



Packet Duplication

Table 1: Feature History

Feature Name	Release Information	Description
Packet Duplication for Noisy Channels	Cisco IOS XE Catalyst SD-WAN Release 16.12.1b	This feature helps mitigate packet loss over noisy channels, thereby maintaining high application QoE for voice and video.
Packet Duplication for Large Packets Using Underlay Fragmentation	Cisco IOS XE Catalyst SD-WAN Release 17.15.1a Cisco Catalyst SD-WAN Control Components Release 20.15.1	This feature enables packet duplication even when the packet size is greater than the path maximum transmission unit (PMTU) discovered on the duplicate tunnel. With the help of underlay fragmentation, this feature uses adjacency MTU instead of tunnel PMTU to provide this capability. Cisco SD-WAN Manager provides a chart for viewing packet duplication information for tunnels. IPv6 support for Packet Duplication is also added.

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Information about Packet Duplication

Cisco IOS XE Catalyst SD-WAN devices use packet duplication to overcome packet loss.

Packet duplication sends copies of packets on alternate available paths to reach Cisco IOS XE Catalyst SD-WAN devices. If one of the packets is lost, a copy of the packet is forwarded to the server. Receiving Cisco IOS XE Catalyst SD-WAN devices discard copies of the packet and forward one packet to the server.

Packet duplication is suitable for edges with multiple access links. Once packet duplication is configured and pushed to your device, you can see the tunnel packet duplication statistics.

Packet Duplication for Large Packets Using Underlay Fragmentation

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.

Starting from Cisco IOS XE Catalyst SD-WAN Release 17.15.1a, packet duplication with underlay fragmentation ensures that packets get duplicated even when the packet size is more than the PMTU of duplicate tunnel.

For more information on how to enable underlay fragmentation, see [VFR and Underlay Fragmentation](#).

To monitor packet duplication statistics, see [View Loss Percentage, Latency, Jitter, Octet, and Packet Duplication Information for Tunnels](#).

Supported Traffic

Cisco IOS XE Catalyst SD-WAN Devices support packet duplication for the following traffic types:

From Cisco IOS XE Catalyst SD-WAN Release 16.12.1b:

IPv4 traffic over IPv4 tunnel

From Cisco IOS XE Catalyst SD-WAN Release 17.15.1a:

- IPv4 traffic over IPv6 tunnel
- IPv6 traffic over IPv4 tunnel
- IPv6 traffic over IPv6 tunnel

Configure Packet Duplication Using Centralized Policy

1. From the Cisco SD-WAN Manager menu, choose **Configuration > Policies**.
2. Select **Centralized Policy** at the top of the page and then click **Add Policy**.
3. Click **Next** twice to select **Configure Traffic Rules**.
4. Select **Traffic Data**, and from the **Add Policy** drop-down list, click **Create New**.
5. Click **Sequence Type** in the left pane.
6. From the **Add Data Policy** pop-up window, select **QoS**.
7. Click **Sequence Rule**.
8. In the **Applications/Application Family List/Data Prefix**, select one or more applications or lists.
9. Click **Actions** and choose **Loss Correction**.
10. In the Actions area, select the **Packet Duplication** option to enable the packet duplication feature.

- **FEC Adaptive:** Only send Forward Error Correction (FEC) information when the system detects a packet loss.
- **FEC Always:** Always send FEC information with every transmission.
- **None:** Use when no loss protection is needed.
- **Packet Duplication:** Enable when packets need to be duplicated and sent on the next available links to reduce packet loss.

11. Click **Save Match and Actions**.
12. Click **Save Data Policy**.
13. Click **Next** and take these actions to create a Centralized Policy:
 - a. Enter a Name and a Description.
 - b. Select **Traffic Data Policy**.
 - c. Choose **VPNs/site list** for the policy.
 - d. Save the policy.

Configure Packet Duplication Using Policy Groups

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

1. Select **Configuration > Policy Groups**.
2. Click **Application Priority & SLA**.
3. Click **Add Application Priority & SLA Policy**. Provide a policy name and description.
4. Enable **Advanced Layout** in the top right pane.
5. Click **Add Traffic Policy**.
6. Enter a name for the policy and specify VPNs.
7. In the **Direction** drop-down list, select **All**.
8. In the **Default Action**, click **Accept**.
9. Click **Add**.
10. Click **Add Rules**.
11. Click **Match**. Select appropriate match condition.
12. Click **Action > Loss Correction**.
13. In the **Type** drop-down list, choose **Packet Duplication**.
14. Click **Save Match and Actions**.
15. Click **Save Policy**.

