# Configure Packet Duplication Using Policy Groups in SD-WAN

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## Introduction

This document describes Packet Duplication configuration in Software-Defined Wide-Area Networks (SD-WAN).

## Prerequisites

### Requirements

Cisco recommends that you have knowledge of general topics related to Cisco Catalyst Software-Defined Wide Area Network (SD-WAN).

### Components Used

The information in this document is based on:

- Cisco Catalyst SD-WAN Manager version  20.15.3.
- Cisco IOS® XE Catalyst SD-WAN Edges version 17.15.3a

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, ensure that you understand the potential impact of any command.

# Background Information

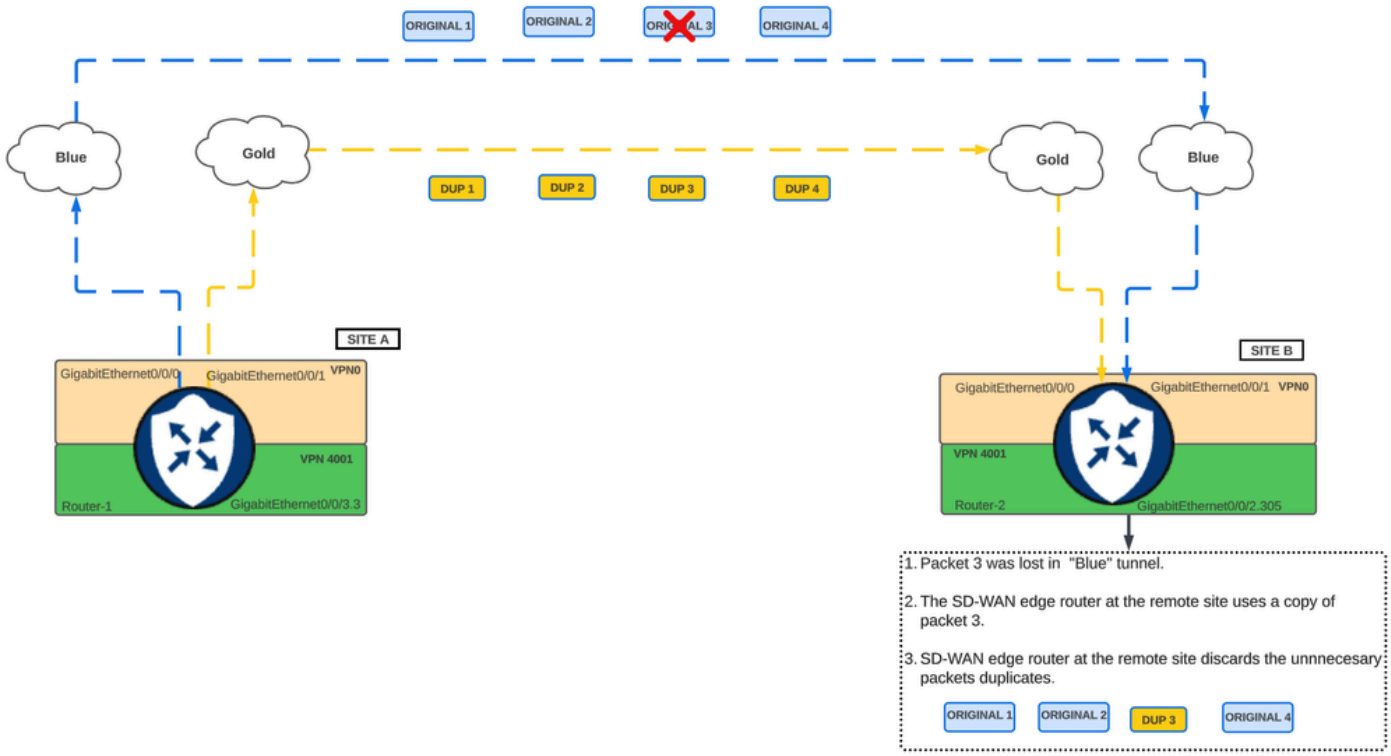
## Packet Duplication

Packet duplication is an SD-WAN feature designed to ensure reliability and reduce packet loss for time-sensitive applications (such as Voice over IP (VoIP), video conferencing, financial transactions and Mission-Critical control systems) in networks where a SD-WAN edge router has multiple overlay IPsec tunnels to the next-hop router.

When Packet Duplication is enabled, the SD-WAN edge router **creates duplicate packets** and transmits them simultaneously over **another active IPsec tunnel.**

## Packet Duplication Workflow

1. The SD-WAN edge router creates duplicate copies of the outbound packet.
2. The duplicated packets are transmitted simultaneously over another tunnel IPsec tunnel.
3. If a packet is lost over one path, the SD-WAN edge router at remote site, processes a copy of the same packet received over another tunnel.
4. If no packets are lost, the SD-WAN edge router at the remote site discards the unnnecesary packets duplicates.




*Packet Duplication workflow*

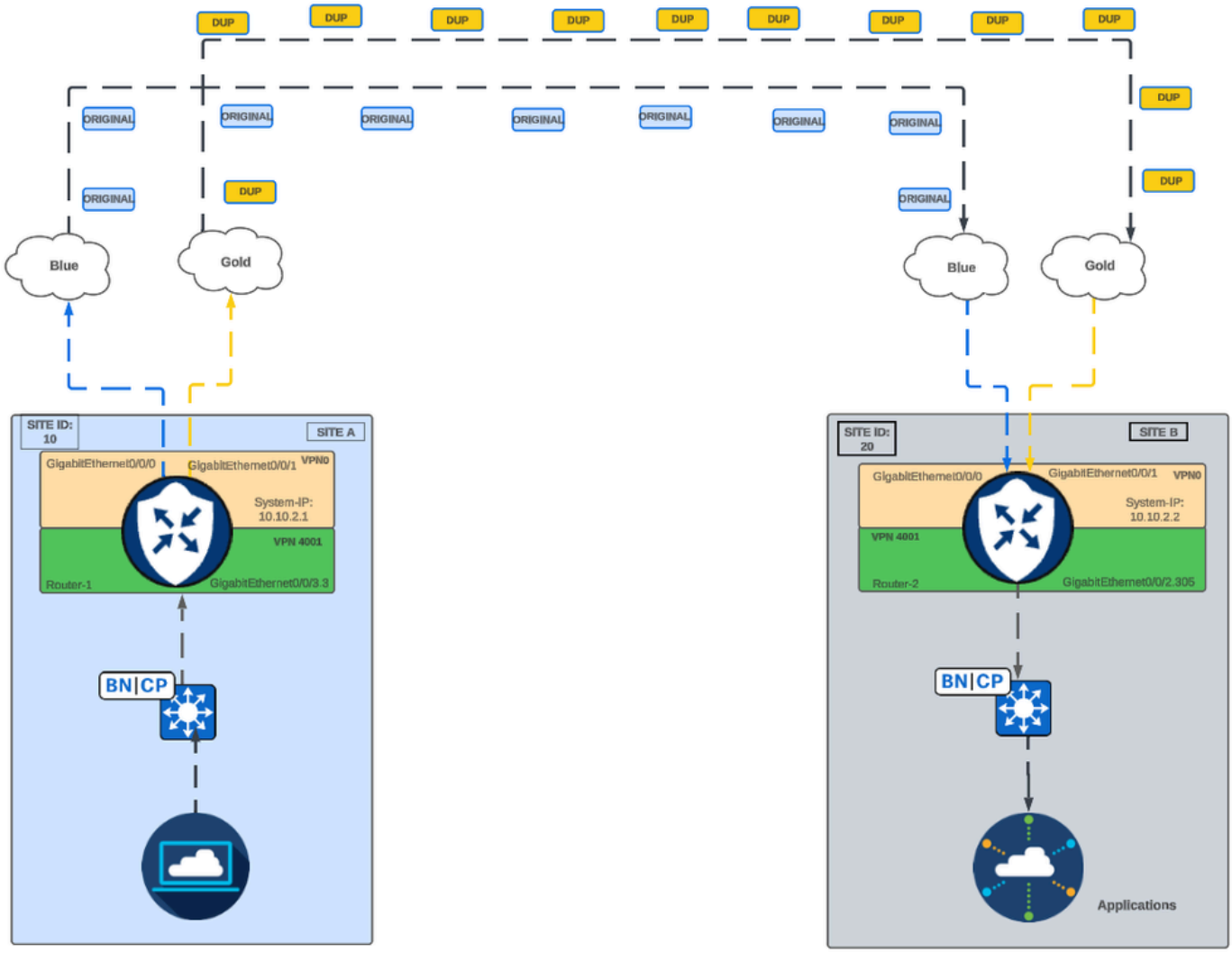
## Key Points

- Packet Duplication is only supported in topologies where SD-WAN edge routers establish at least two overlay IPsec tunnels between the local site to the remote site.
- Data Policy and Application-Aware Routing (AAR) must not be applied to packet-duplicated traffic.
- Packet duplication interop, forward error correction (FEC), and TCP optimization on Cisco IOS XE Catalyst SD-WAN devices is not supported between Cisco IOS XE Release 16.x and Cisco IOS XE Catalyst SD-WAN Release 17.x versions.

