



SD-WAN Test Guide

For Service Providers and Vendors

Where are your customers on the SD-WAN journey?

Whether you are an SD-WAN service provider or vendor, converting potential SD-WAN enterprise customers and successfully deploying a new complex hybrid network across their business can be challenging for a number of reasons.

Whether its barriers to adoption limiting Managed SD-WAN service growth, or the complexity and unique characteristics of large enterprise networks causing deployment problems and slowing a project down, network emulation can help overcome these challenges and accelerate your go to market plans.



For many customers 'digital transformation' is the current business focus and the adoption of SD-WAN is an integral part of this transformation, but each enterprise business is different and their challenges differ depending where they are on the SD-WAN journey. **Network Emulation** can be utilised to support your customers and address their unique challenges whether they are in the planning, deployment or optimization phase of their SD-WAN journey.

Acting as a network in a box the **Calnex SNE** can perfectly mimic the real-world conditions under which your SD-WAN solution will perform. This live environment testing can enable you to:

- Design and test network architecture to find optimal customer solutions
- Evaluate the network performance benchmarked against customer requirements, SLA's and QoS agreements
- Answer customer questions and queries
- Prove service viability
- Identify optimal design changes without having to touch the live network.

This test guide provides an insight into some examples of how these tests can be carried out on the **Calnex SNE**. The test examples used in this guide have been focused around validating conformance to policies when SLA's are violated. The guide explores how this can be done on both a basic SD-WAN architecture and a complex mesh network architecture.

Click on the buttons below to learn more.

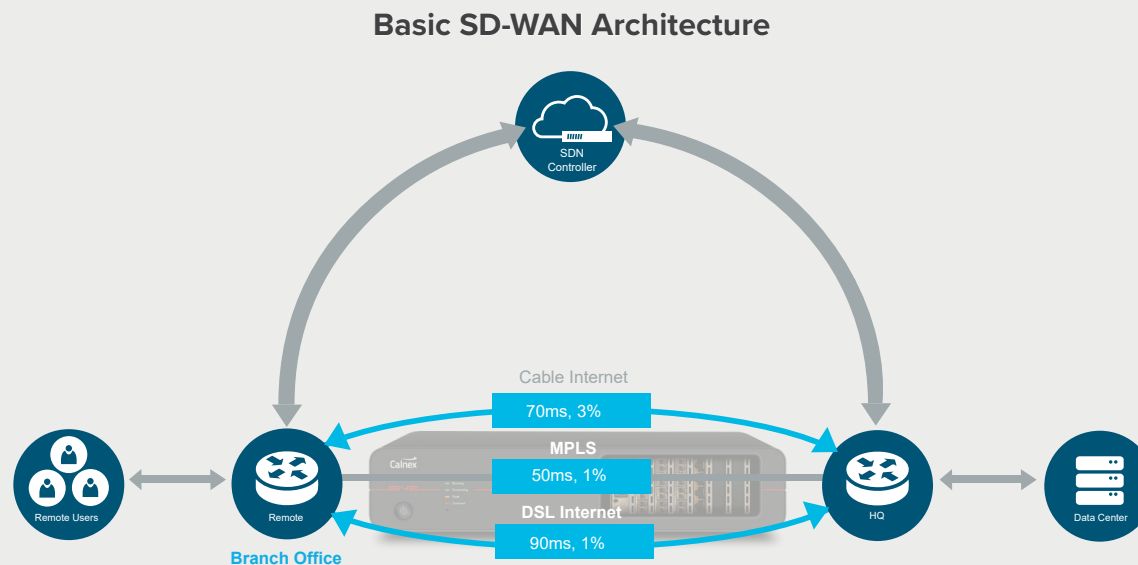


Testing Basic SD-WAN Architecture

One of the most common tests carried out is validating conformance to policies when SLAs are violated. The graphic below shows the basic architecture whereby there are two links – a dedicated MPLS connection and a public internet connection. This could be between a branch office and corporate HQ or datacentre.

Impairments will be introduced that violate the policy set for traffic along a specific link. In the main example delay will be introduced. If this exceeds the value set within the SLA the expected behaviour would be that some or all of the traffic switches to the next best path, in this case the internet connection. The test validates whether the expected behaviour is observed.

