Catalyst SD-WAN AppQoE DRE - Topology, Configuration, Verification

Contents

Introduction

This document describes how to create and configure a setup for Data Redundancy Elimination (DRE) optimization.

Background Information

This document aims to serve as a starting point for guidance on how to create and configure a setup for DRE which is part of an Integrated Application Quality of Experience (AppQoE) Solution, offering an End-to-End Consistent Policy Framework and Monitoring, for a Multitude of Deployment Use Cases.

Building blocks of AppQoE Solution:

- Forward Error Correction (FEC) and Packet Duplication (PD): Addresses Packet Loss issues. See for FEC.
- TCP optimization: Addresses WAN latency issues. See for a single-sided TCP Opt Use Case.

- DRE optimization: Addresses Low Bandwidth issues. Typically DRE Optimization is used together with TCP Optimization.

Existing CCO DRE documentation does not contain a full end-to-end process description. This document provides a step-by-step end-to-end description of the DRE solution.

A deep technical explanation of DRE functionality is out of the scope of this article. If you want to learn more about technical details and DRE functionality, please use this documentation.

DRE Optimization

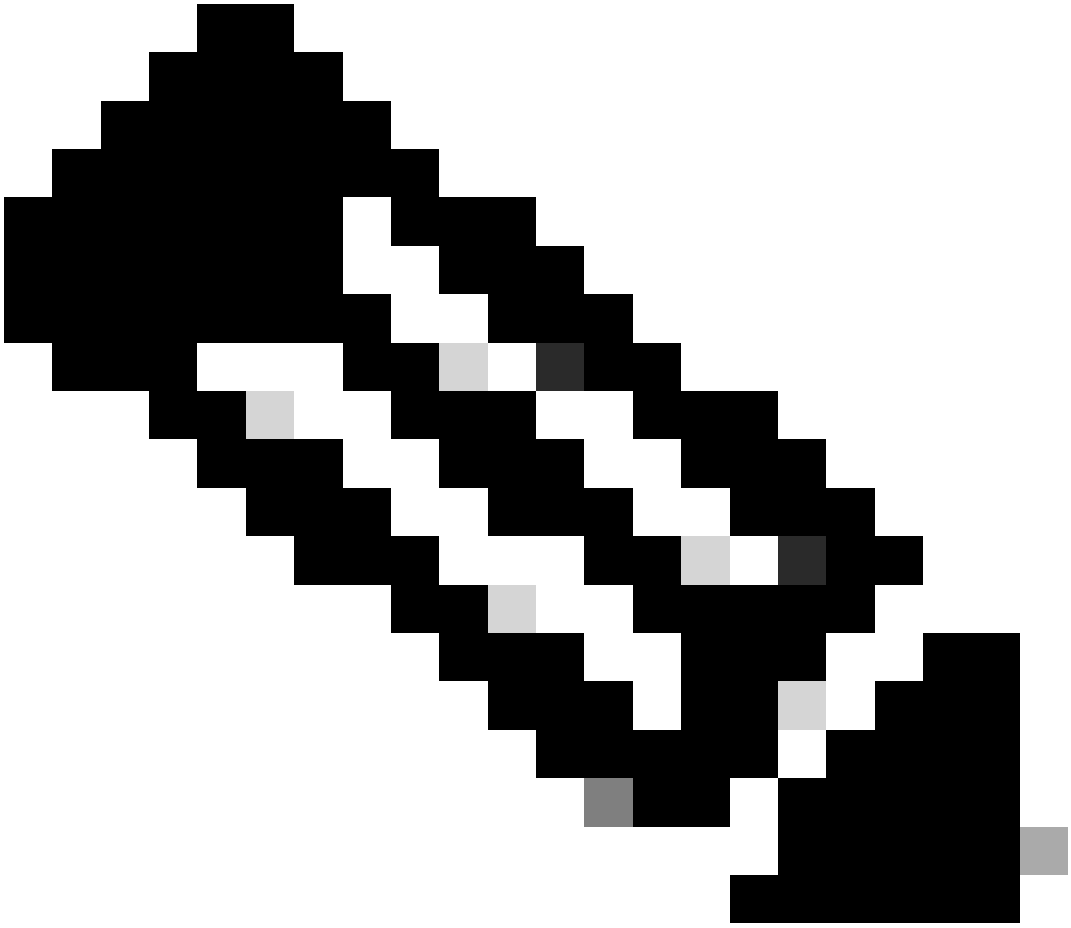
DRE is a dual-sided solution that removes redundant data by caching previously seen patterns. Combined with the Lempel–Ziv–Welch (LZW) algorithm, which provides compression to reduce the amount of data over WAN, the DRE feature offers a fully secure and integrated solution with Unified Threat Defense (UTD) and Secure Sockets Layer (SSL) proxy.

It is Application and Protocol agnostic and is a Cloud-ready solution which offers around 60-90% WAN traffic reduction.

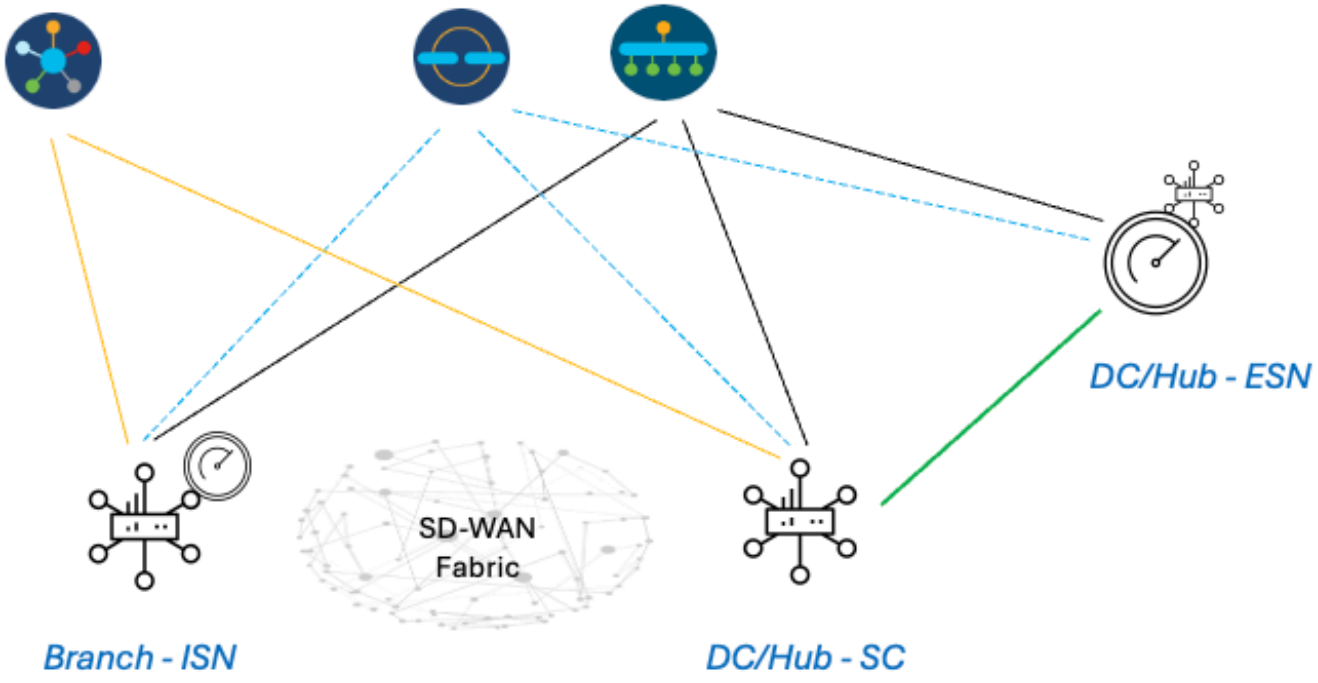
Different deployment scenarios are supported to achieve a scalable solution.

- The integrated solution provides a one-box solution for deploying branch services, termed as an Integrated Service node (ISN).
- External Service Nodes (ESN) are decoupled from intercepting edge routers or Service Controller (SC) in External Service Node deployment, typically at Data Centers and Hubs. Redirection of flows based on application traffic is achieved using a Data Policy.

Control Connections



Note: The ESN does not form any control connection with the Controller (formerly known as vSmart). The ESN has a control connection to the SD-WAN Manager.