- Packet duplication is supported only on Cisco IOS XE Catalyst SD-WAN devices.
- When packets are intercepted for duplication, the system queries the IP database using the incoming tunnel ID. It then fetches the duplicate tunnel object. The system compares the packet length with the path maximum transmission unit (PMTU) of the duplicate tunnel. If the packet length is smaller than the duplicate tunnel's PMTU, the packets are duplicated.

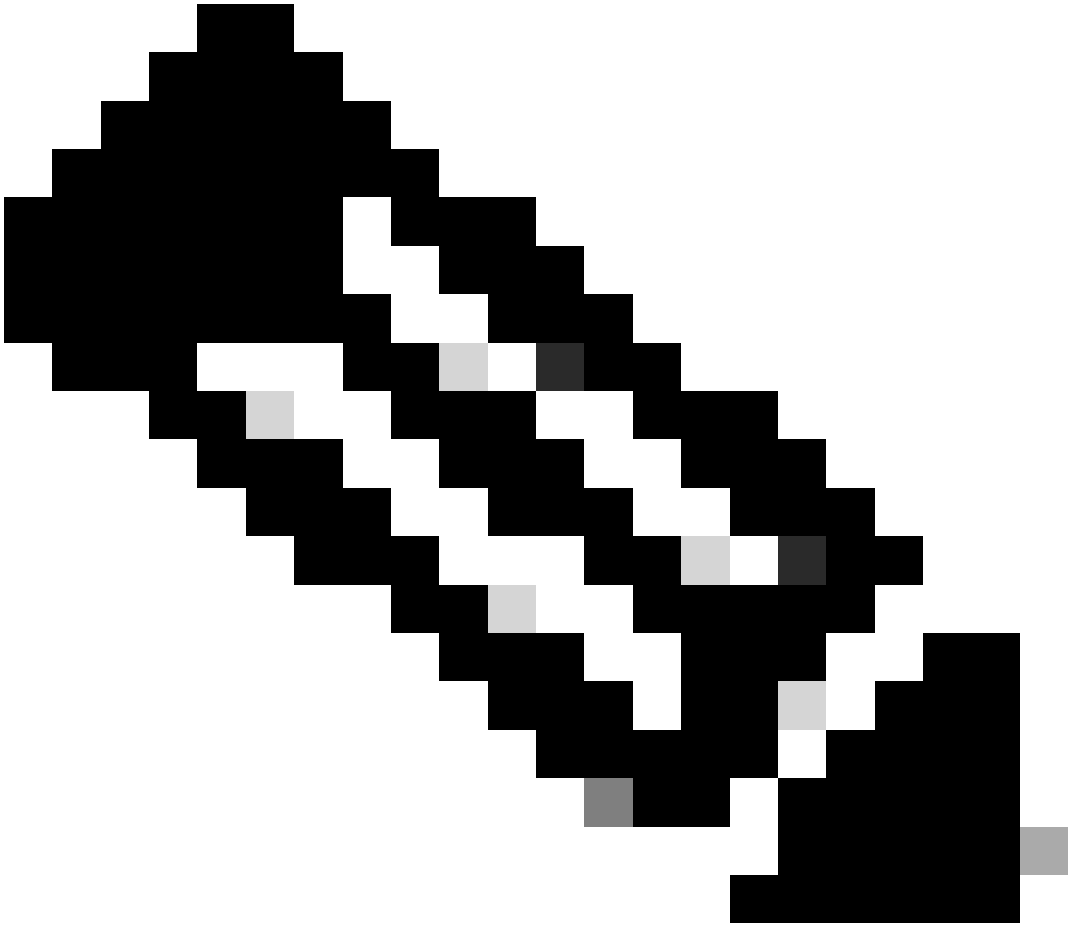
# Configure

## Network Diagram




*Site-to-Site Network Diagram*

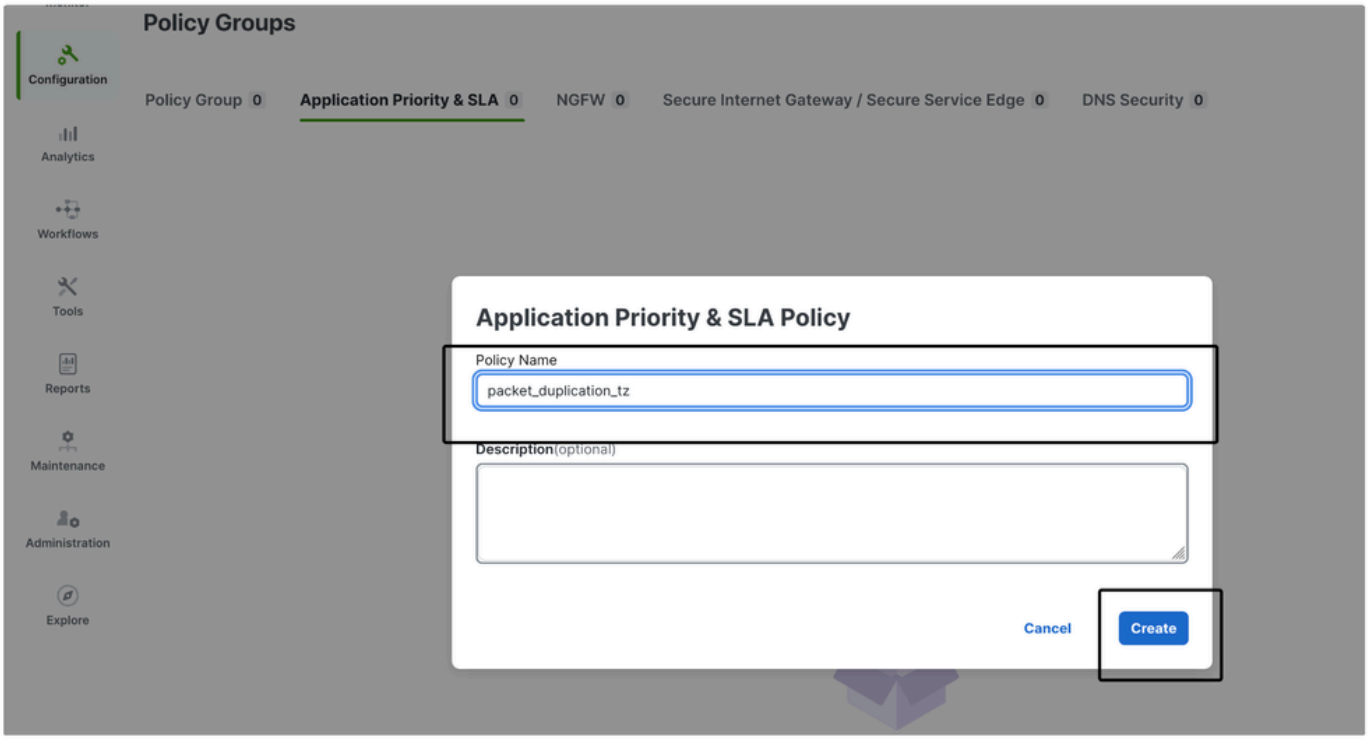
# Configure Packet Duplication Using Policy Groups