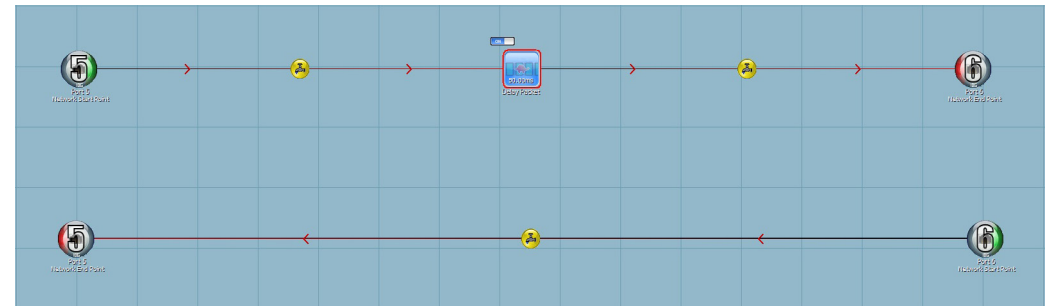
In the following tests we show how using Calnex SNE you can run test scenarios for validating conformance policies.



Testing Basic SD-WAN Architecture

1. Policy violation of a static SLA with delay

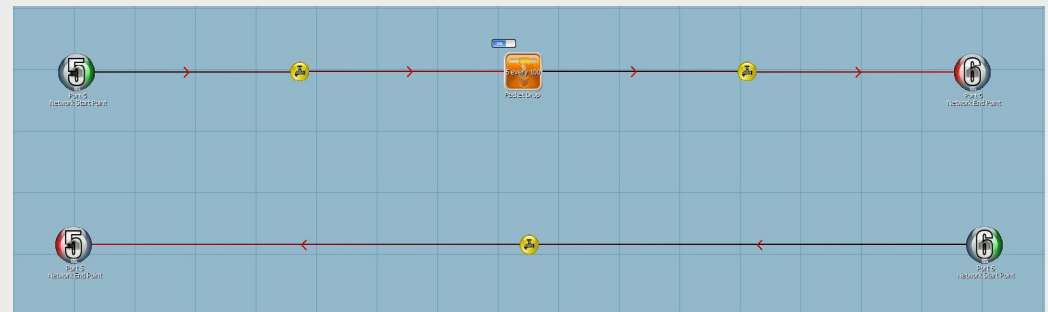
The service should be able to detect and report network KPI violations and upon a violation detection, should be able to intelligently reroute the affected paths to maintain service performance.



Calnex SNE single link map with delay packet.

Additional tests include:

- Policy violation of static SLA with packet loss
- Policy violation of static SLA with limited bandwidth



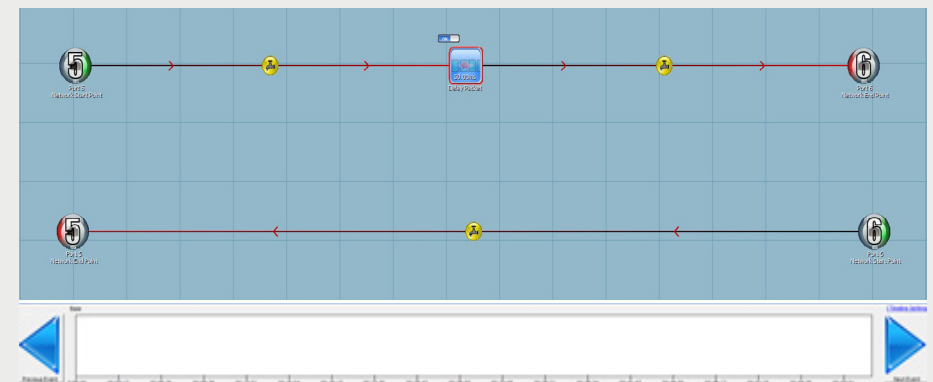
Calnex SNE single link map with packet loss.

Testing Basic SD-WAN Architecture

2. Policy violation of a **dynamic SLA** with delay

The rationale for this test is the same for the series of tests with static SLAs. The service should be able to detect and report network KPI violations and upon a violation detection, should be able to intelligently reroute the affected paths to maintain service performance. What differs is that a number of SD-WAN platforms will operate with dynamic SLAs. In other words values set for permissible levels of latency, loss, etc. may change at different times. In this case the architecture and basic emulation map design will remain the same. What the test requires is the ability to automate changes to impairment values.