Steps to Build an AppQoE DRE Setup with ISN and ESN

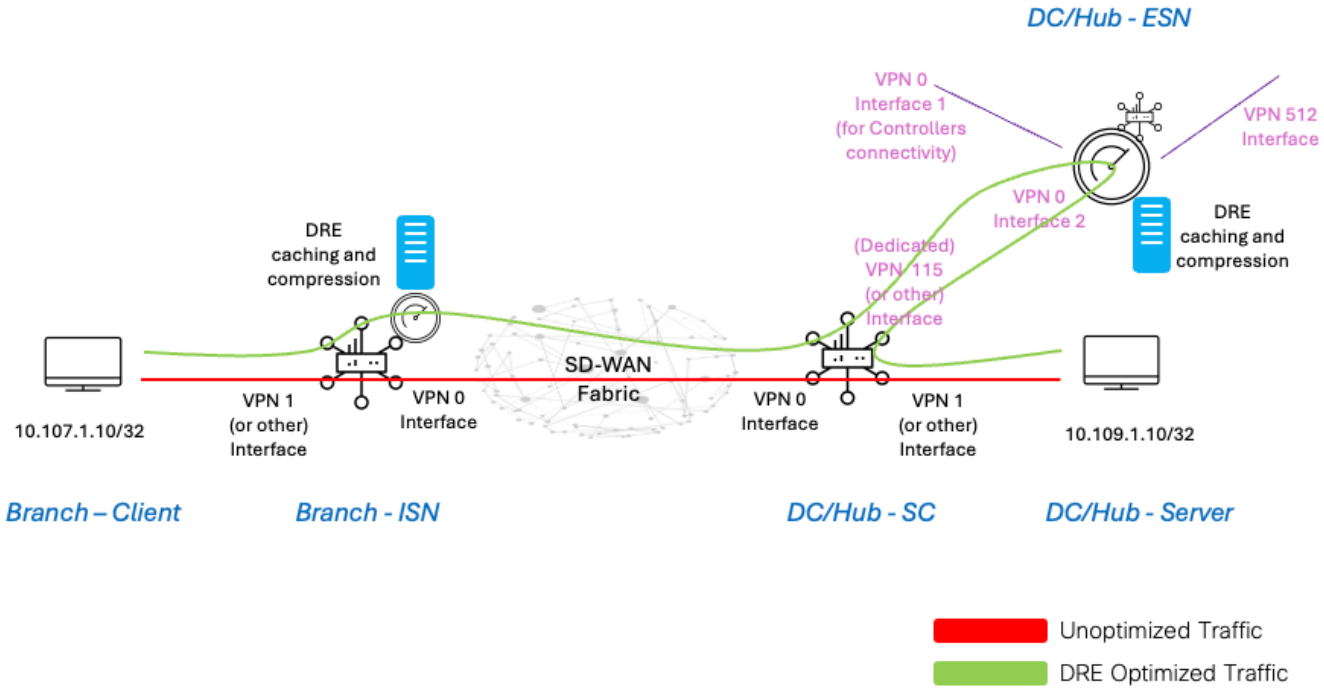
1. System (Interfaces and Hardware) and Topology

1.1. Topology and Interfaces

The ESN requires the following interfaces:

- A VPN0 Interface connectivity to the Controllers (Manager and Validator [transient]). Connectivity from ESN to Controllers can be directly or via SC. The recommendation is via SC since this avoids the need for an additional WAN circuit on the ESN.

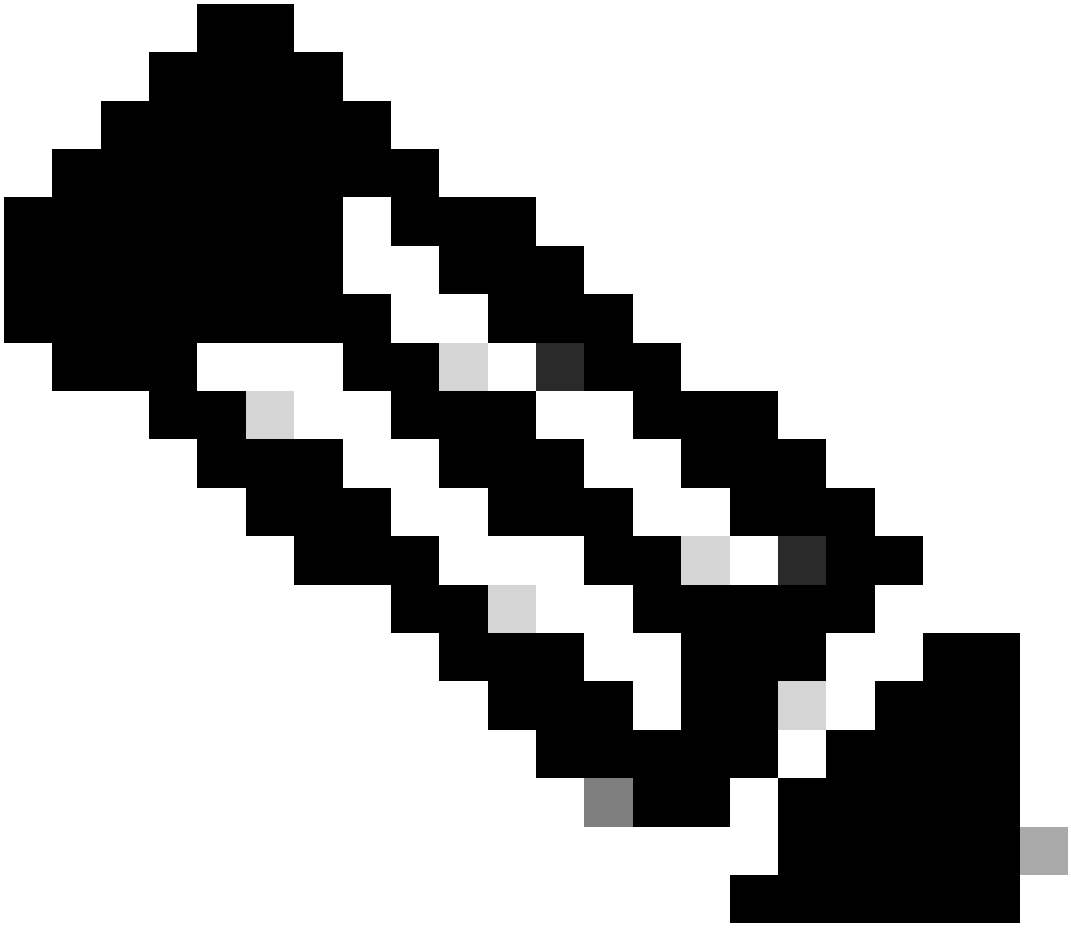
- Another VPN0 Interface for connectivity to the Service Controller.
- Optional: A VPN512 Management interface.



1.2. Disk Requirement

For a lab setup, a 150GB disk is good enough, for the DRE optimization to work.

This holds good only for functional verification in a lab environment, and is not meant for production. For accurate disk and other recommendations, please check this CCO link.



Note: This additional disk requirement is only for the ISN and ESN. It is not required on SC.