**Note**: Minimum supported release: Cisco Catalyst SD-WAN Control Components Release 20.14.1

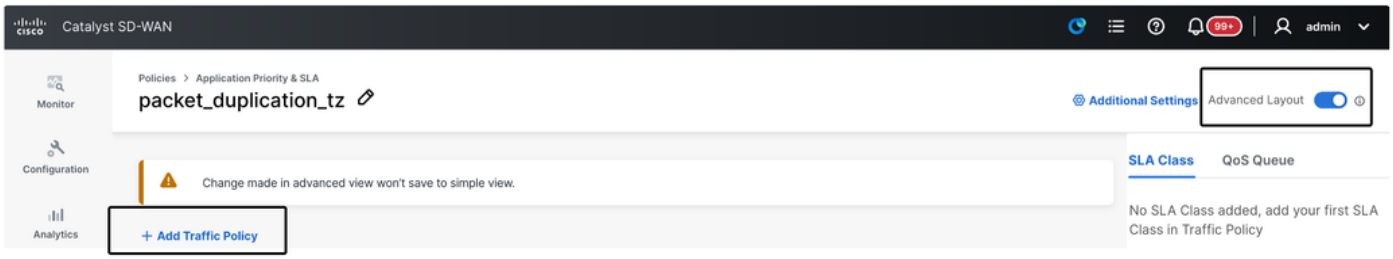
## Step 1. Configure Application Priority & SLA Policy

- Log in to Cisco Catalyst SD-WAN Manager GUI.
- Navigate to **Configuration** > **Policy Groups** > **Application Priority & SLA** > **Add Application Priority & SLA Policy.**
- Configure **Application Priority & SLA Policy** name > Click on **Create.**



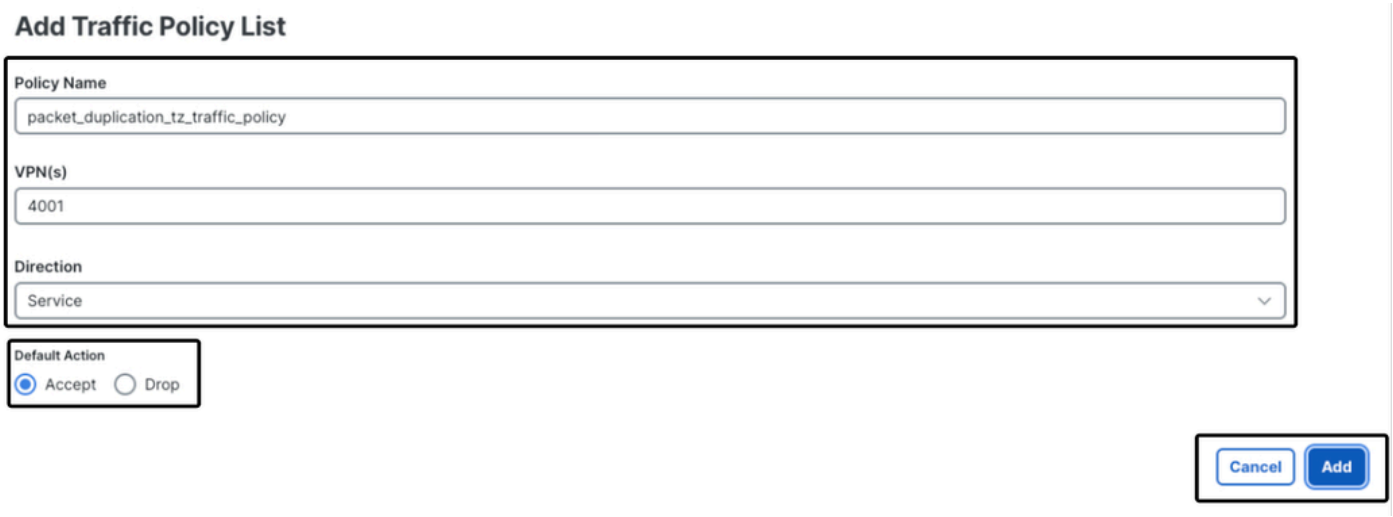

*Application Priority & SLA Policy name*

- Enable **Advanced Layout** in the top right pane > Click on **Add Traffic Policy.**



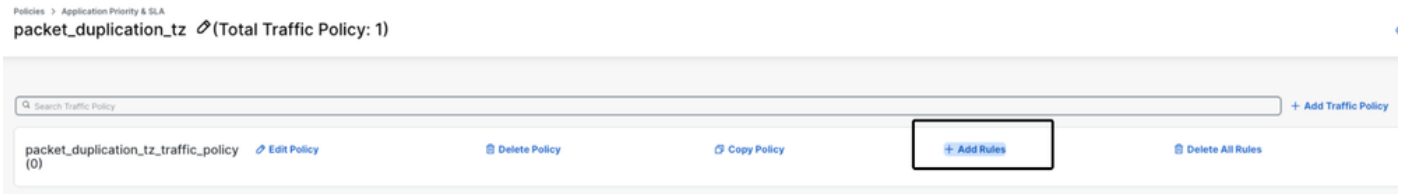

*Advance Layout*

- Configure **Traffic PolicyName**, service **VPN(s)** and **Direction.**
- Identify **Default Action** > Select **Accept** > Click on **Add**



