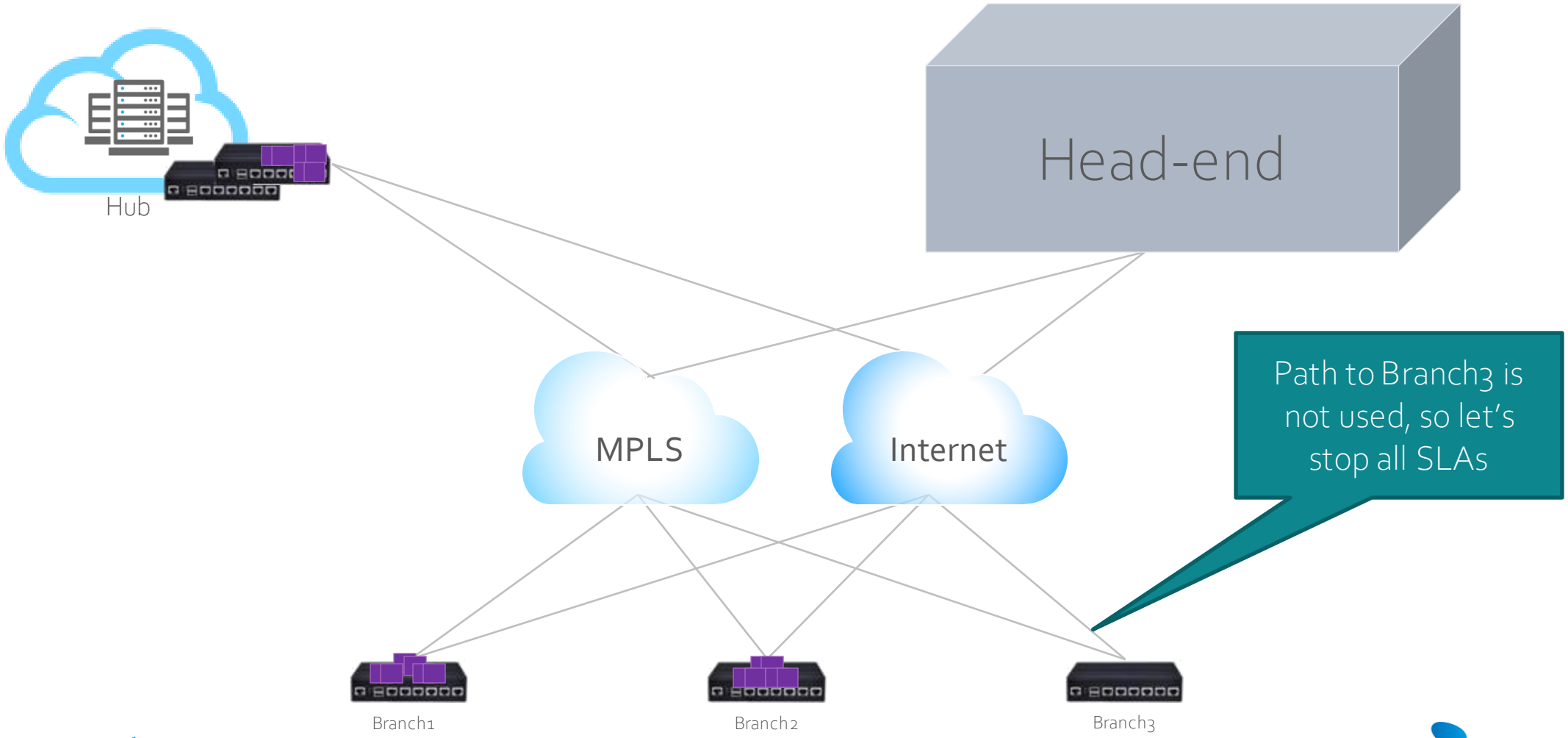
Selective Local DIA



Selective Local DIA



Data-driven SLA Monitoring



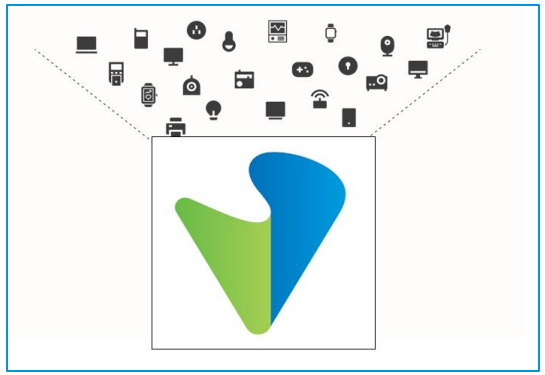
Client-less

Advanced Access Control

802.1X NAC

- Certificate based client device authentication
- RADIUS backed – rich interop options
- Ability to place clients in respective microsegments
- Single supplicant, multiple supplicant profiles per port

Device Fingerprinting (Dev-ID)



- Inline Analysis of traffic flows for IoT (and Corporate, BYOD/personal) devices
- Device Fingerprint DB – Leyer 2 to Layer 7
- Low Latency Rule-based Engine
- Match based on device class for consumption of policies, analytics, and others