1.3. Adding Devices to SD-WAN Fabric

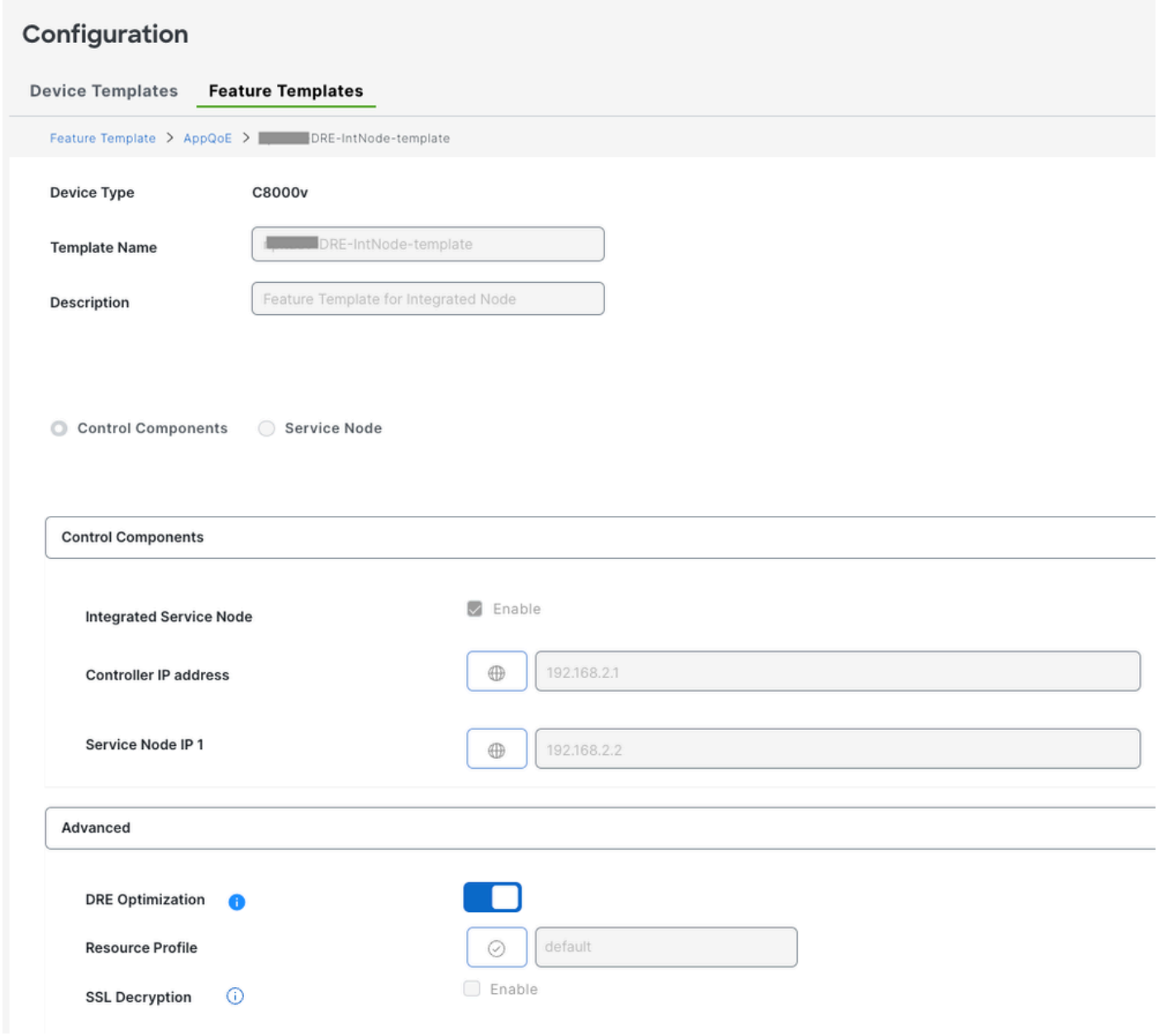
- Using templates (available from 20.6/17.6 onwards): AppQoe Feature template which can be specified in the Device Template as an Additional Template.
- Using Configuration Groups (available from 20.14/17.14 onwards): AppQoE Feature parcel available in Service/LAN profile in Configuration Group.

1.4. C8000v Details

If you are using c8kv, please ensure to enable app-heavy CPU profile configuration. Useful article.

2. Branch: AppQoE ISN Configuration

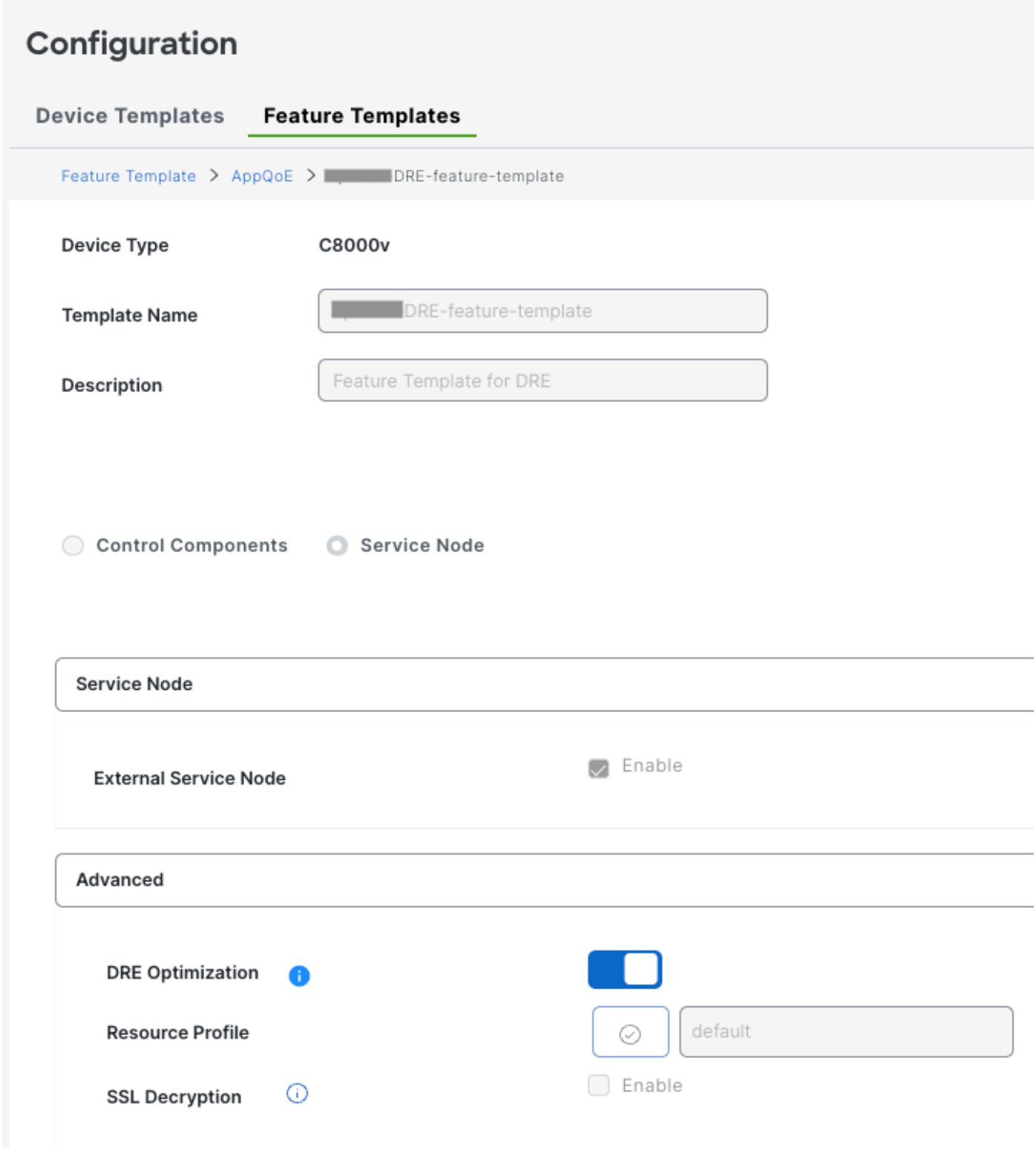
Create an AppQoE feature template (using templates as shown here) for the device model.



Then, specify this Feature template in the Device template.