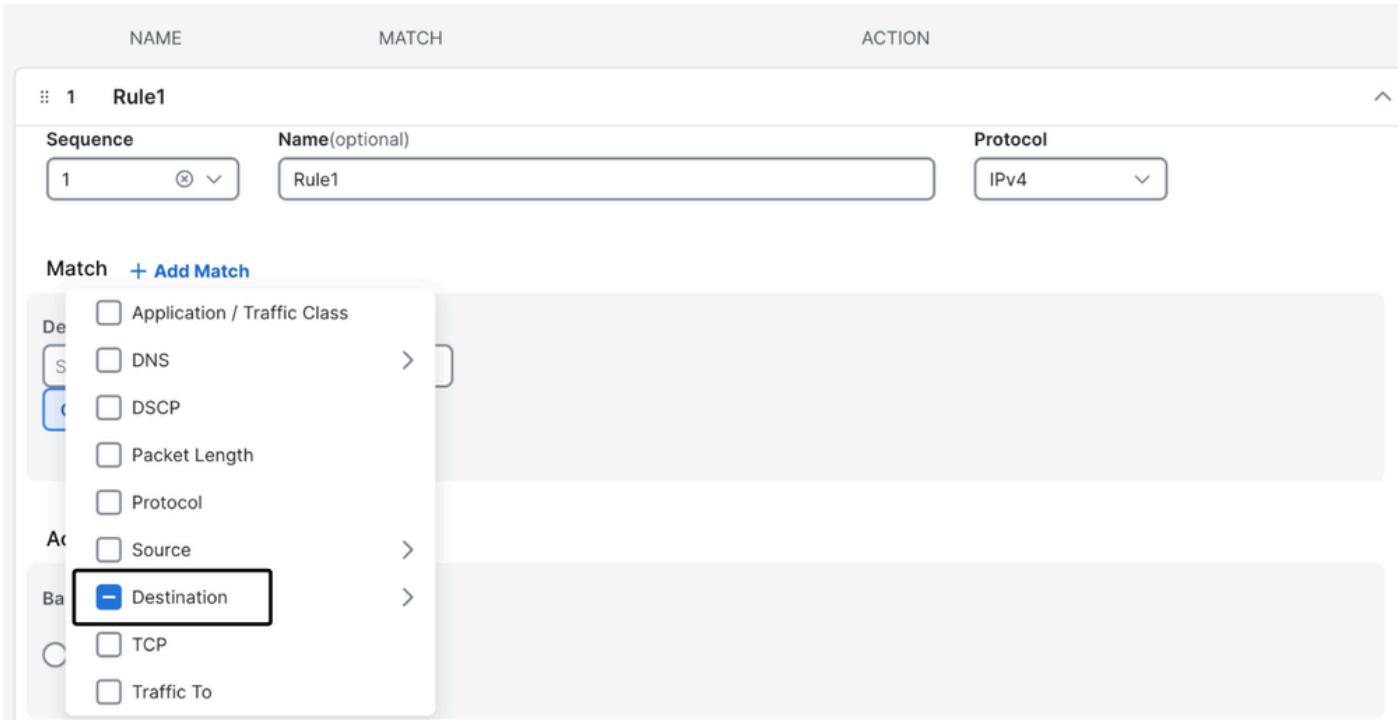

*Traffic Policy name*

- Click on **Add Rules**

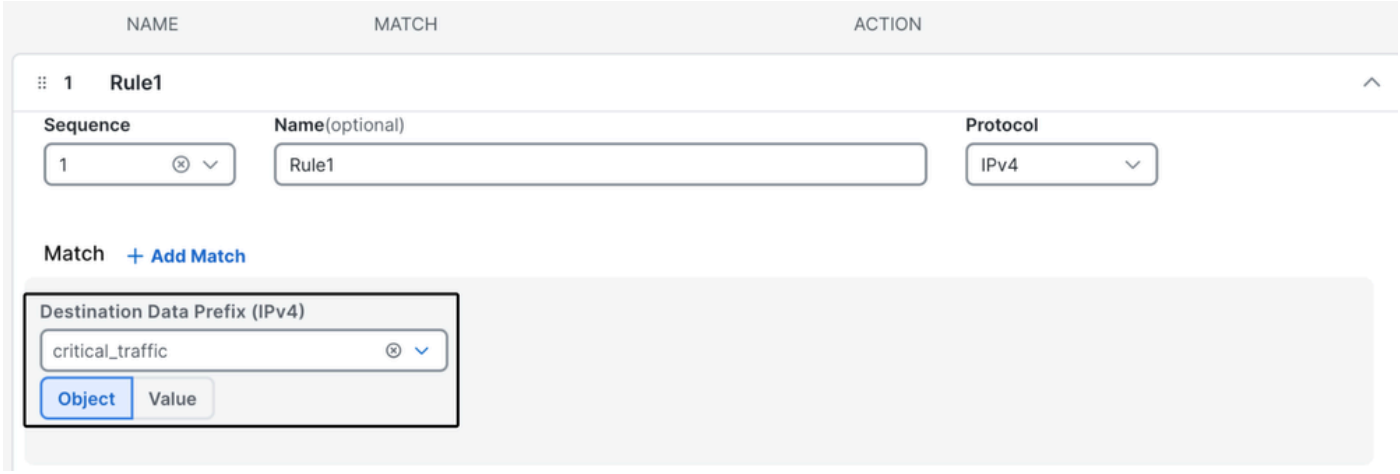



*Add Rules*

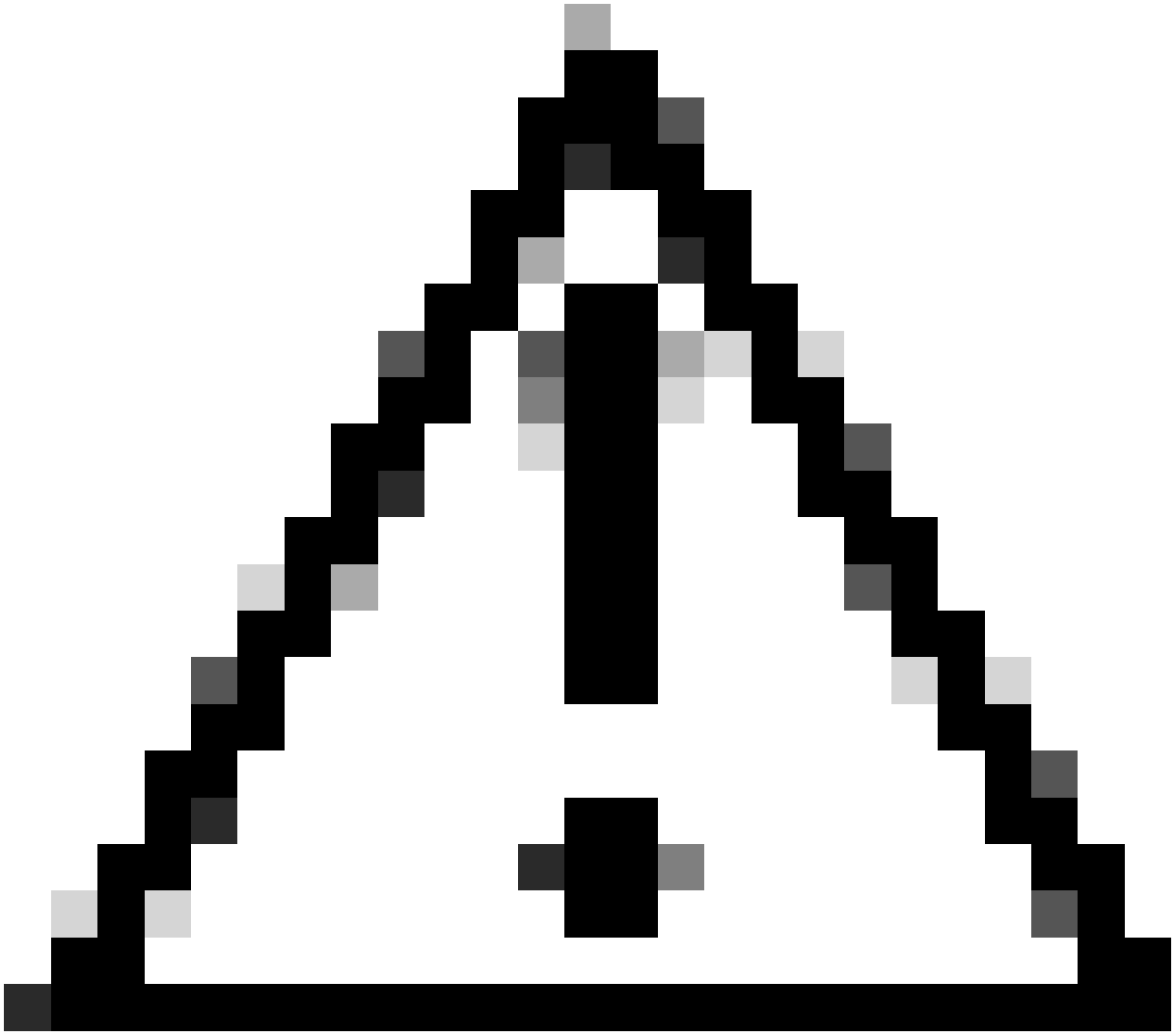
- Click on **Add Match** > Select a match condition.