User & Group Access Control

- User authentication via common IdP services
  or via Enterprise's own Active Directory
- Captive Portal or Passive/Inline User Authentication
- User Group policies
- Network access criteria, user policies based on user/group credentials

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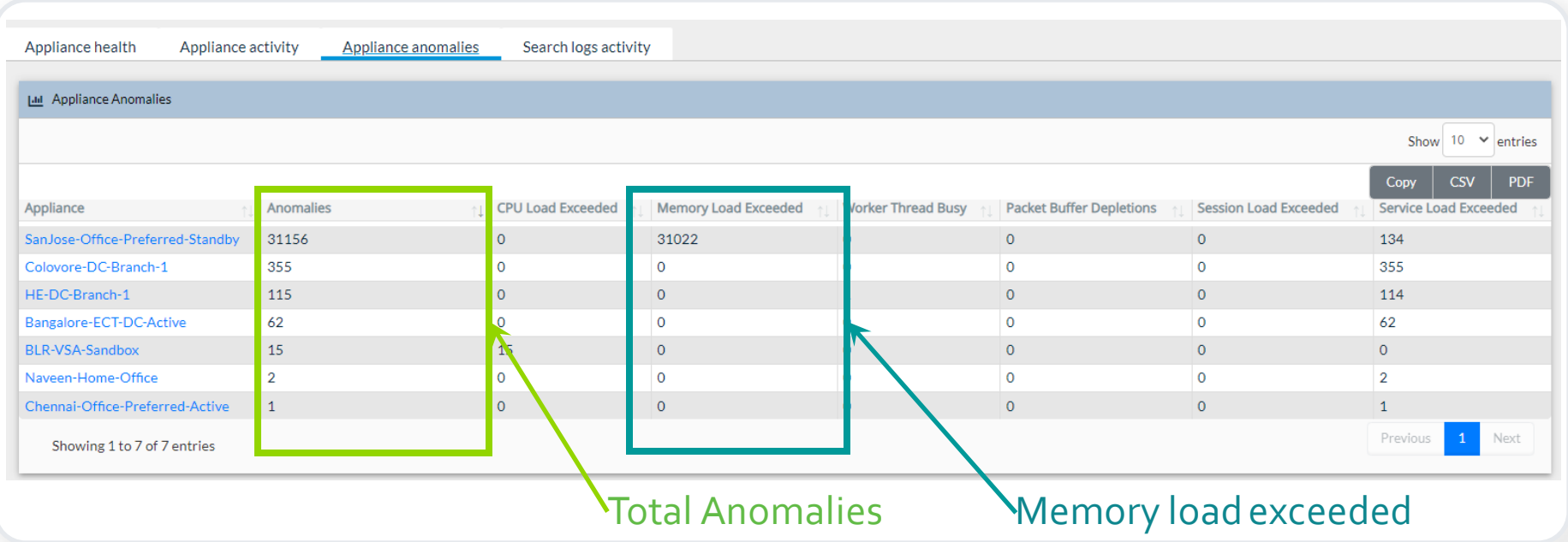
Find Anomalies

Monitor for unusual events



- Max session exceeded
- CPU load exceed
- Memory load exceed
- Packet buffer depletion
- Worker thread busy

- User generating a high number of traffic flows
  - Restrict max session per user using DDOS
- User using majority of network bandwidth
  - Restrict max bandwidth per user using per user policer

- Don't struggle endlessly if there are basic issues in your network such as duplicate IP in WAN and LAN, monitor alarms in Analytics