3. DC/Hub: AppQoE ESN Configuration

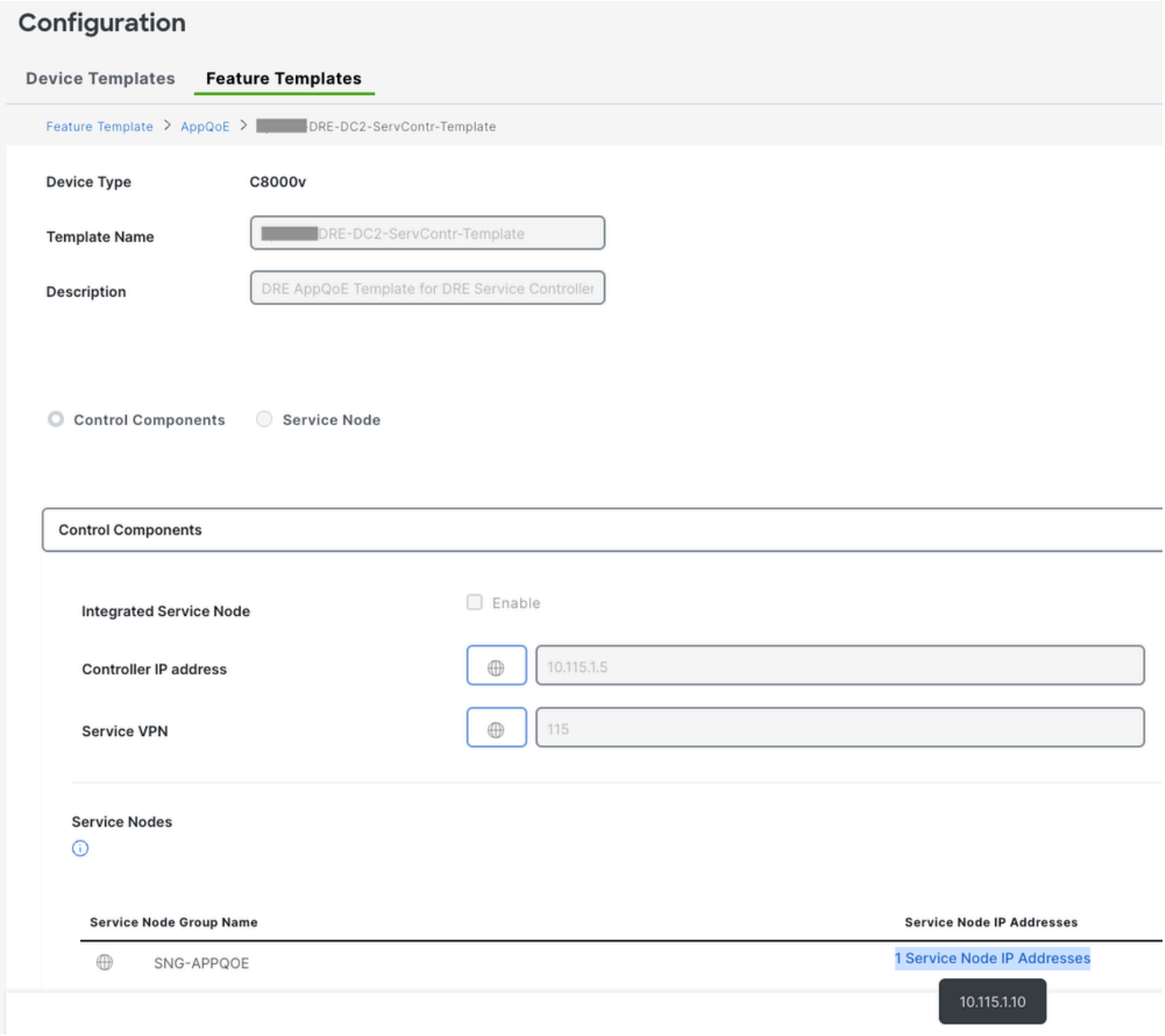
Create an AppQoE Feature Template for the device model.



Then, specify this Feature template in the Device template.

4. DC/Hub: AppQoE SC Configuration

Create an AppQoE Feature Template for the device model.



Then, specify this Feature template in the Device template.

5. Centralized Traffic Data Policy

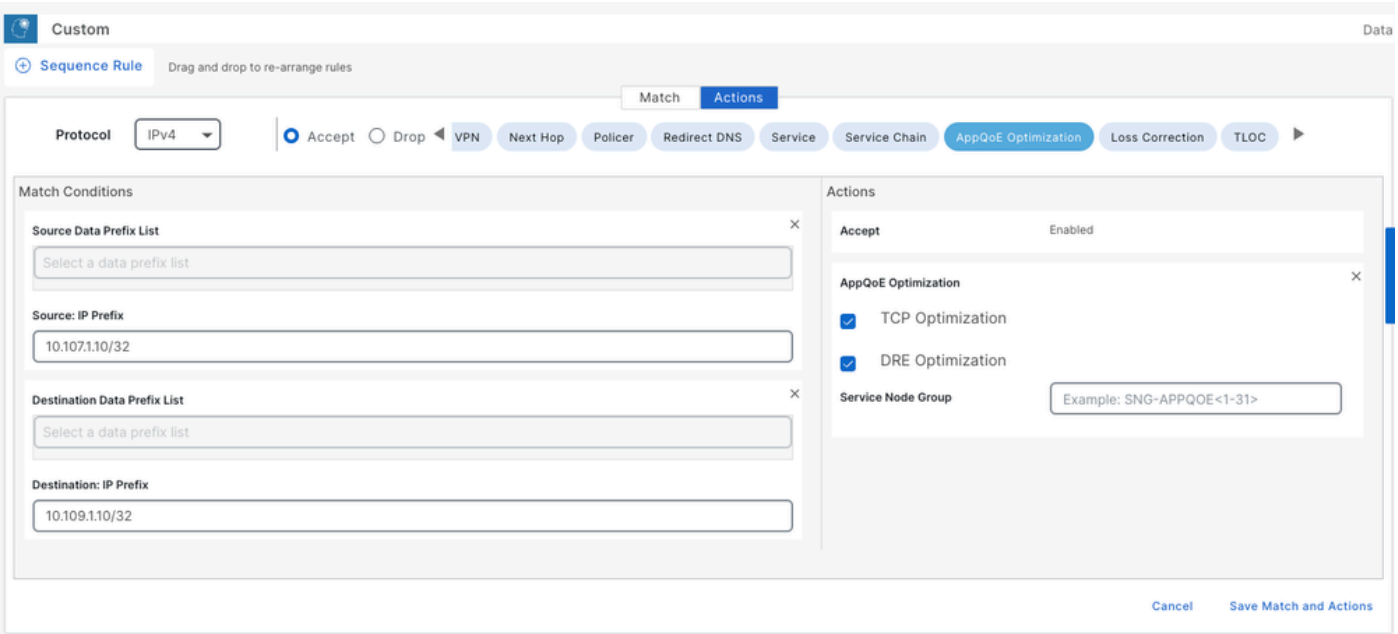
- Two different policies are required: one for the Internal Service Node (ISN) and the second for the Service Controller (SC). See the difference below.
- The Policy direction must be "All" for both
- The Service-node-group must be blank for ISN and specified for the SC.
- DRE optimization is typically used along with TCP optimization.

In this example, a Web Client on a Branch location is defined and a Web Server on the DC site, you might want to adjust it for your traffic of interest accordingly.

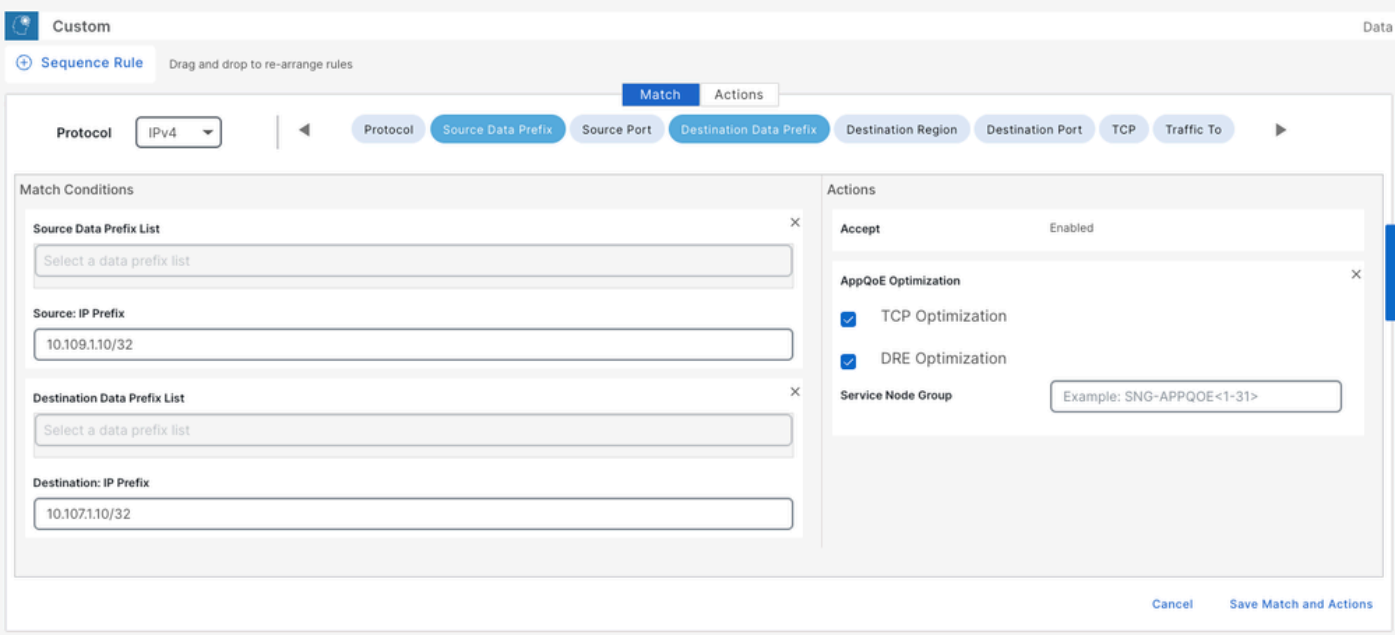
A. Branch ISN

UI - Template

Sequence 1 - from Client 10.107.1.10 to Server 10.109.1.10:



Sequence 2 - from Server back to Client:



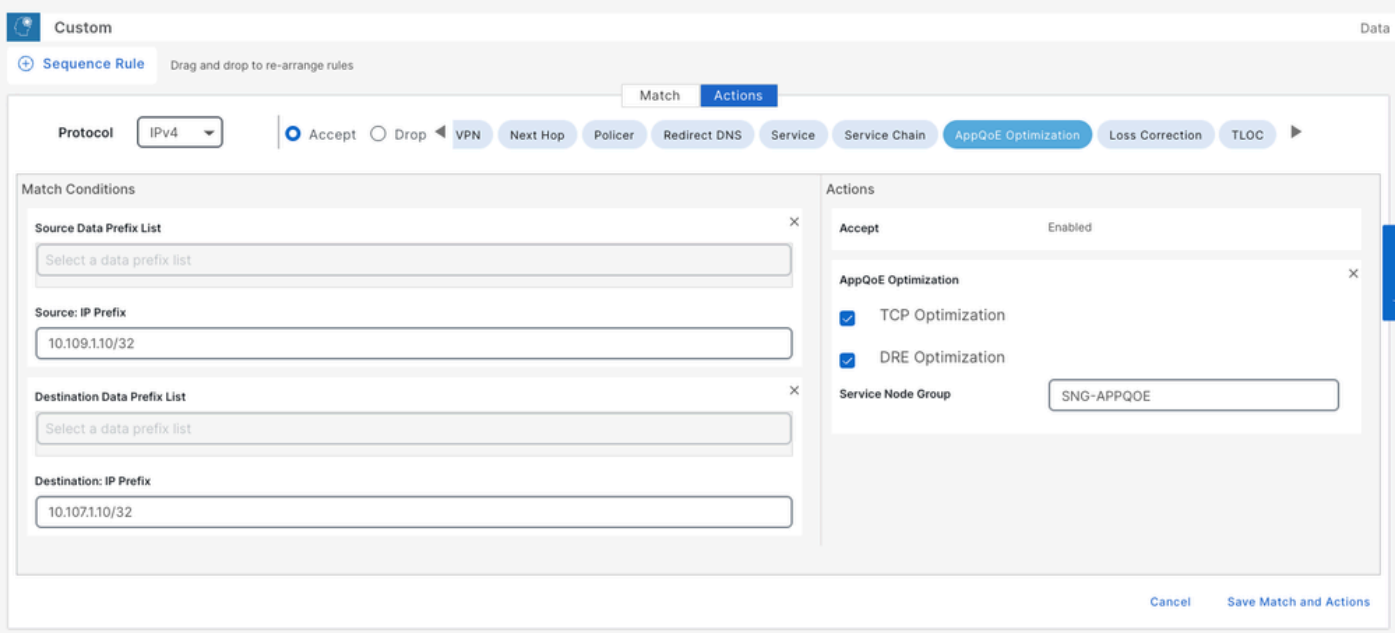
CLI:

```
ISN# show sdwan policy from-vsmart

from-vsmart data-policy _CorpVPN_DRE-data-policy-ISN-2
 direction all
 vpn-list CorpVPN
  sequence 1
   match
    source-ip 10.107.1.10/32
    destination-ip 10.109.1.10/32
   action accept
    tcp-optimization
    dre-optimization
  sequence 11
   match
    source-ip 10.109.1.10/32
    destination-ip 10.107.1.10/32
   action accept
    tcp-optimization
    dre-optimization
  default-action accept

from-vsmart lists vpn-list CorpVPN
 vpn 1
```

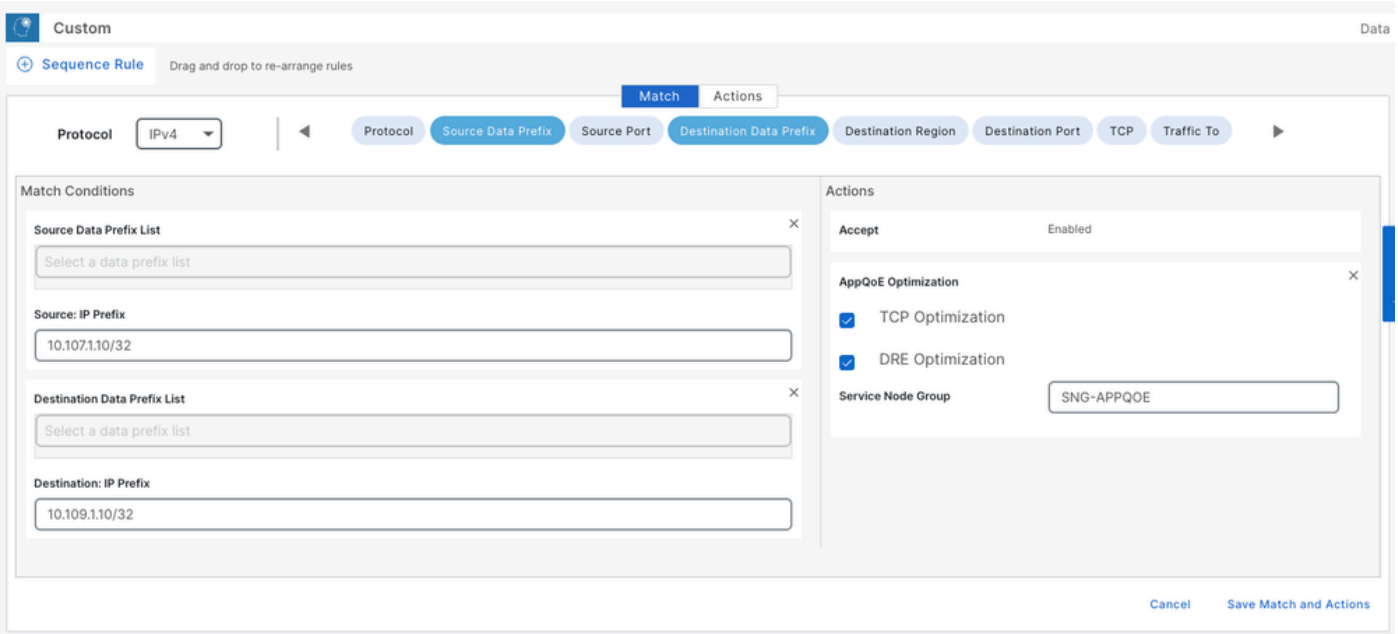
B. DC/Hub SC

UI - Template

Sequence 1:



Sequence 2:



CLI:

```
SC# show sdwan policy from-vsmart

from-vsmart data-policy _CorpVPN_DRE-data-policy-SC_ESN-2
 direction all
 vpn-list CorpVPN
  sequence 1
   match
    source-ip 10.107.1.10/32
    destination-ip 10.109.1.10/32
   action accept
    tcp-optimization
    dre-optimization
    service-node-group SNG-APPQOE
  sequence 11
```

```
   match
    source-ip 10.109.1.10/32
    destination-ip 10.107.1.10/32
   action accept
    tcp-optimization
    dre-optimization
    service-node-group SNG-APPQOE
  default-action accept

from-vsmart lists vpn-list CorpVPN
 vpn 1
```