Configure Underlay Fragmentation Using Cisco SD-WAN Manager

Minimum supported releases: Cisco IOS XE Catalyst SD-WAN Release 17.15.1a

1. From the Cisco SD-WAN menu, choose **Configuration > Configuration Groups**.
2. Click **Transport & Management Profile**.
3. Select the desired transport profile and click **Edit**.
4. Click **Edit Ethernet Interface > Tunnel**.
5. Enable **Allow Fragmentation** and **MTU To Max**.
6. Click **Save**.

Restrictions for Packet Duplication

- 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 cannot work in conjunction with local or remote TLOC in the policy. Data policy or AAR is not configured when specifying the packet duplicated tunnel.
- Packet duplication is supported only on Cisco IOS XE Catalyst SD-WAN devices but not on all the edge devices.

Monitor Packet Duplication Statistics for a Device using CLI

The following is sample output from the **show sdwan tunnel statistics pkt-dup** command:

```
Device#show sdwan tunnel statistics pkt-dup
tunnel stats ipsec 192.0.2.1 203.0.113.1 12366 12406
pktdup-rx                                1313388
pktdup-rx-other                          526666
pktdup-rx-this                           1324958
pktdup-rx-fwd                            540190
pktdup-rx-fwd-dup-tun                    789569
pktdup-tx                                0
pktdup-tx-other                          0
pktdup-tx-dup-tun-selection-failed       0
pktdup-tx-dup-tun-sent-failed            0
pktdup-capable                           true
```

The following table describes the packet duplication counters that appear as the output of the **show sdwan tunnel statistics pkt-dup** command:

Name of Counter	Description
pktdup-rx	Displays number of original packets received by primary tunnel.
pktdup-rx-other	Displays the number of duplicate packets received by duplicate tunnels.
pktdup-rx-this	N/A
pktdup-rx-fwd	Displays the number of packets received and forwarded by this tunnel.
pktdup-rx-fwd-dup-tun	Displays the number of packets received and forwarded by the duplicate tunnel.
pktdup-tx	Displays the number of packets intercepted for duplication.
pktdup-tx-other	Displays the number of packets transmitted by its duplicate tunnels.
pktdup-tx-dup-tun-selection-failed	Displays the number of packets for which duplicate tunnel selection failed.
pktdup-tx-dup-tun-sent-failed	Displays the number of packets for which transmission over the duplicate tunnel failed
pktdup-capable	Indicates that remote TLOC is capable of supporting Packet Duplication functionality

Monitor Packet Duplication Statistics for a Device using Cisco SD-WAN Manager

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

The following table describes the packet duplication counters that appear in the **Tunnel Packet Duplication Statistics** pane:

Table 2:

Packet Duplication Counters	Description	Mapping to CLI Counters
RX	Displays the number of packets received by primary (this) tunnel and duplicate tunnels.	pktdup-rx

Packet Duplication Counters	Description	Mapping to CLI Counters
RX Fwd	Displays the number of packets received and forwarded by this tunnel.	pktdup-rx-fwd
RX Dup Fwd	Displays the number of packets received and forwarded by the duplicate tunnel. RX Fwd + RX Dup Fwd = RX	pktdup-rx-fwd-dup-tun
TX Intercepted	Displays the number of packets intercepted for duplication	pktdup-tx
TX Dup	Displays the number of packets duplicated successfully on the duplicate tunnel.	pktdup-tx-other
TX Dup Failed	Displays the number of packets for which duplication failed. TX Intercepted = TX Dup + TX Dup Failed	pktdup-tx-dup-tun-selection-failed + pktdup-tx-dup-tun-sent-failed

Monitor Tunnel Information for a Device

1. From the Cisco SD-WAN Manager menu, choose **Monitor > Devices**.
2. Click a device name.
3. In the left pane, click **Tunnel** in the WAN area.

The right pane displays information about tunnel connection information, including loss percentage, latency, jitter, octets, and packet duplication.
4. In the right pane, click **Chart Options** to choose the format in which you want to view the information.