Calnex SNE has a feature called “Timeline”. This feature enables you to preset values which will automatically change at a point in time. Therefore when running the test if the SLA changes to a higher/lower value then SNE can equally change values without manual intervention. As before multiple variations of the test with delay can be set up in the same manner using different impairments.



To explore testing with **complex mesh network architecture** view the next section of the test guide.

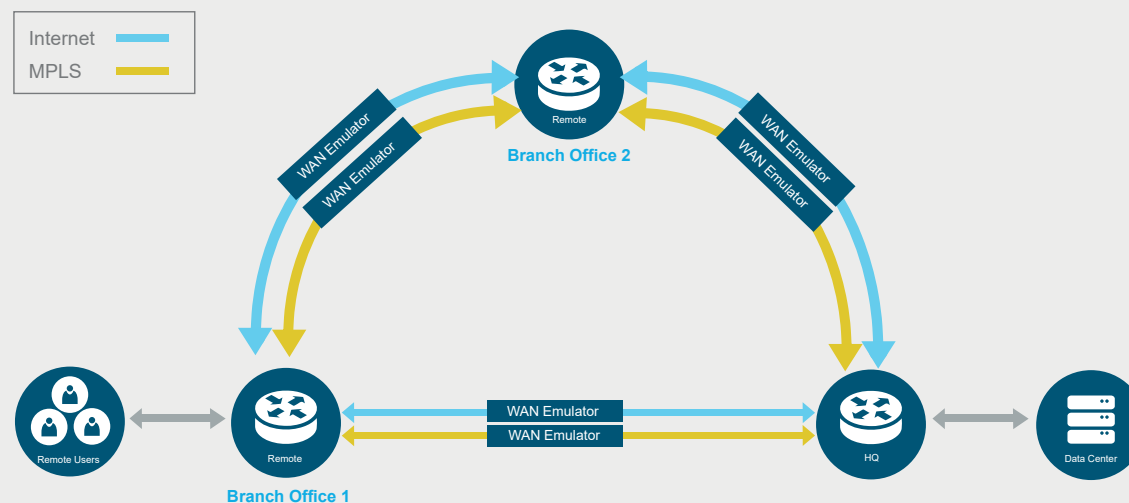
Testing Complex Mesh Network Architecture

Complex mesh networks can have a wide range of design options, with multiple MPLS and Internet link combinations between various locations such as a datacentre, HQ office and branch offices.

Regardless of where customers are on the SD-WAN journey being able to mimic their real-world network topology and run various scenario tests can enable you to test the real-world conditions under which your SD-WAN solution will perform and validate its performance.

The example below displays a mesh architecture between a datacentre, HQ office, Branch office 1 and Branch office 2. In the following test scenarios we explore how using Calnex SNE you can test scenarios such as validation of conformance to policies when SLAs are violated across one or multiple links in the network.

SD-WAN Mesh Emulation using Point to Point links



Policy Violation - Complex Mesh Network Architecture

The flexibility of the Calnex SNE means that you can design a map to emulate your exact architecture and introduce impairments on the network to meet your testing needs.

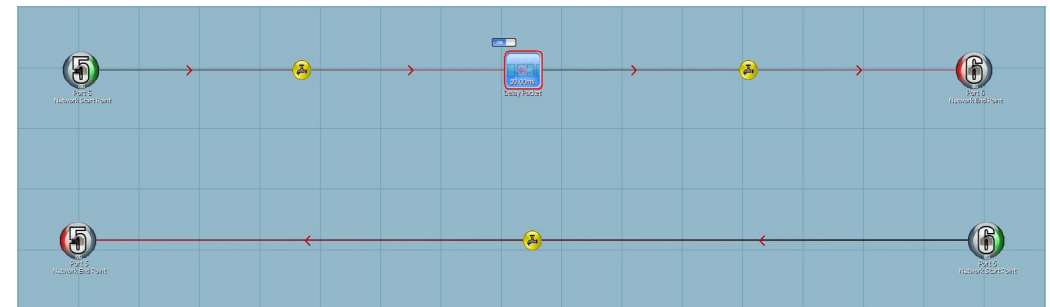
In this test case we are going to look at policy violations.

Example of the types of tests you can carry out under this scenario are:

- Policy violation of a static SLA with delay
- Policy violation of static SLA with packet loss
- Policy violation of static SLA with limited bandwidth
- Policy violation of a dynamic SLA with delay.