Verification - CLI

Branch ISN

```
ISN# show sdwan appqoe dreopt status

DRE ID                                  : 52:54:dd:2a:74:d7-018eafaa99e1-f9ff51aa
DRE uptime                              : 04:10:59:59
Health status                           : GREEN
Health status change reason             : None
Last health status change time          : 04:10:59:59
Last health status notification sent time : 1 second
DRE cache status                        : Active
Disk cache usage                        : 2%
Disk latency                            : 25 ms
Active alarms:
  None

Configuration:
  Profile type                          : S
  Maximum connections                   : 750
  Maximum fanout                        : 35
  Disk size                             : 60 GB
  Memory size                           : 2048 MB
  CPU cores                             : 1
  Disk encryption                       : ON


ISN# show sdwan appqoe flow active
T:TCP, S:SSL, U:UTD, D:DRE

Flow ID        VPN ID   Source IP      Port  Destination IP  Port  Tx Bytes       Rx Bytes       Services
-------------------------------------------------------------------------------------------------------------
54382538667    1        10.107.1.10    55340 10.109.1.10     80    263663268      640416         TD


ISN# show sdwan appqoe dreopt statistics
Total connections               : 4
Max concurrent connections      : 1
Current active connections      : 1
Total connection resets         : 0
Total original bytes            : 3570 MB
Total optimized bytes           : 1633 MB
```

Overall reduction ratio : 54%
Disk size used : 2%
Cache details:
Cache status : Active
Cache Size : 59132 MB
Cache used : 2%
Oldest data in cache : 01:22:02:49
Replaced(last hour): size : 0 MB

DC/Hub SC

SC# show service-insertion type appqoe service-node-group
Service Node Group name : SNG-APPQOE
Service Context : appqoe/1
Member Service Node count : 1

Service Node (SN) : 10.115.1.10
Auto discovered : No
SN belongs to SNG : SNG-APPQOE
Current status of SN : Alive
System IP : 10.1.90.2
Site ID : 90
Time current status was reached : Sat Apr 6 07:26:16 2024

Cluster protocol VPATH version : 2 (Bitmap recvd: 3)
Cluster protocol incarnation number : 1
Cluster protocol last sent sequence number : 1714282683
Cluster protocol last received sequence number: 1931795
Cluster protocol last received ack number : 1714282682

Health Markers:
AO Load State

tcp GREEN 0%
ssl RED/NOT AVAILABLE
dre GREEN 0%
http RED/NOT AVAILABLE
utd chnl RED/NOT AVAILABLE

DC/Hub ESN

ESN# show sdwan appqoe dreopt status
DRE ID : 52:54:dd:c3:40:17-018eb15f4fc3-49ee2d0f
DRE uptime : 04:11:28:50
Health status : GREEN
Health status change reason : None
Last health status change time : 04:11:28:50
Last health status notification sent time : 1 second
DRE cache status : Active
Disk cache usage : 2%

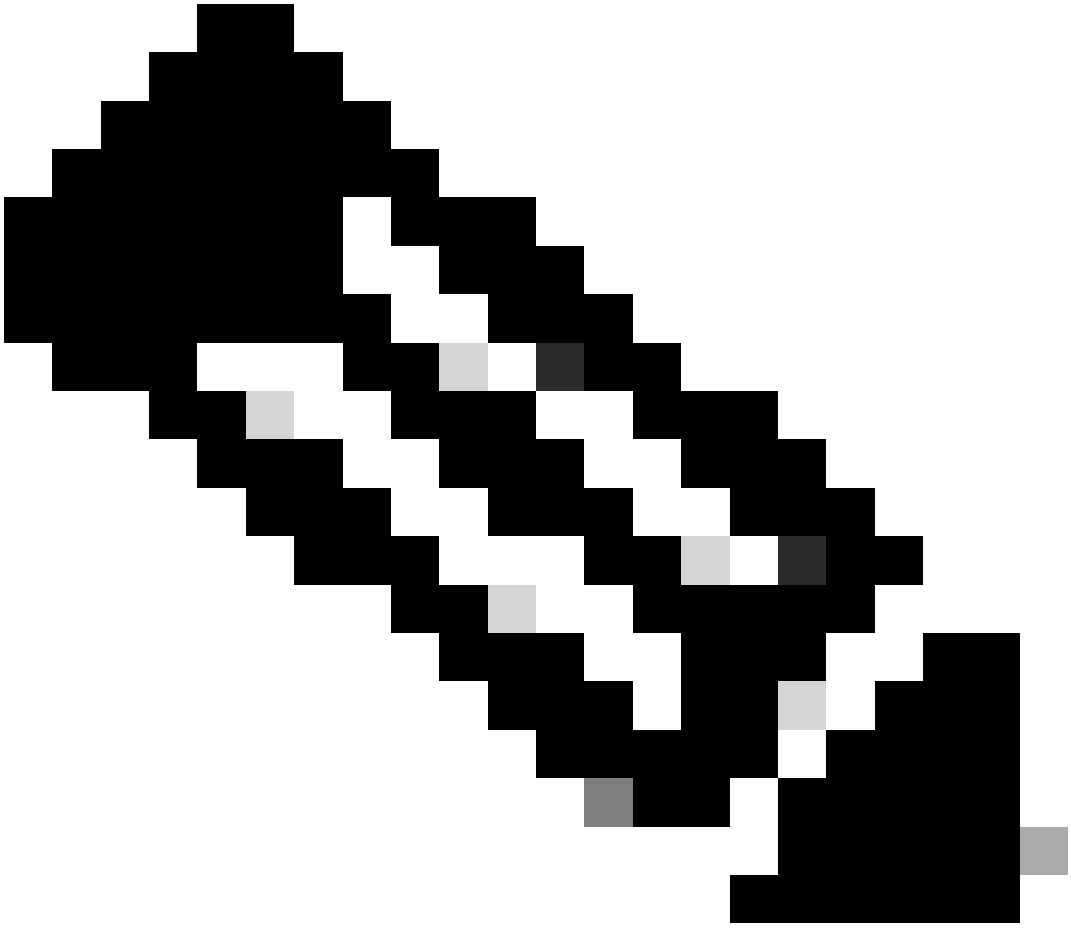
```
Disk latency                          : 10 ms
Active alarms:
  None

Configuration:
  Profile type                        : S
  Maximum connections                 : 750
  Maximum fanout                      : 35
  Disk size                           : 60 GB
  Memory size                         : 2048 MB
  CPU cores                           : 1
  Disk encryption                     : ON

ESN# show sdwan appqoe flow active
T:TCP, S:SSL, U:UTD, D:DRE

Flow ID        VPN ID    Source IP      Port  Destination IP  Port  Tx Bytes       Rx Bytes       Services
-------------------------------------------------------------------------------------------------------------
20022800299    1         10.107.1.10    55340 10.109.1.10     80    2998777        1074725760     TD



ESN# show sdwan appqoe dreopt statistics
Total connections                 : 4
Max concurrent connections        : 1
Current active connections        : 1
Total connection resets           : 0
Total original bytes              : 4294 MB
Total optimized bytes             : 1634 MB
Overall reduction ratio           : 61%
Disk size used                    : 2%
Cache details:
  Cache status                    : Active
  Cache Size                      : 59132 MB
  Cache used                      : 2%
  Oldest data in cache            : 01:22:04:08
  Replaced(last hour): size       : 0 MB
```

Verification - Dashboard

To view the AppQoE DRE data in the SD-WAN Manager Device dashboard, ensure the following:

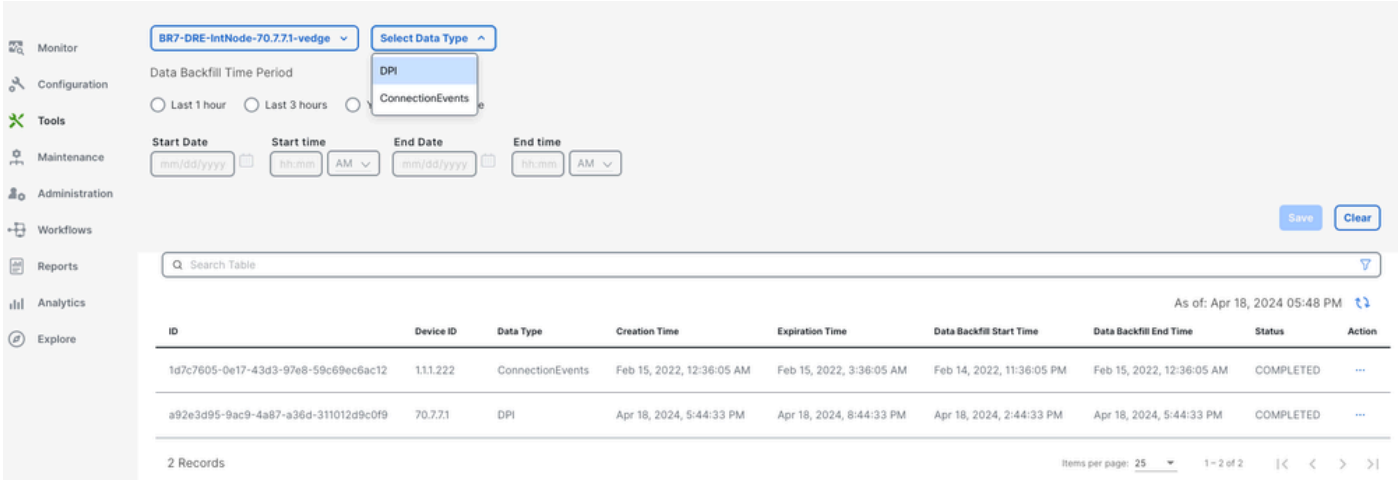
- Controllers and Devices time is synchronized by configuring Network Time Protocol (NTP). You can also use the Clock set command to set the clock manually.
- Add these CLIs to the Device configuration (ISN/SC/ESN):

```
policy ip visibility features multi-sn enable
policy ip visibility features dre enable
policy ip visibility features sslproxy enable - (for SSL traffic)
```



Note: On-demand Troubleshooting should be enabled to view these dashboards. Note that the dashboard screens shown here do not show real-time information.

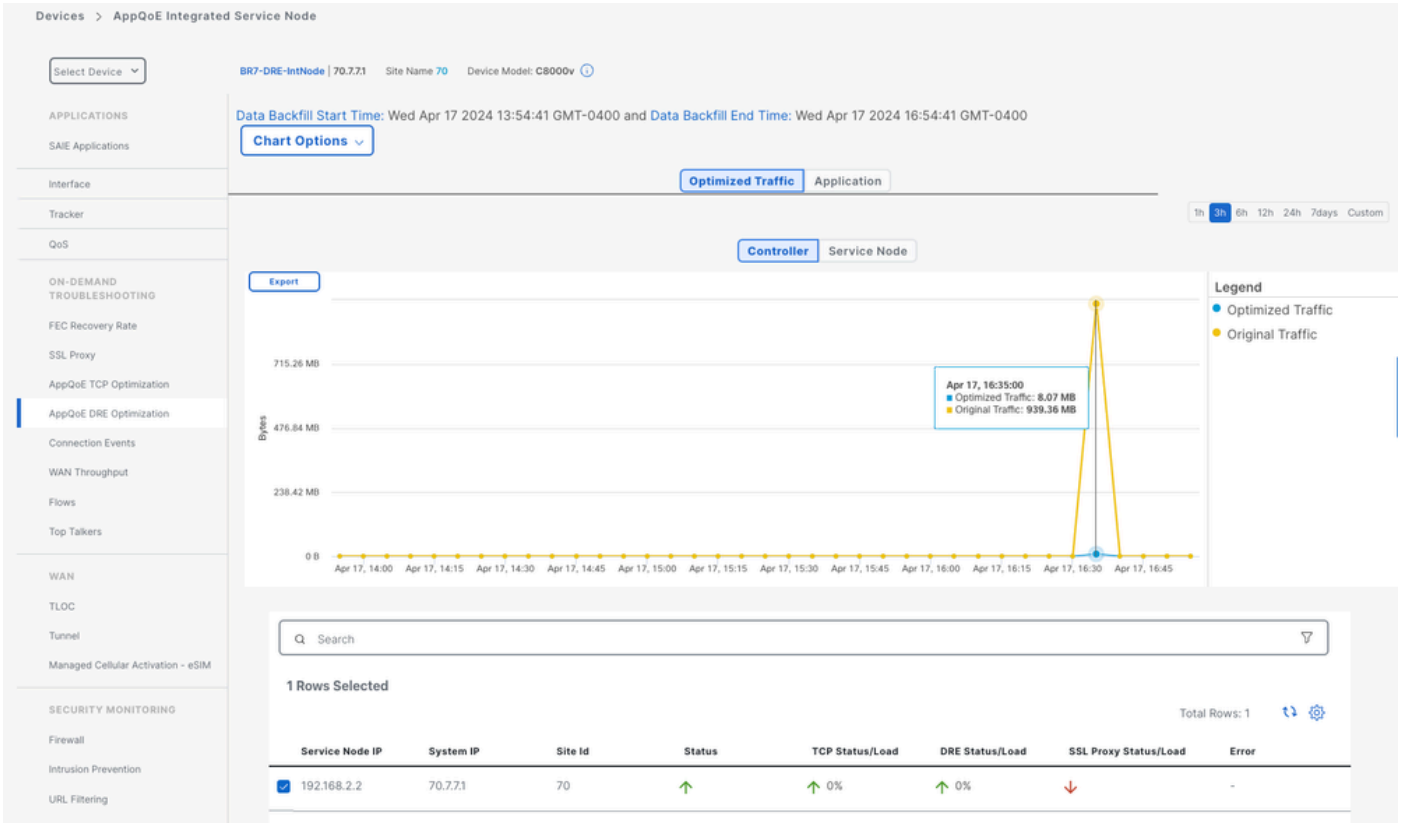
To get the latest data, you might want to navigate to Tools > On Demand Troubleshooting , select the appropriate Device and "DPI" as Data Type and retrieve the DPI statistics for the last 3 hours as shown here:



Branch ISN

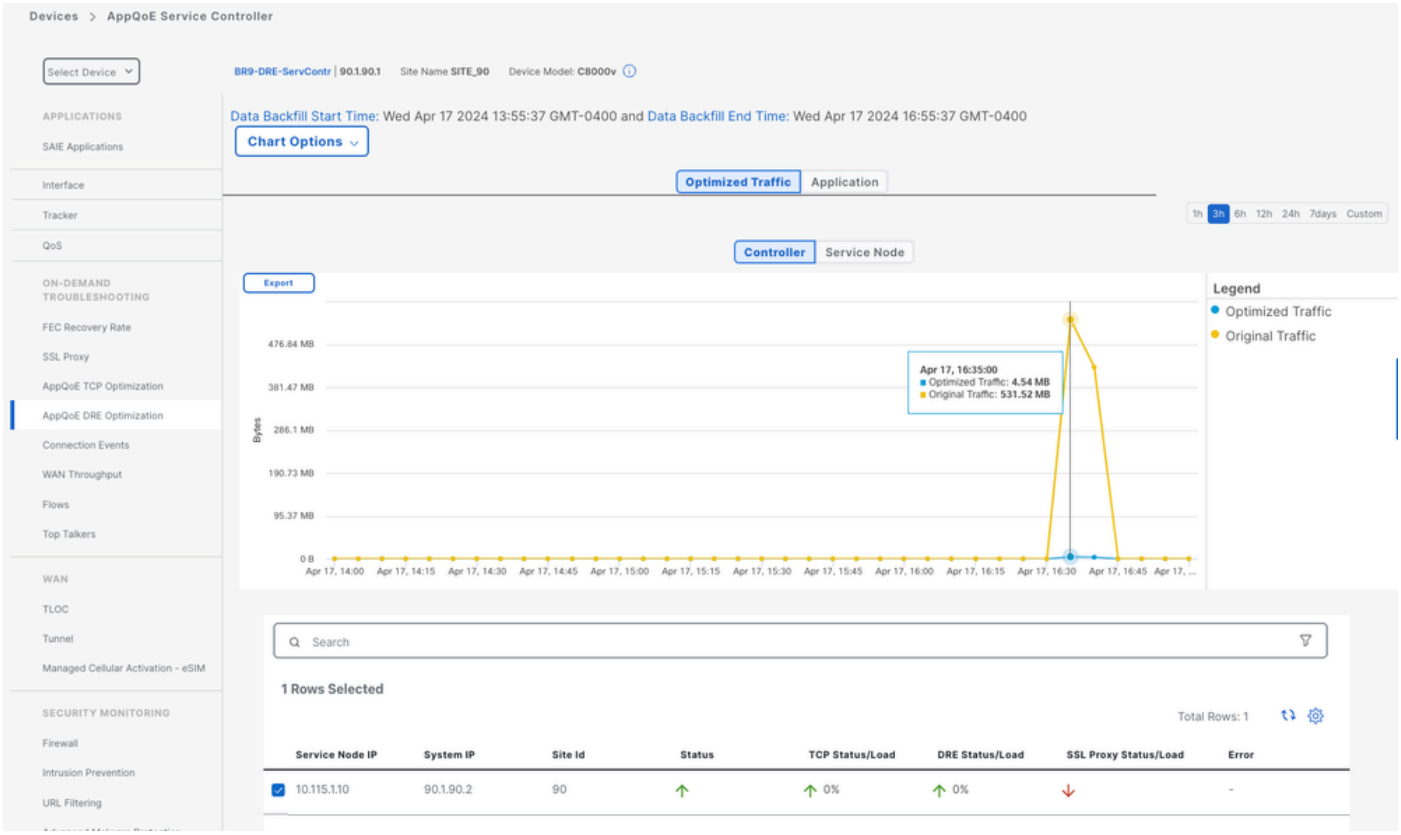
Approximately 900MB of data was downloaded (3 x 200MB files and 3 x 100MB files) - Original Traffic (YELLOW).