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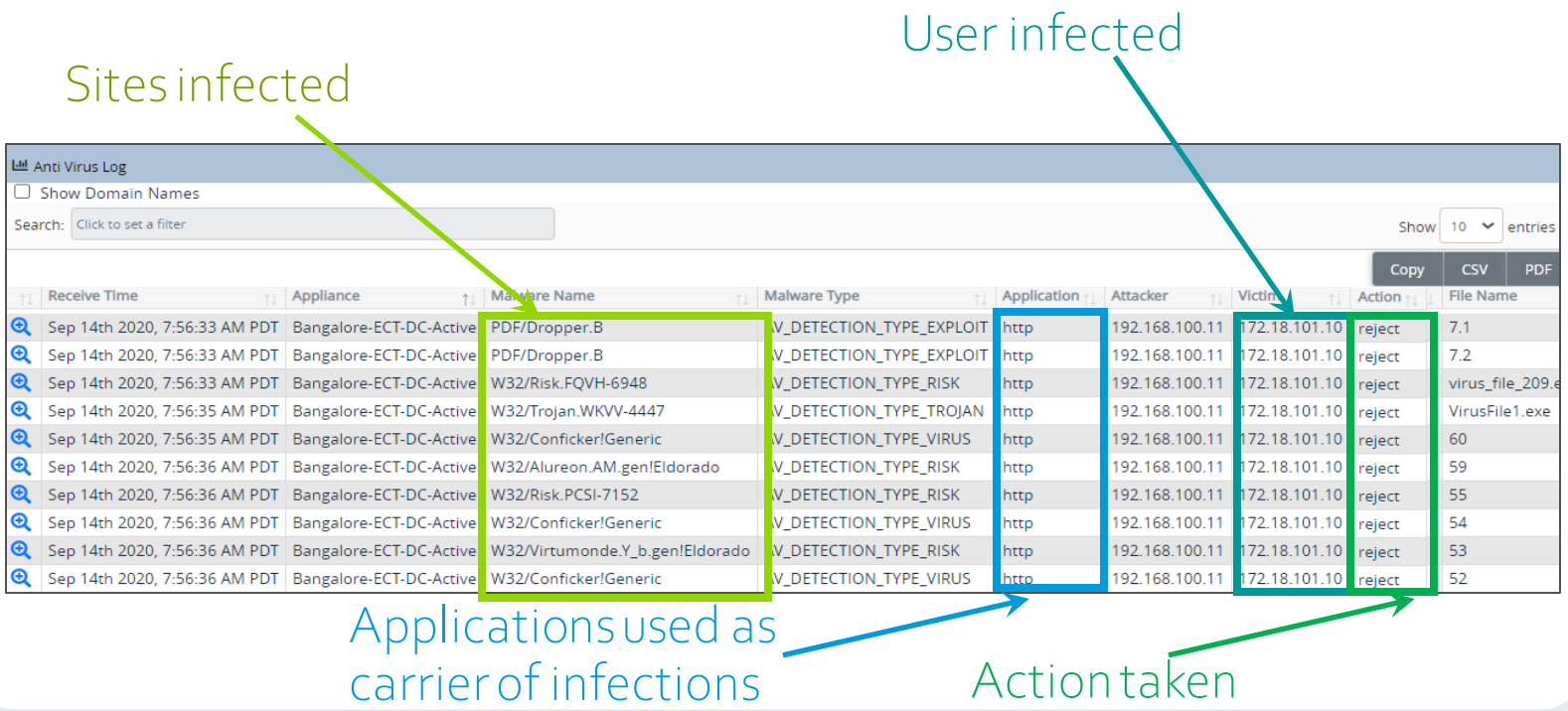
Find Anomalies

Monitor for unusual user activities

Monitor UTM threat events on Analytics to find the following malware, spyware, and ransomware



- Users accessing content with malware
- Users accessing content which is potentially malicious
- Users accessing URLs which are not compliant with organization policies
- Users accessing sites which are categorized as Phishing, Proxy, Exploits, etc.

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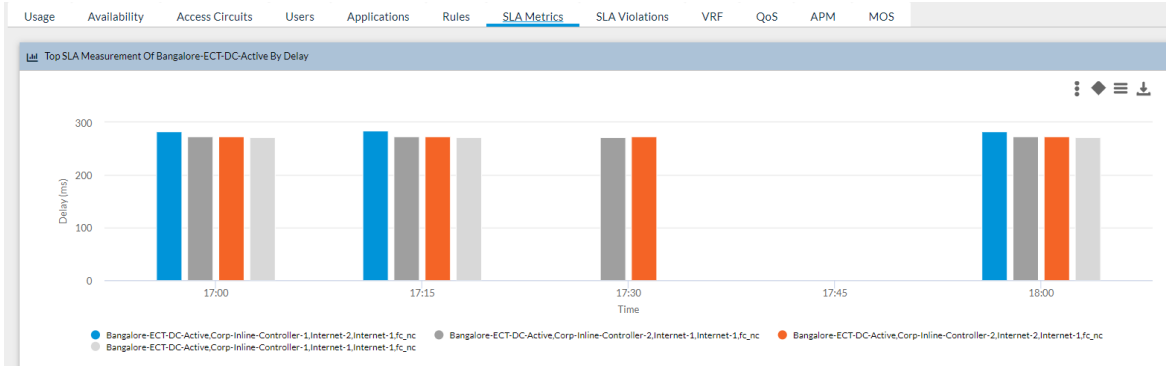
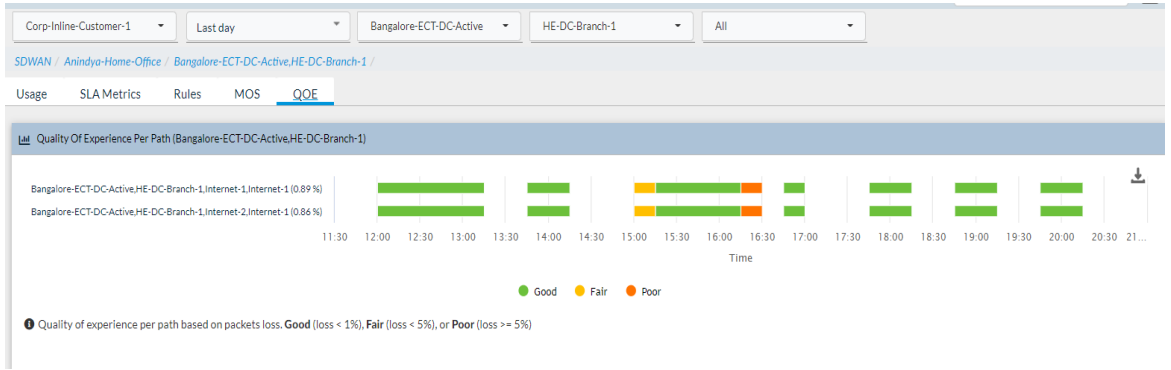
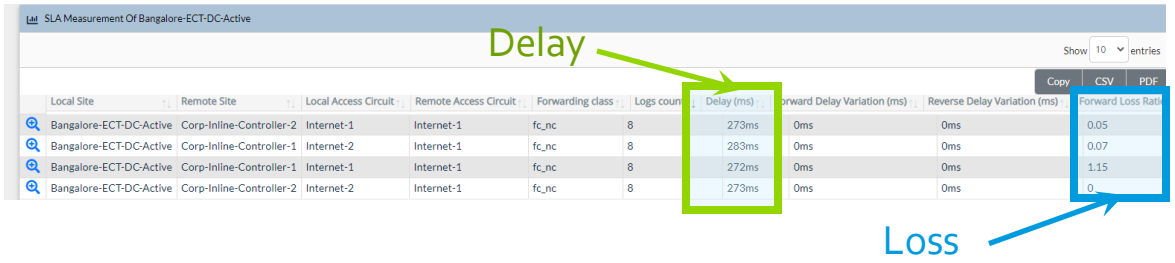
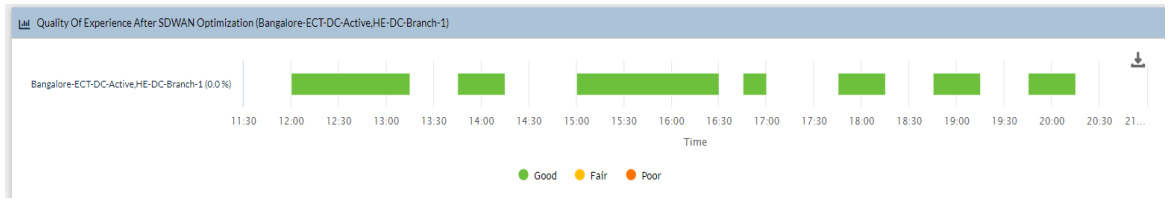
Monitor Network Performance