In our use case below we use 'Policy Violation of a static SLA with delay'. To test a simple link to link we introduce Delay that violates the policy set for traffic along this specific link.

If this exceeds the value set within the SLA the expected behaviour is that some or all of the traffic switches to the next best path. This test validates whether the expected behaviour is observed.



Calnex SNE single link map with delay packet.

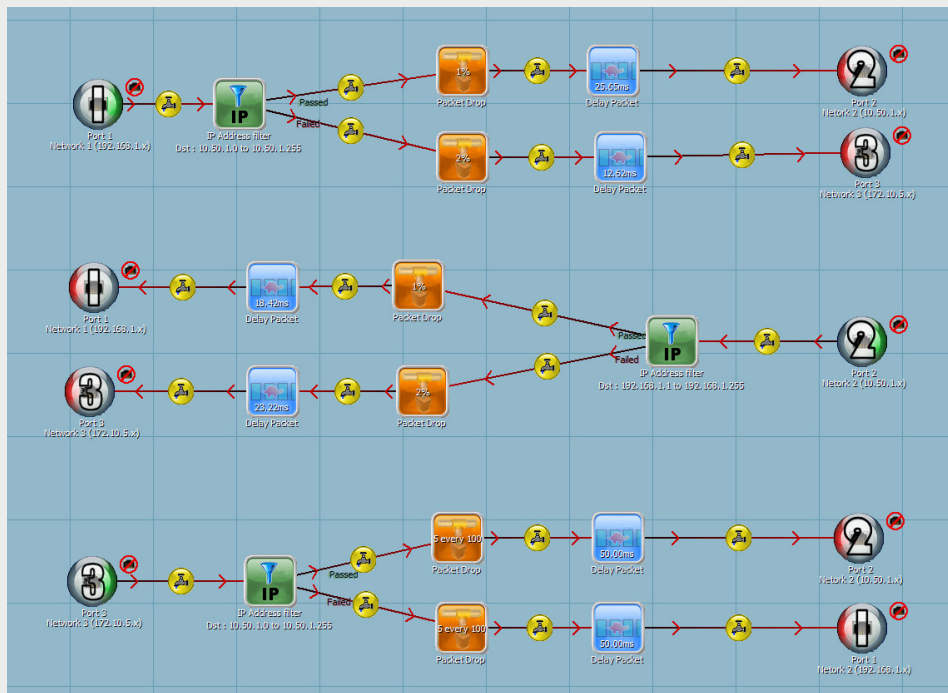
Taking this approach we can then explore how you can to do this test within our example **complex mesh network with multiple links**.

Policy Violation of a static SLA with delay - Complex Mesh Network Architecture

For policy violation testing, each link in our network may have a different SLA value and so a test plan for the full network would need to include options for testing the violation behaviour on each of these.

Using the SNE core capabilities, the exact topology can be recreated and values set rather breaking it down and creating multiple single link tests. The map example below shows both the MPLS and internet links on our example network mapped on the emulator. Each of these has impairments that are used to exceed the value set within the SLA to initiate the expected behaviour that some or all of the traffic switches to the next best path. The test validates whether the expected behaviour is then observed across all the links.

Ports 1-3 MPLS links



Calnex SNE complex multi-link map with multiple impairments.

For each of these links the values and impairment types can be adjusted to suit the testing needs.

Ports 4-6 Internet links



Calnex SNE complex multi-link map with multiple impairments.

Policy Violation of a static SLA with delay - Complex Mesh Network Architecture

With complex architectures, the link configurations between HQ, branch offices, datacentres and cloud based applications can create extensive testing requirements due to the number of potential scenarios which can arise.

Flexibility is essential when testing these and key features in emulation can enable testing to be carried out effectively and efficiently.

- Ability to route traffic from any port to any port on the emulator.
- Port density that scales up to 16 1GbE ports to enable greater interconnectivity.
- Virtual routing meaning that test traffic sent to the unit can take an intelligent routing decision at the ingress port.

For more information on how Calnex SNE can help make your transition to SD-WAN as seamless as possible:

Click on the button below to learn more about our Network Emulation product.

Calnex Solutions is a global leader in Test and Measurement solutions for next-generation telecom networks. Our products help to prove new technologies for applications such as SD-WAN, DataCenters, Cloud/OTT, Broadcast Video, and AV/Video conferencing.

For more information on Calnex's network emulation products, and to take advantage of our extensive experience in network emulation test, contact Calnex Solutions today:

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