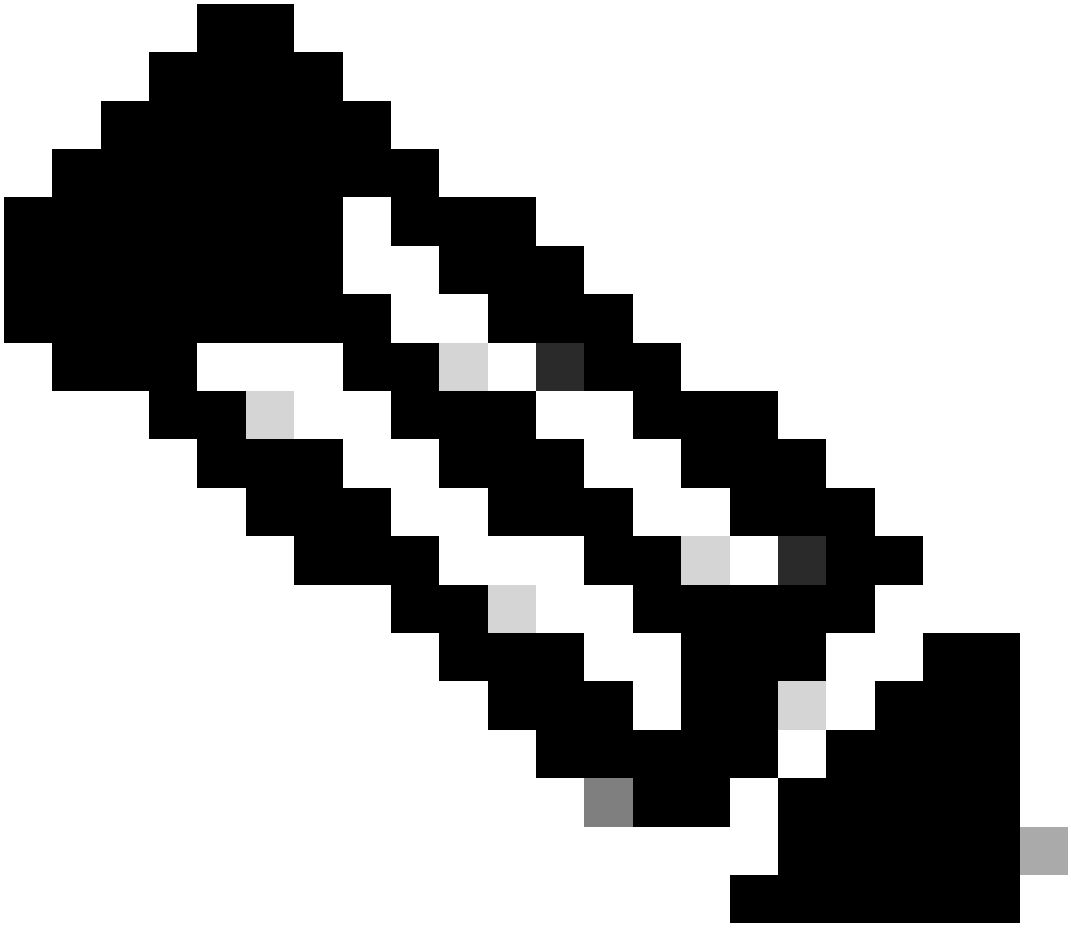

*Match conditions*




*Destination Data Prefix*

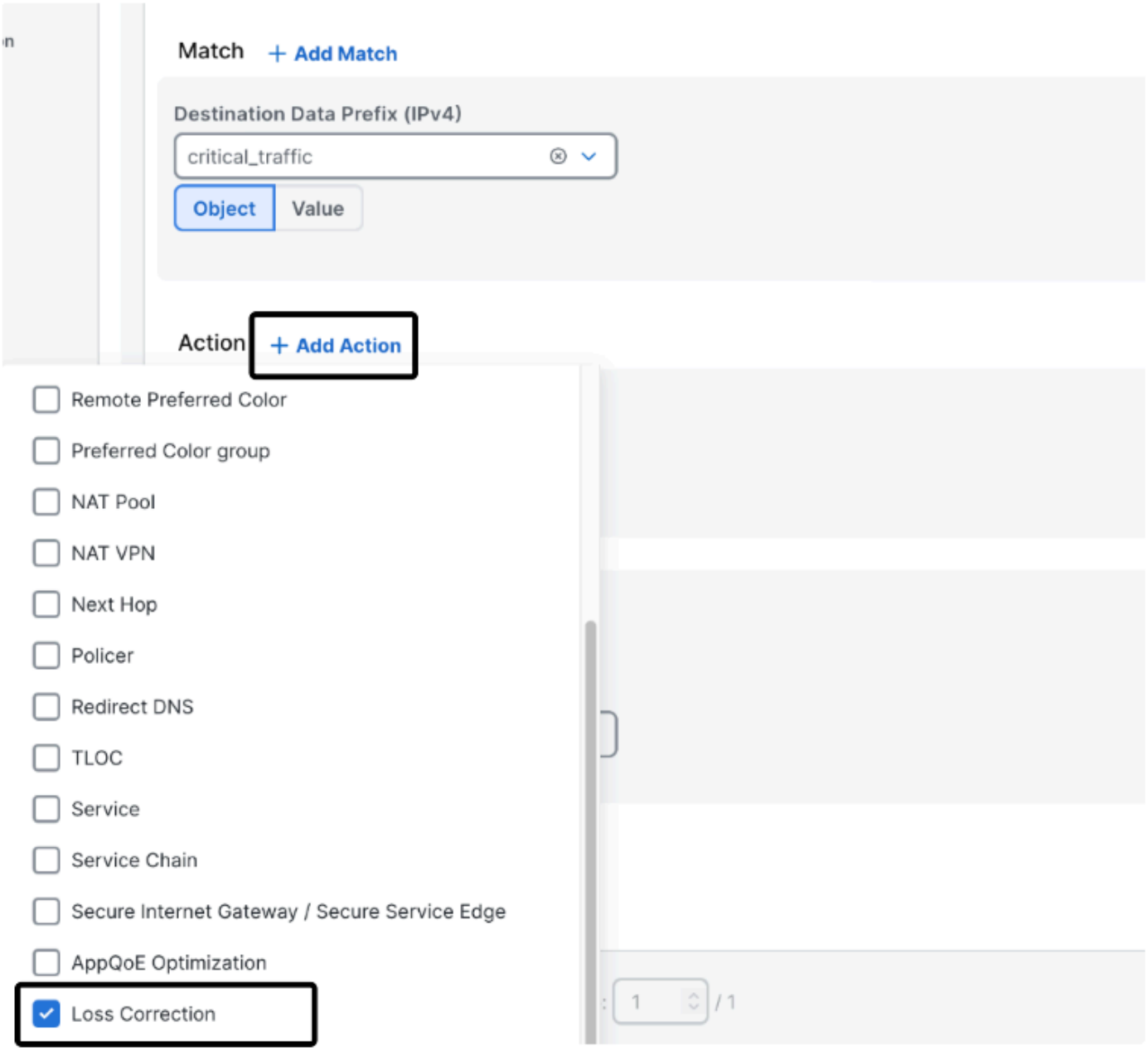


**Caution**: Packet Duplication in SD-WAN is intended for use with critical applications or critical traffic. Enabling this feature for all traffic types is not recommended, as it results in increased CPU load and potential performance degradation on the SD-WAN edge router. During this laboratory test, CPU usage went up by about 10%.



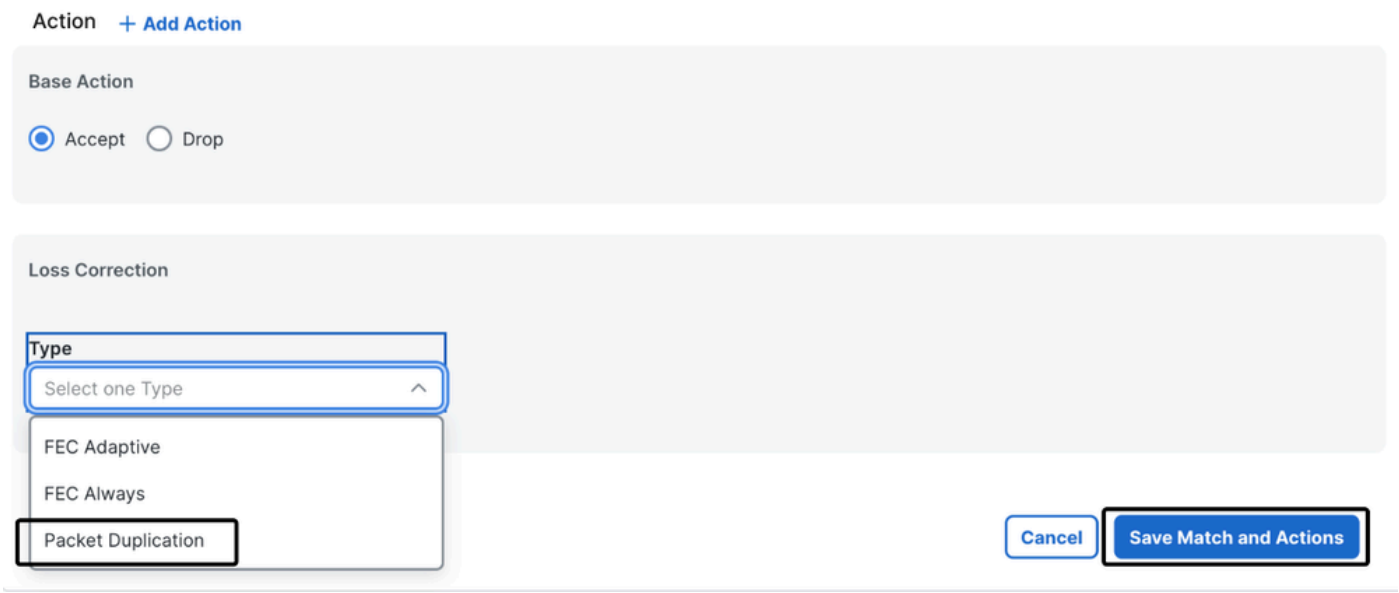
**Note**: This laboratory uses the Destination Data Prefix as a match condition. Additionally, the Cisco Catalyst SD-WAN Manager supports the use of Applications or Application Family Lists, if required.