- Packet loss on underlay paths
- Latency and jitter on underlay paths
- Complete black out of underlay paths
- Quality of Experience (QoE)

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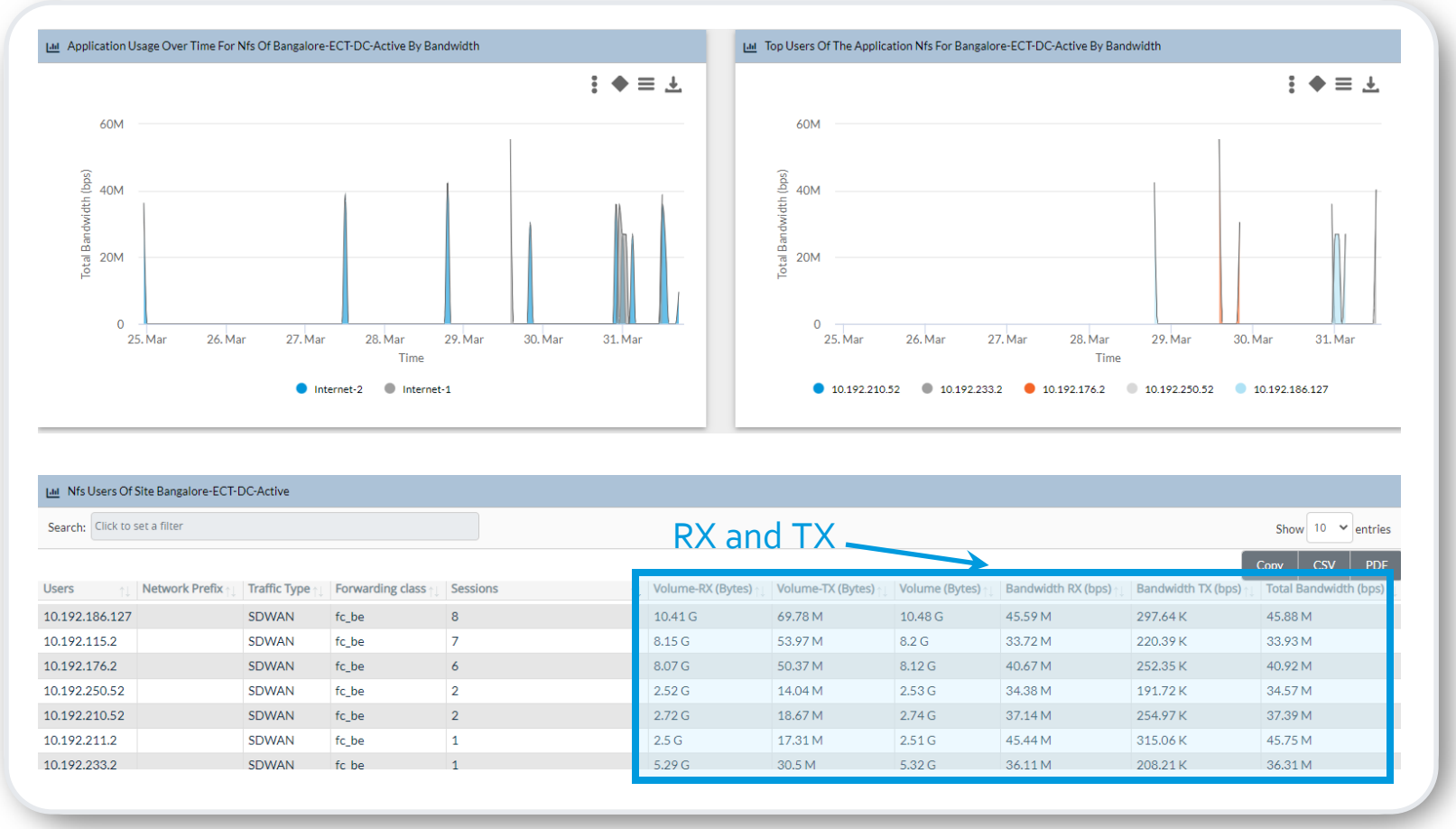
Monitor Application Performance