The optimization resulted in only 8.07MB of traffic sent over the WAN, around 90% bandwidth usage reduction - Optimized Traffic (BLUE).

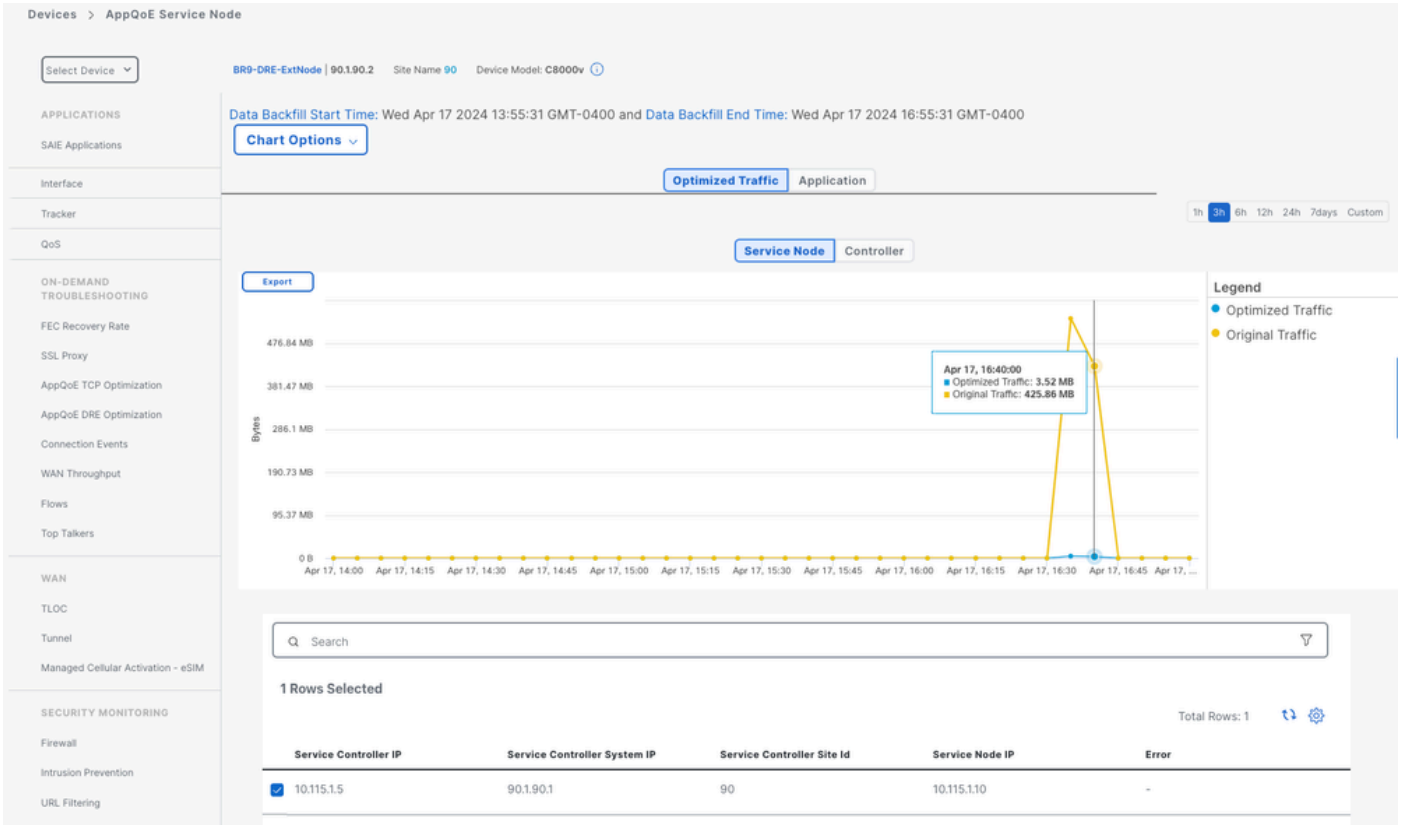


DC/Hub SC

If there are multiple ESNs, then the Controllertab shows the cumulative data and the Service Nodetab shows the individual ESN data.


Devices > AppQoE Service Controller
Select Device
BR9-DRE-ServContr | 90.1.90.1 Site Name SITE_90 Device Model: C8000v
APPLICATIONS
SAIE Applications
Interface
Tracker
QoS
ON-DEMAND TROUBLESHOOTING
FEC Recovery Rate
SSL Proxy
AppQoE TCP Optimization
AppQoE DRE Optimization
Connection Events
WAN Throughput
Flows
Top Talkers
WAN
TLOC
Tunnel
Managed Cellular Activation - eSIM
SECURITY MONITORING
Firewall
Intrusion Prevention
URL Filtering
Data Backfill Start Time: Wed Apr 17 2024 13:55:37 GMT-0400 and Data Backfill End Time: Wed Apr 17 2024 16:55:37 GMT-0400
Chart Options
Optimized Traffic
Application
1h 3h 6h 12h 24h 7days Custom
Controller
Service Node
Export
Legend
Optimized Traffic
Original Traffic
476.84 MB
381.47 MB
286.1 MB
190.73 MB
95.37 MB
0 B
Bytes
Apr 17, 16:35:00
Optimized Traffic: 4.54 MB
Original Traffic: 531.52 MB
Search
1 Rows Selected
Total Rows: 1
Service Node IP
System IP
Site Id
Status
TCP Status/Load
DRE Status/Load
SSL Proxy Status/Load
Error
10.115.1.10
90.1.90.2
90
0%
0%

DC/Hub ESN


Devices > AppQoE Service Node
Select Device
BR9-DRE-ExtNode | 90.1.90.2 Site Name 90 Device Model: C8000v
APPLICATIONS
SAIE Applications
Interface
Tracker
QoS
ON-DEMAND TROUBLESHOOTING
FEC Recovery Rate
SSL Proxy
AppQoE TCP Optimization
AppQoE DRE Optimization
Connection Events
WAN Throughput
Flows
Top Talkers
WAN
TLOC
Tunnel
Managed Cellular Activation - eSIM
SECURITY MONITORING
Firewall
Intrusion Prevention
URL Filtering
Data Backfill Start Time: Wed Apr 17 2024 13:55:31 GMT-0400 and Data Backfill End Time: Wed Apr 17 2024 16:55:31 GMT-0400
Chart Options
Optimized Traffic
Application
1h 3h 6h 12h 24h 7days Custom
Service Node
Controller
Export
Legend
Optimized Traffic
Original Traffic
476.84 MB
381.47 MB
286.1 MB
190.73 MB
95.37 MB
0 B
Bytes
Apr 17, 16:40:00
Optimized Traffic: 3.52 MB
Original Traffic: 425.86 MB
Search
1 Rows Selected
Total Rows: 1
Service Controller IP
Service Controller System IP
Service Controller Site Id
Service Node IP
Error
10.115.1.5
90.1.90.1
90
10.115.1.10