- Identify **Action**
- Select **Accept** > Click on **Add Action** > Select **Loss Correction**




*Add Action*

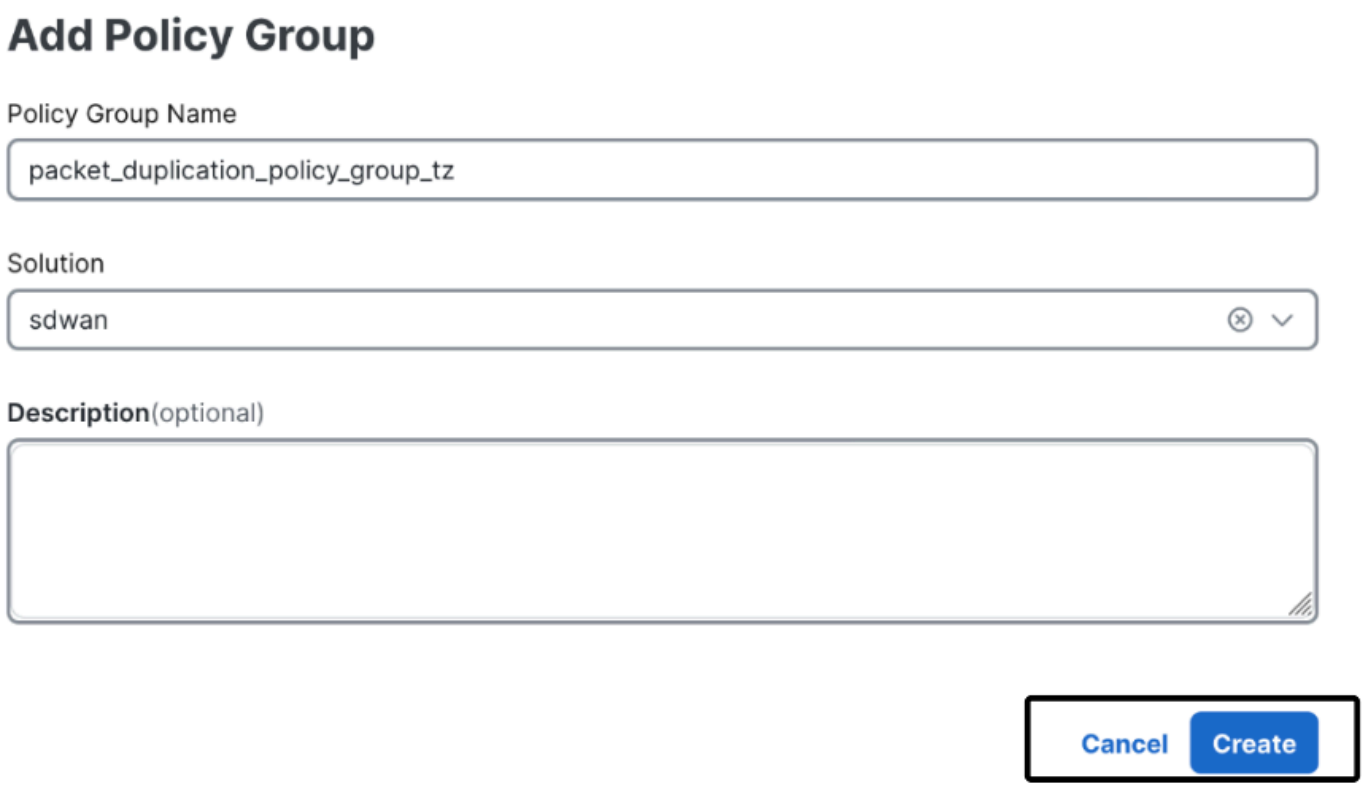
- Select **Packet Duplication** > Click on **Save Match and Actions** > Click on **Save**




*Select Packet Duplication*

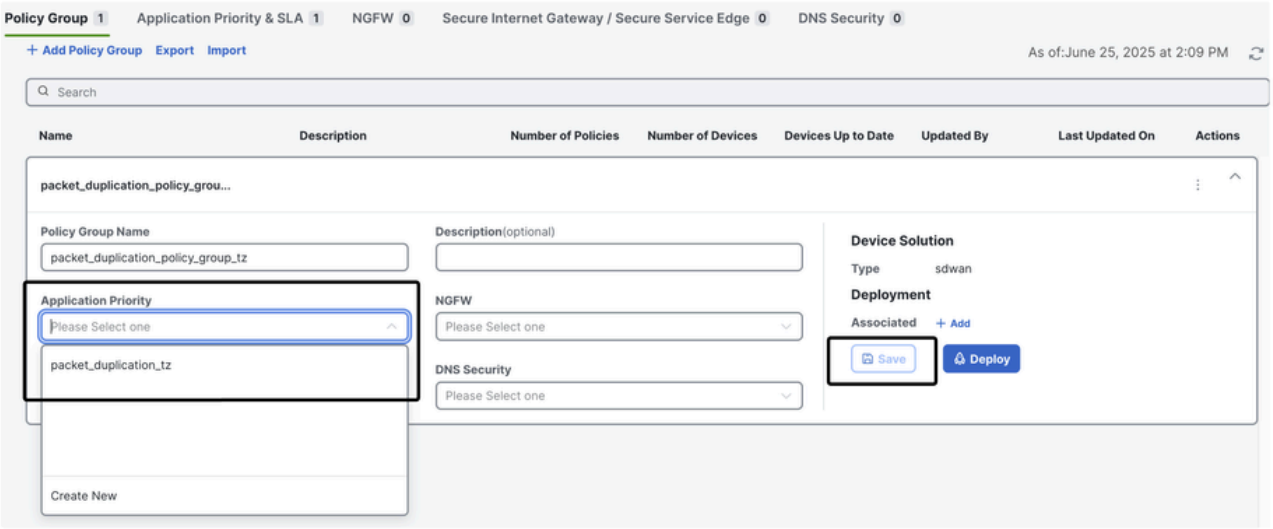
## Step 2. Define Policy Groups

- Navigate to **Policy Group** > Click on **Add Policy Group**
- Configure **Policy Group Name** and **Solution** > Click on **Create**



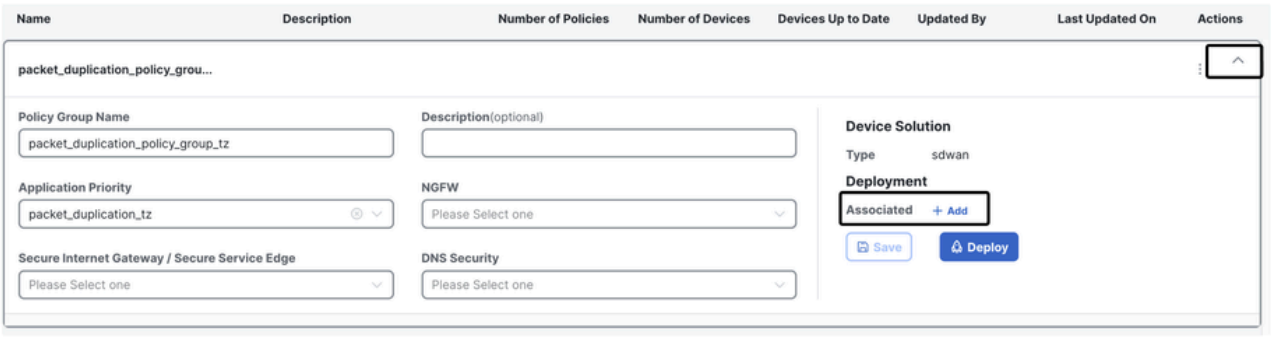

*Define Policy Groups*

- Identify **Application Priority**
- Select **Application Priority & SLA Policy** created > Click on **Save**

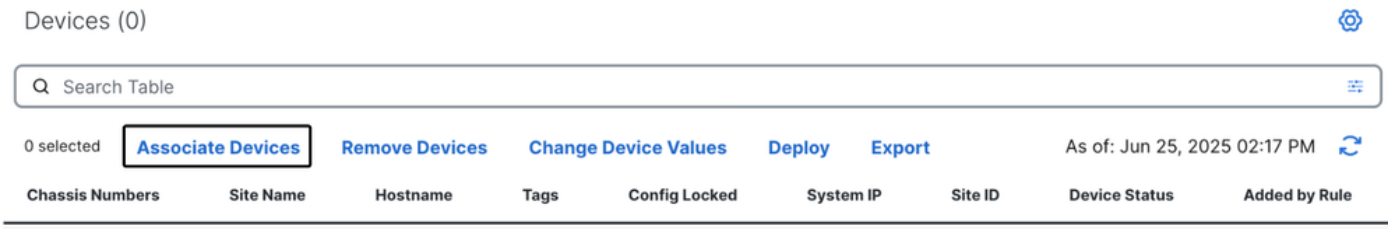



*Select Application Priority & SLA Policy*

- Associate the SD-WAN edge routers where packet duplication is to be enabled.
- Identify **Associated** > Click on **Add**
- Click on **Associated Devices** > Choose Devices > Click on **Associated Devices**