Historical Application Performance



Monitor Application Performance

If the Network performance is good, Is it server issue or application issue?

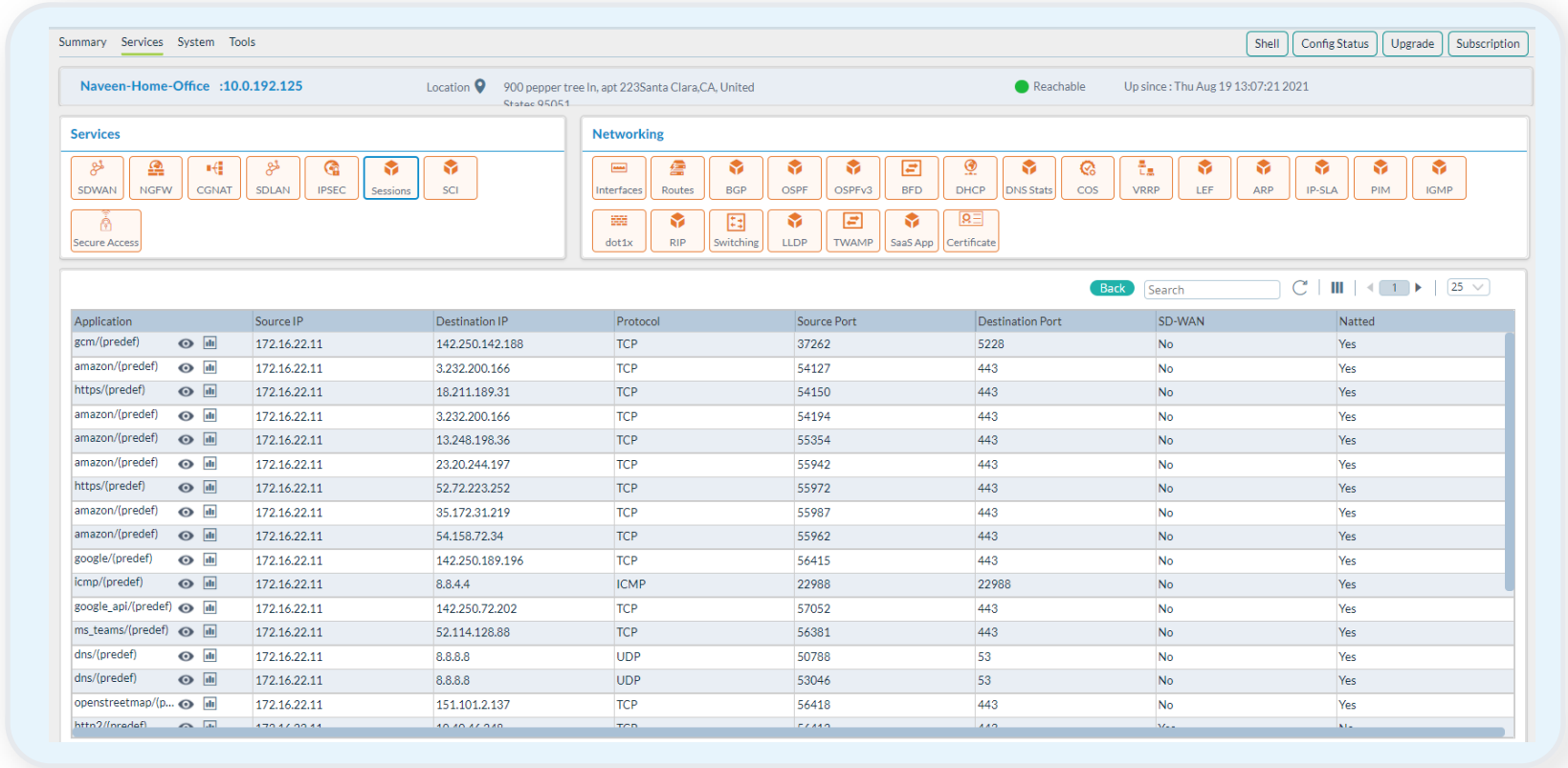
Monitor application historical performance and Versa App rank

