APPOSITE TECHNOLOGIES

SOLUTION BRIEF
Testing the Performance of Satellite Systems and Devices

INTRODUCTION

Satellite networks have become a critical part of our modern communication infrastructure, providing connectivity to remote areas and enabling global communication.

Ensuring optimal performance is not always an easy task. Satellite systems are comprised of a multitude of devices, including satellite modems, VSATs, SD-WAN gateways, TCP proxies, Performance Enhancing Proxies, hubs, and ground stations, and the network itself is often volatile and susceptible to performance degradation. Therefore, testing is necessary to identify and address any potential issues before they impact users.

CHALLENGES

Network Volatility: Satellites are continuously moving, and the network conditions like latency, packet loss, and bandwidth are constantly changing depending on factors like weather. Testing on live links means your tests are subject to whatever the current conditions are.

Cost & Availability: Buying time to test on live satellite links can be expensive, and the limited availability of time slots can make scheduling time for comprehensive testing difficult.

Scalability: As the number of users on a satellite network increases, the network can become congested, leading to further performance degradation. Ensuring the scalability of satellite networks can be challenging, especially in areas with high demand for satellite services.

Apposite Test Capabilities

End-to-end system testing

Benchmarking performance of satellite network devices

- Modems
- VSATS
- TCP proxies, PEPs
- SD-WAN gateways
- Firewalls

Validating QoS by sending realistic application traffic at high scale

Testing with and without real satellite links with network emulation

TYPICAL SATELLITE NETWORK

SD-WAN Gateway — TCP Proxy — Satellite Modem & VSAT — Satellite Network — Satellite Modem — SD-WAN Gateway — Server
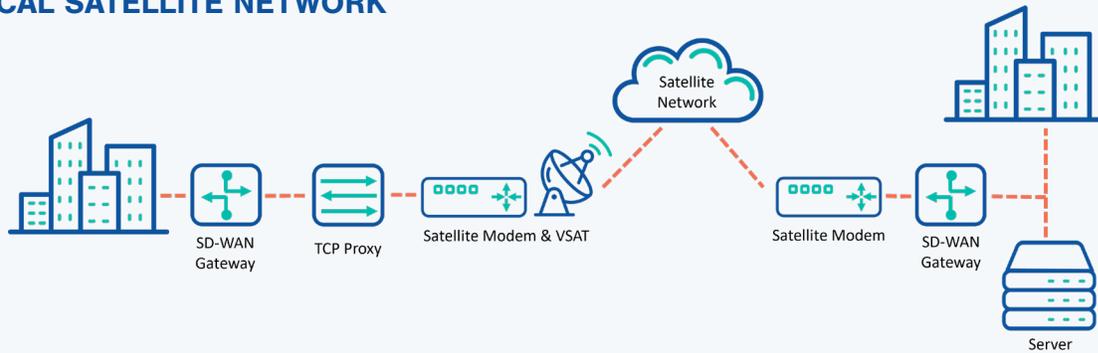
KEY TESTING AREAS

Benchmarking Device Performance

Each component that makes up the satellite system needs to be tested individually to ensure optimal performance. By measuring key performance indicators such as throughput, latency, jitter, and packet loss, you can compare the performance of a device against a set of standardized tests or industry benchmarks. This helps understand the performance of a device under specific conditions and identify areas for improvement.

It is also important to test the end-to-end performance of the satellite system with all its components in place. This involves testing the complete satellite network, including the satellite, ground stations, and all associated devices, to ensure that they are working together effectively and delivering reliable performance as a holistic system.

Evaluating Proxies

TCP proxies and Performance Enhancing Proxies (PEPs) are commonly used in satellite networks to improve application performance and user experience. A TCP proxy acts as a mediator between a client and server, intercepting and relaying TCP packets between them. This helps improve satellite network performance by reducing latency and network congestion and load balancing traffic.

To ensure that TCP proxies and PEPs are performing as intended and that you are choosing the right device for your network scenario, it is important to conduct thorough performance testing. Generate test traffic from a variety of application types to benchmark system performance metrics before and after the device is put in place. This verifies that the TCP proxy or PEP is improving application performance as expected. Additionally, it is important to test the TCP proxy or PEP under various network conditions to ensure that it performs effectively in all scenarios.

Validating QoS Policies

Testing Quality of Service (QoS) on satellite networks ensures that the satellite network is delivering the required level of performance for different types of applications. This involves verifying that satellite systems and individual components are prioritizing certain applications over others based on their relative importance.

It is common to have three or four levels of priority which can be assigned to different types of applications. To do this, people might use QoS schemes such as DSCP prioritization or ToS prioritization. For example, email and social media may be given low priority, while video streaming and web conferencing are given high priority. To test QoS on satellite networks, it is important to measure performance metrics on the application level, especially when the network becomes over-saturated. This ensures that the correct traffic is prioritized and that critical applications are given priority when network resources become limited.

Testing without Live Satellites

While testing on live satellite links is a necessary aspect of performance testing, the cost and complexity make it challenging for organizations to conduct effective testing. Satellite providers can charge high fees for accessing their networks, and there is often limited availability.

Additionally, the conditions of a live satellite network can vary greatly from day to day, making it difficult to control and reproduce the testing environment. To isolate and test individual components of the network, many organizations turn to network emulators and other simulation tools to replicate the conditions of a live satellite link. By adding network impairments, these tools can emulate changing atmospheric conditions, ground weather, outages, and more in a controlled and cost-effective environment.