*Associated devices*

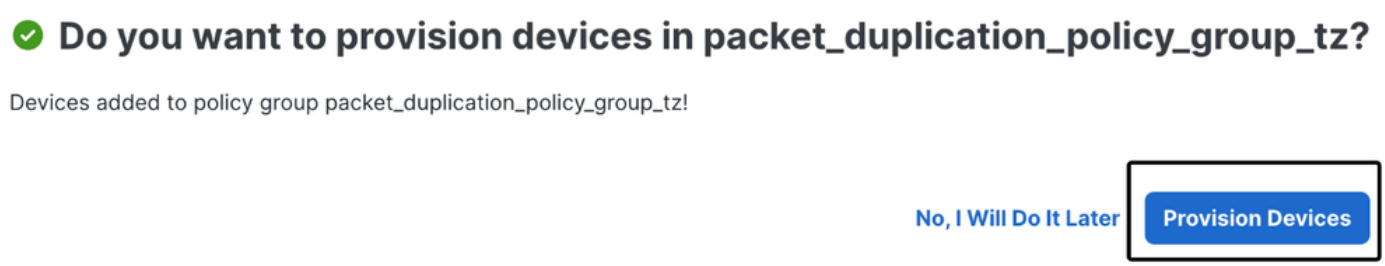



*Associate Devices*



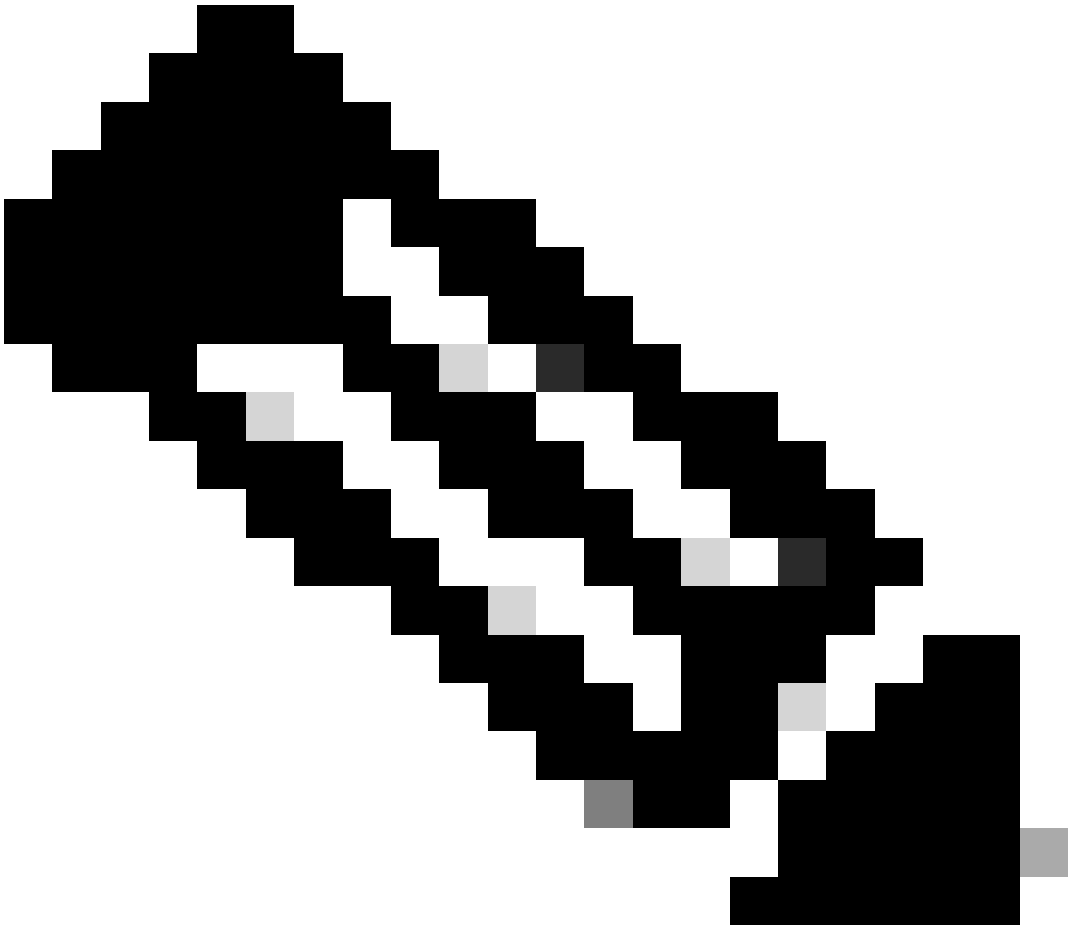

*Devices to be associated*

- Click on **Provision Devices** > Select **Devices to Deploy** > Click on **Deploy**




*Provision Devices*

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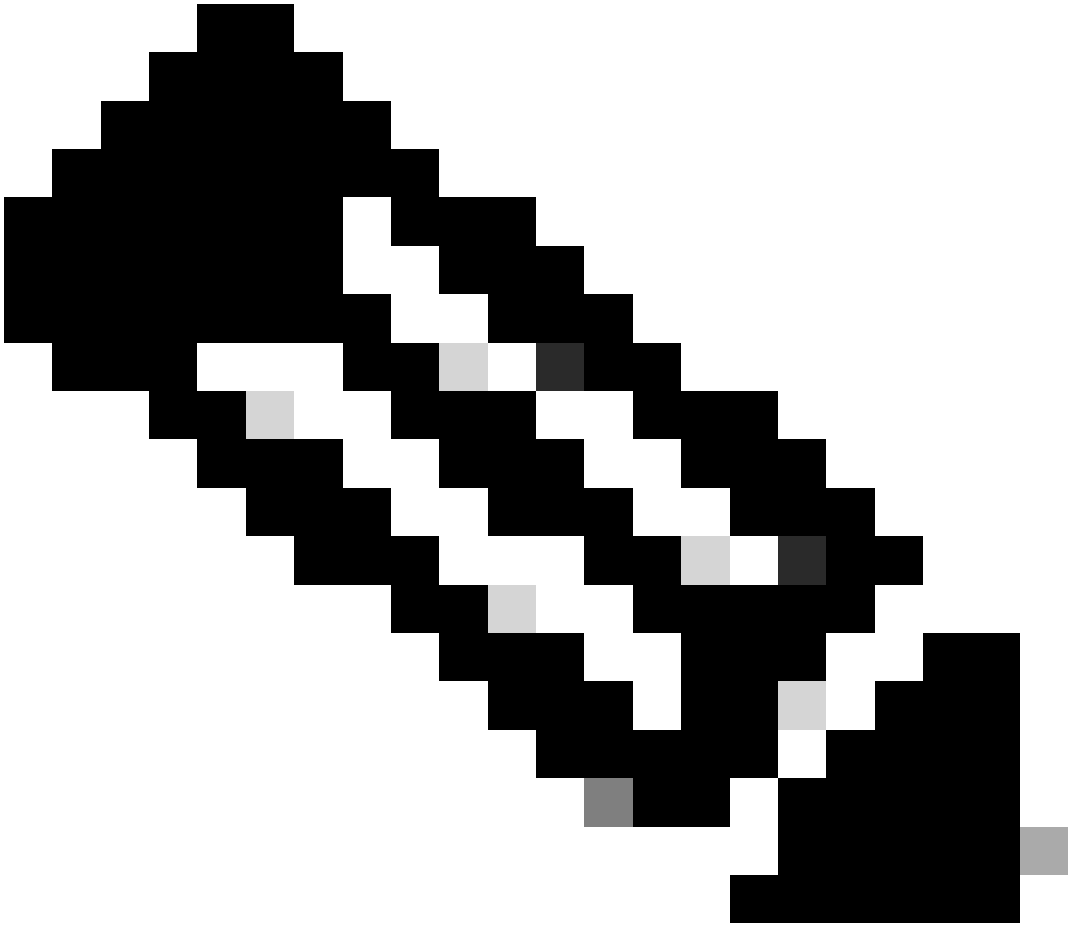


**Note**: A Configuration Group needs to be associated with the SD-WAN edge router before deploying a Policy Group.

---

# Verify

## Monitor Packet Duplication Statistics from the SD-WAN edge router`s CLI



**Note**: A SD-WAN data policy has been used to configure packet duplication on the Cisco Catalyst SD-WAN Controller and the configuration has been pushed to the SD-WAN edge router.