Users	Network Prefix	Versa App Rank	Sessions	Network Response Time (ms)	TCP Retransmit Fwd	TCP Retransmit Rev	SAA RTT (usec)	SSA RTT (usec)	TCP Packets Fwd	TCP Packets Rev	Syn Retransmiss
10.192.186.3	10.48.0.0/24	99	108	283ms	0.91	2.68	512	282835	110	112	0
10.192.211.2	10.48.0.0/24	99	7	244ms	0.05	0.08	2063	1287825	1920	1956398	0
10.192.211.203	10.48.0.0/24	99	109	281ms	0	1.8	9654	282884	109	111	1
10.192.186.103	10.48.0.0/24	99	109	282ms	0.91	0.91	638	281671	110	110	0
10.192.186.52	10.48.0.0/24	99	12	285ms	10	0	676	283947	20	18	0
10.192.186.128	10.48.0.0/24	90	129	283ms	0.52	0.52	552	282140	193	193	0
10.192.233.2	10.40.1.0/24	61	6	283ms	0	0.22	301	282664	2105	2190811	0
10.192.176.2	10.48.0.0/24	60	14	285ms	0	0.2	468	284555	6071	6327100	0
10.192.186.127	10.48.0.0/24	58	12	293ms	0	0.18	504	292444	5699	5854288	0
10.192.211.27	10.48.0.0/24	57	5	283ms	0	0.18	262	282419	1931	1958900	0

Application rank is computed between 1-100 (1 for best and 100 for worst performing app) using various traffic attributes

Live Monitoring of Application Performance

Monitor application performance in real-time



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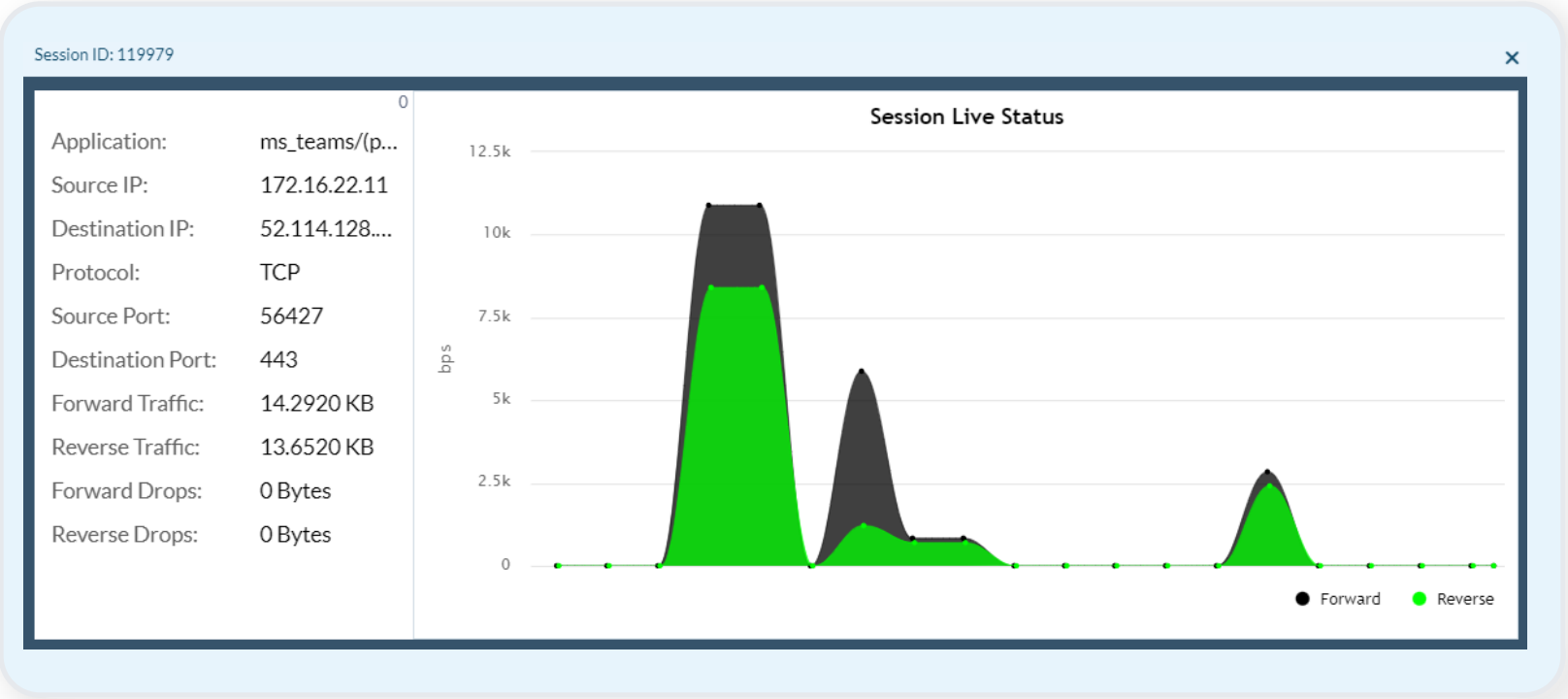
Monitor Application Performance

Live Monitoring of MS Teams application



Guidelines for External Monitoring Tools

- Do not use basic auth while sending RestAPI requests to director. Use OAuth instead of basic auth.
- Versa recommend to use streaming alarms and events from analytics to your collector and use that data instead of any pull models like API calls to director or SNMP walk
- Limit monitor APIs to lesser than 50 APIs/second to director.