Run the command **show sdwan policy from-vsmart** to display the data policies that have been sent from the Cisco Catalyst SD-WAN controller to the SD-WAN edge router.

```
<#root>

Router#

show sdwan policy from-vsmart


from-vsmart data-policy data_service_packet_duplication_tz

direction from-service


vpn-list vpn_packet_dup_4001


sequence 1
```

```
match
source-data-prefix-list critical_traffic
action accept


loss-protection packet-duplication


default-action accept
from-vsmart lists vpn-list vpn_packet_dup_4001
vpn 4001
from-vsmart lists data-prefix-list critical_traffic
ip-prefix 0.0.0.0/0
```

Run the command **show sdwan tunnel statistics pkt-dup** to display statistics related to packet duplication in SD-WAN transport tunnels.

```
<#root>

Router#
show sdwan tunnel statistics pkt-dup


tunnel stats ipsec 10.0.20.15 10.0.21.16 12346 12386
 pktdup-rx       0
 pktdup-rx-other 56


<<<< Duplicate packets were received on the Secondary tunnel


 pktdup-rx-this  0
 pktdup-tx       0
 pktdup-tx-other 56 <<<< Duplicate packets were sent from the Secondary tunnel


 pktdup-capable  true

tunnel stats ipsec 10.1.15.15 10.1.16.16 12346 12366
pktdup-rx       56 <<<< Original packets were received on the primary tunnel


 pktdup-rx-other 0
pktdup-rx-this  56


<<<< Duplicate packets were received on secondary tunnel but counted in the primary tunnel statistics


 pktdup-tx       56 <<<< Original packets sent from primary tunnel


 pktdup-tx-other 0
```

```
 pktdup-capable  true
```

**<<<< Capability exchange with other edge routers**

Run the command **show sdwan bfd sessions** to display the status and statistics of BFD sessions between SD-WAN edge routers.

<#root>

```
Router#
```

**show sdwan bfd sessions**

```
                           SOURCE TLOC    REMOTE TLOC              DST PUBLIC DST PUBLIC  DETECT TX
SYSTEM IP  SITE ID   STATE     COLOR          COLOR     SOURCE IP              IP                      PO
-------------------------------------------------------------------------------------------------------
10.10.2.2       10      up        gold           gold      10.0.20.15       10.0.21.16                12
10.10.2.2       10      up        blue           blue      10.1.15.15       10.1.16.16                12
```

Run the command **show platform hardware qfp active feature bfd datapath sdwan summary** to display the statistics at the hardware/data plane level, for IPSEC SD-WAN tunnels.

<#root>

```
Router#
```

**show platform hardware qfp active feature bfd datapath sdwan summary**

```
Total number of session:
```

**LD**

```
         SrcIP           DstIP        TX     RX       Encap   State   AppProbe   AdjId
```

**20024**

```
     10.0.20.15     10.0.21.16   1057739 1057489    IPSEC    Up     YES       GigabitEthernet0/0/1 (0xf
```

**<<< Identify LD's number that uses the gold color**

**20028**

```
     10.1.15.15     10.1.16.16   1057782 1057494    IPSEC    Up     YES       GigabitEthernet0/0/0 (0xf
```

**<<<**

**Identify LD's number that uses the blue colo**

```
r
```

Run the command **show platform hardware qfp active feature sdwan client sysip summary** to display a **summary of the system IP addresses (sysip)** associated with the SD-WAN client feature, as processed by

the Quantum Flow Processor (QFP).

TunID = Tunnel ID of the primary local SD-WAN tunnel (based on the last 2 digits of LD)

DupID = TheDuplication ID of the secondary local SD-WAN tunnel (based on the last 2 digits of LD)

<#root>

Router#

**show platform hardware qfp active feature sdwan client sysip summary**

SysIP - SiteID - Next -

**TunID**

-

**DupID**

- BfdDis - BfdSta - LocCo - RemCo - Encap - feC - mtu

10.10.2.2 10 0

**24**

**28**

20024 UP 1 1 IPSEC 352 1442
10.10.2.2 10 0

**28**

**24**

20028 UP 2 2 IPSEC 352 1442

Run the command **show platform hardware qfp active feature sdwan data sysip summary** to display a **summary of SD-WAN system IPs** in the data plane**.**

TunID = Tunnel ID of the primary local SD-WAN tunnel (based on the last 2 digits of LD)

DupID = TheDuplication ID of the secondary local SD-WAN tunnel (based on the last 2 digits of LD)

<#root>

Router#

**show platform hardware qfp active feature sdwan data sysip summary**

BktIdx BktAddr SysIP SiteID Next on-demnd Gleaning glean_ipc_paks
Idx

**TunID**

```
DupID

   bfdDisc   bfdState  locCol   remCol Encap  feC mtu   sess-ppe
-------------------------------------------------------------------------------
77   0x6a9a4c60

10.10.2.2

        10          0x0        No         No        0
0

24



28

     20024  3          1     1          IPSEC    352     1442 0x6934f1a0
1

28


 24

     20028  3          1     17         IPSEC    352     1442 0x6934f1e0
```

Additional commands to review CPU utilization:

<#root>

```
Router#

show processes cpu platform sorted | include CPU


Router##

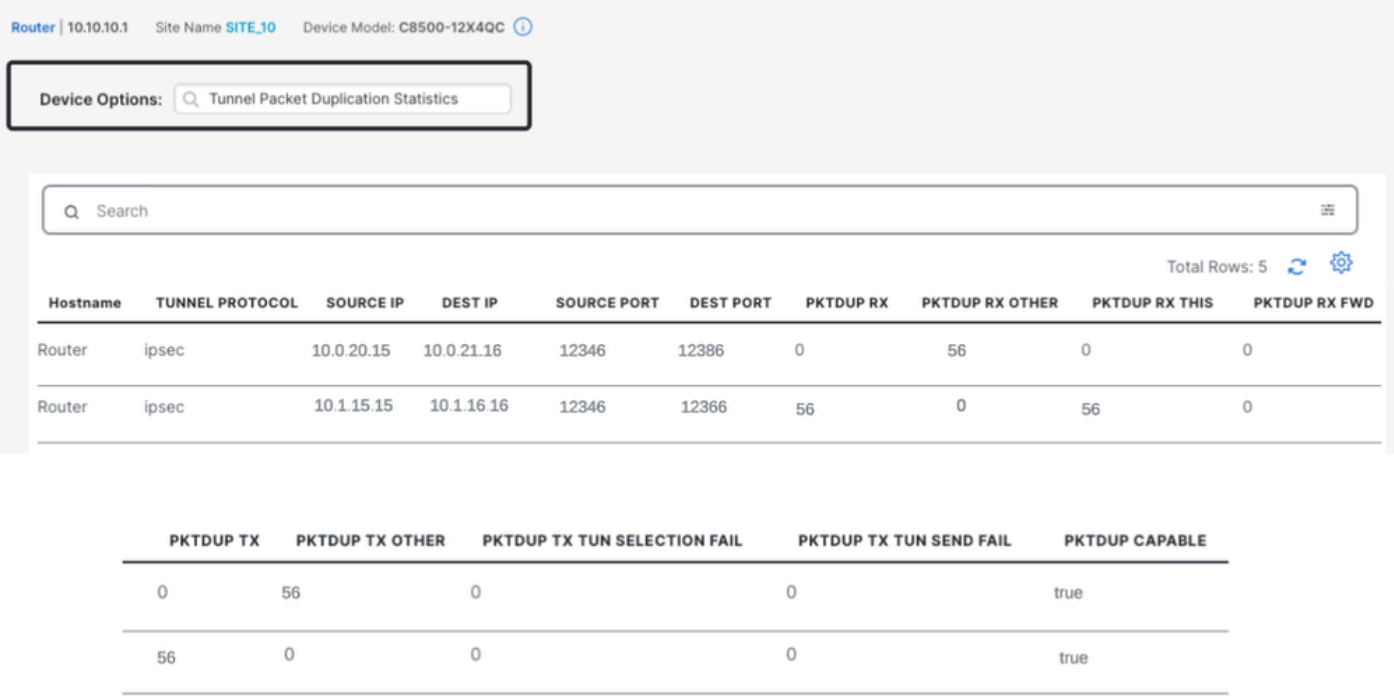
show platform resources


Router#

show processes cpu history
```

## Monitor Packet Duplication Statistics from the Cisco Catalyst SD-WAN Manager

- From the Cisco SD-WAN Manager menu, choose **Monitor** > **Devices**
- Choose a device.
- For a device, in the **Action** column, click **"..."** and choose **Real Time**.
- In the Device Options drop-down menu and choose **Tunnel Packet Duplication Statistics**.




*Packet Duplication statistics*

# Related Information

- Packet Duplication
- Policy Groups
- Cisco Catalyst SD-WAN Configuration Groups