Stay Up-to-Date with the Latest Security, OSSpack, and Software

OSSpack released with fixes for vulnerabilities found in Linux open source packages

- Versa uses Ubuntu as base OS for running software.
  Any vulnerabilities discovered in Ubuntu are fixed in OSSpack
- Install latest OSSpack

Upgrade to latest Director, Analytics, VOS software

- Upgrade all headend components first
- Upload images to VOS devices prior to actual upgrade day
- Once images are uploaded to VOS devices, individual or group of devices can be upgraded.

SPACK is released frequently with fixes for new security issues discovered

- Enable automatic spack update for VOS devices directly over internet

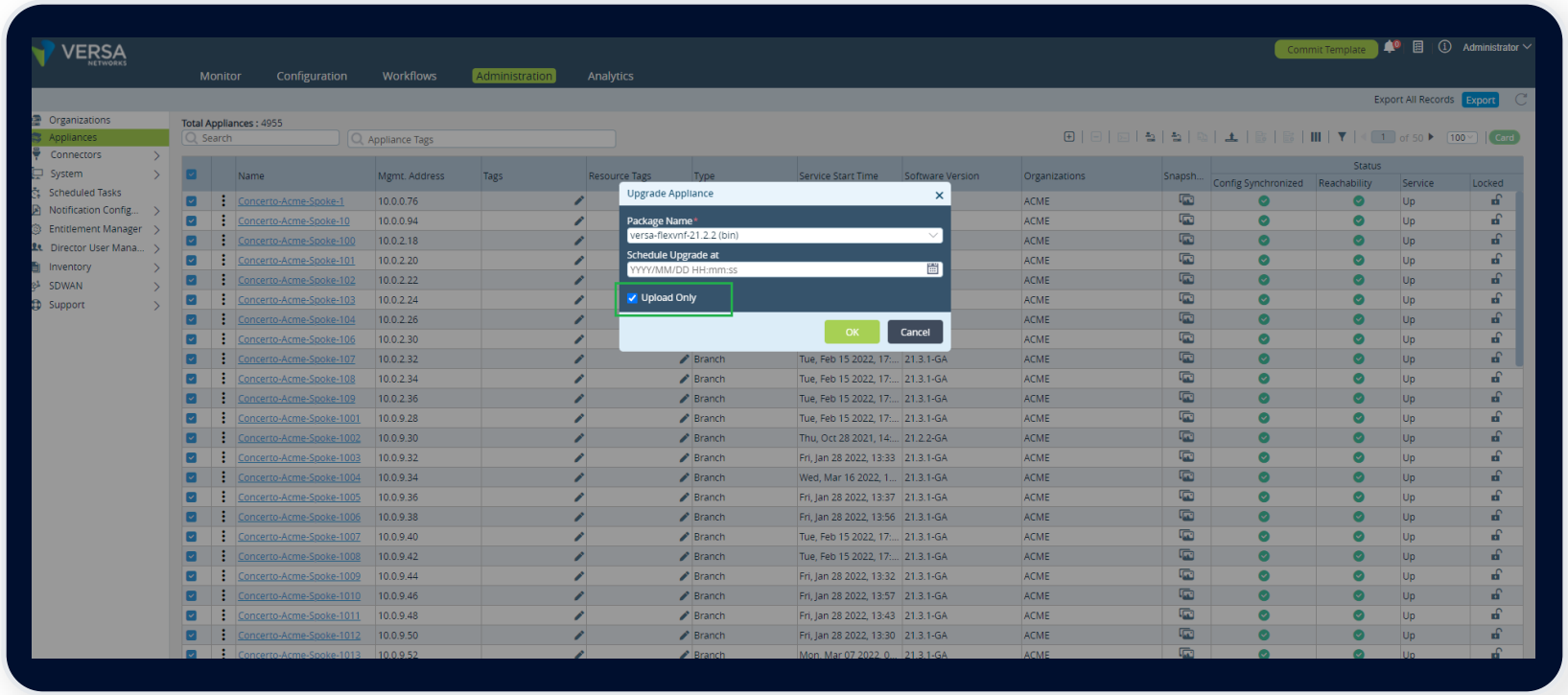
Upgrade to latest based OS (ubuntu)

- Install Versa base OS upgrade orchestrate
- Use Versa orchestrator and upgrade all Versa components

Installing VOS Image on Edge Devices

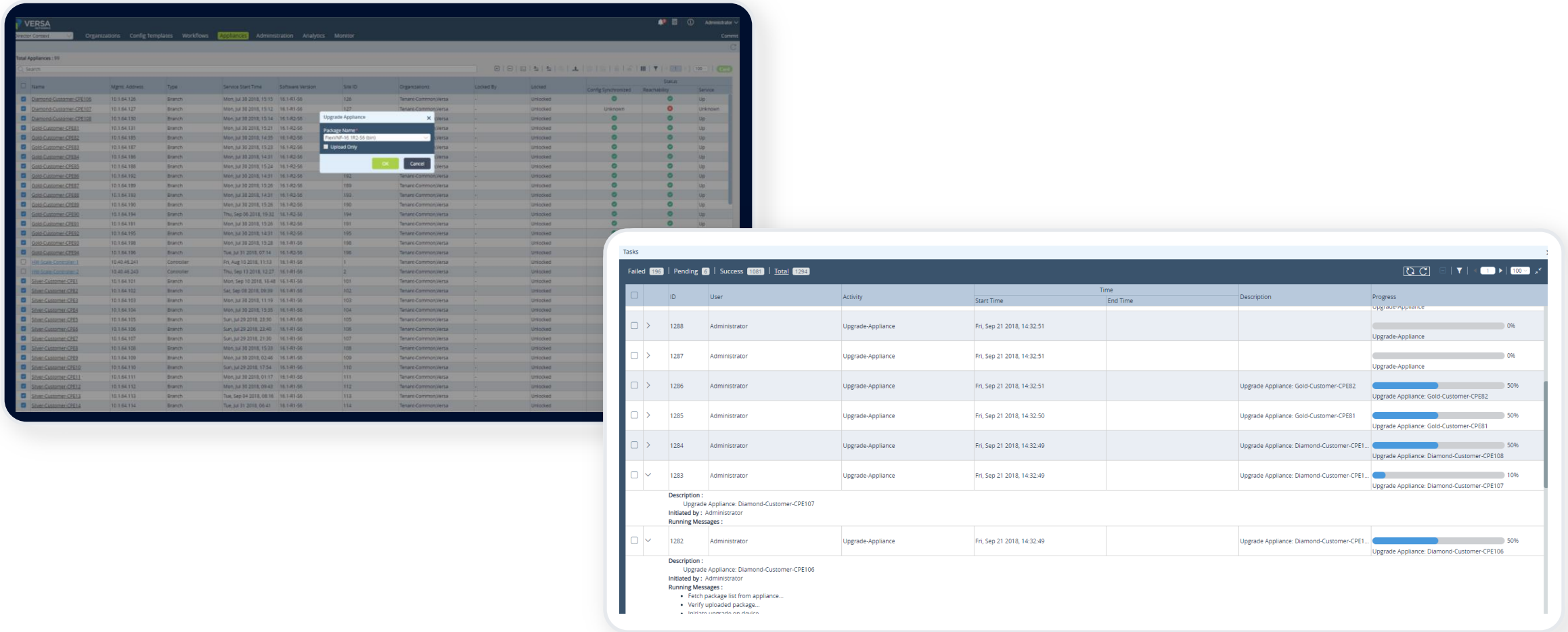
Upload VOS image in advance

- Restrict the max bandwidth used for image transfer if needed
- Use the link which is not bandwidth sensitive and not carrying customer critical traffic to transfer software image



Installing VOS Image on Edge Devices

Parallel upgrade of devices from Versa Director



Installing VOS Image on Edge Devices

Parallel upgrade of devices from Versa Director

Below are approximate times to upgrade 2,000 devices assuming 1 Gbps bandwidth between Versa Director and edge devices

Task	Software Upload	Software Upgrade
Task completion Time on a single device	30 seconds	10 minutes
Batch Processing supported (Y or N)	Y	Y
How many devices can be accommodated in a single Batch	10	100
Time Taken to complete all the Tasks per Batch	5 minute	15 minutes
Time taken to complete the Task for~2000 devices	20 hours	4 hour

Disaster Recovery

Plan ahead for any headend or DC failure where a headend is deployed

- Always take snapshots and recovery backups of Versa Director on a regular basis and keep this in a secure location
- Save snapshots of Versa Analytics in a secure location
- Save snapshots of Versa Controllers in a secure location

Restore the Headend components from snapshots

Summary

- Run headend components on reliable hardware with stable network connectivity between these headend components
- Large scale networks can be configured efficiently using a few templates and can be easily deployed using APIs
- Monitor network and security anomalies for unusual symptoms and take corrective actions
- Monitor network for underlay performance issues from Analytics
  - Identify service provider network issues
  - Monitor quality of experience of each underlay paths
- Monitor application performance to understand any suboptimal user experiences
  - Find root cause for suboptimal application performance by looking at APM metrics and taking corrective actions
- Stay up-to-date with the latest security patches using auto updates of spack, osspack images
- Efficiently upgrade your network using bulk upgrade
- Always prepare for disaster recovery by taking periodic backups and then restore from backup
- Versa SD-WAN allows you to manage network and security with very less resources compared to managing traditional legacy networks

If you need any additional information on achieving operational excellence for your whole network with minimal resources, reach out to naveen@versa-networks.com

Questions

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Thank you

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