SOLUTION OVERVIEW

Netropy Traffic Generators

Benchmark the packet level performance of networks and devices with classic performance measurements like latency, throughput, and loss. Our traffic generators emulate clients and servers and generate a mix of realistic application traffic and malicious attacks at tremendous scale to optimize network performance. Configure up to a million traffic streams or select from our library of pre-defined flows from apps like Zoom, Oracle, Netflix, and SAP to assess satellite modems, SD-WAN gateways, TCP proxies, and more. Validate QoS policies on a per-app and per-stream basis and stress test under the most challenging scenarios.

Netropy Network Emulators

Replicate the dynamic characteristics of a satellite network in the test lab. Our network emulators can mimic the exact satellite link characteristics like bandwidth limitations, latency, and packet loss to determine how adverse network conditions will impact application performance. Choose from preset network profiles and easily simulate the random weather patterns that affect connectivity using the "Gilbert Elliot" model. By using a network emulator, you can avoid the expensive cost of live satellite testing and achieve deterministic, repeatable results instead of being at the mercy of the current satellite conditions.

TEST CONFIGURATIONS

Apposite's solutions support multiple test configurations to support a wide range of satellite perfomance testing use cases, including:

1. Testing end-to-end system quality

2. Isolating the perfomance of individual network devices like satellite modems, TCP proxies, and SD-WAN gateways

3. Testing over real live satellite links or emulating the conditions of a satellite network

TESTING THE SYSTEM END-TO-END
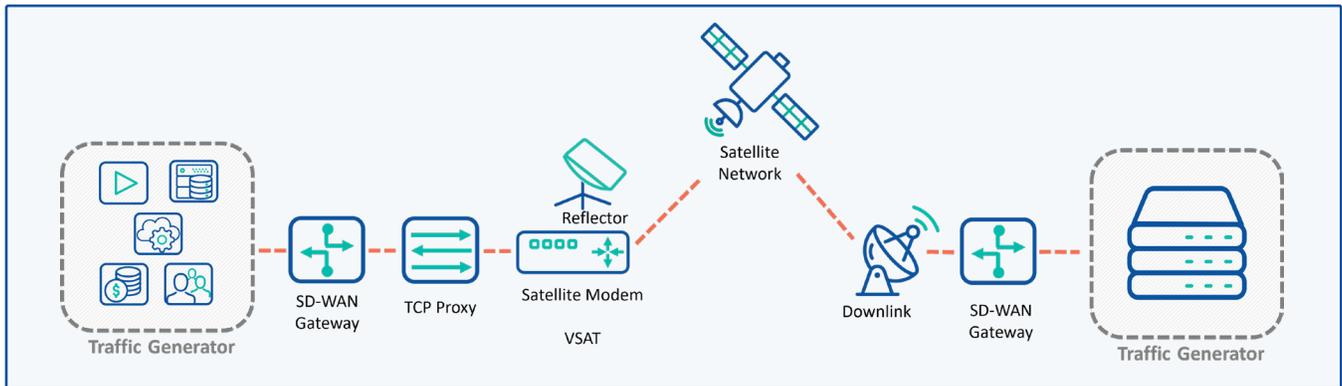
To test the entire satellite system end-to-end, the traffic generator is used to emulate the devices sending and receiving signals on either end of the network. The traffic generator sends various combinations of traffic streams across the network to help measure key performance metrics like throughput, latency, and packet loss by application type. By saturating the network, you can analyze network and device performance, observe if QoS policies are functioning as expected, and identify any performance bottlenecks. The traffic generator can also emulate malicious traffic like CVEs, malware, and other threats to assess network and device security.

When testing the system end-to-end, you can either test over a live satellite link or implement a network emulator to mimic the conditions of a satellite network.

ISOLATING A SATELLITE MODEM
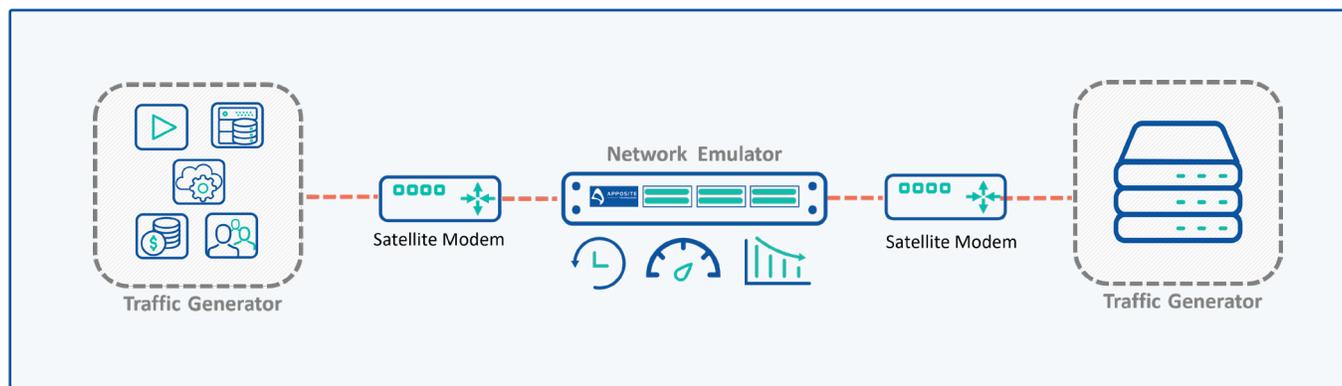
To test the performance of a satellite modem, use a network emulator to replicate the dynamic characteristics of the satellite network. This allows you to isolate the modem in a controlled test environment. Then, by using a traffic generator, emulate a mix of application traffic at high scale to simulate real-world usage scenarios and assess how well the satellite modem handles the traffic load.

By measuring performance metrics on each traffic stream and application type, you can identify potential bottlenecks or areas of weakness in the device. This information can then be used to optimize the performance of the modem and the overall satellite network.

ISOLATING A TCP PROXY
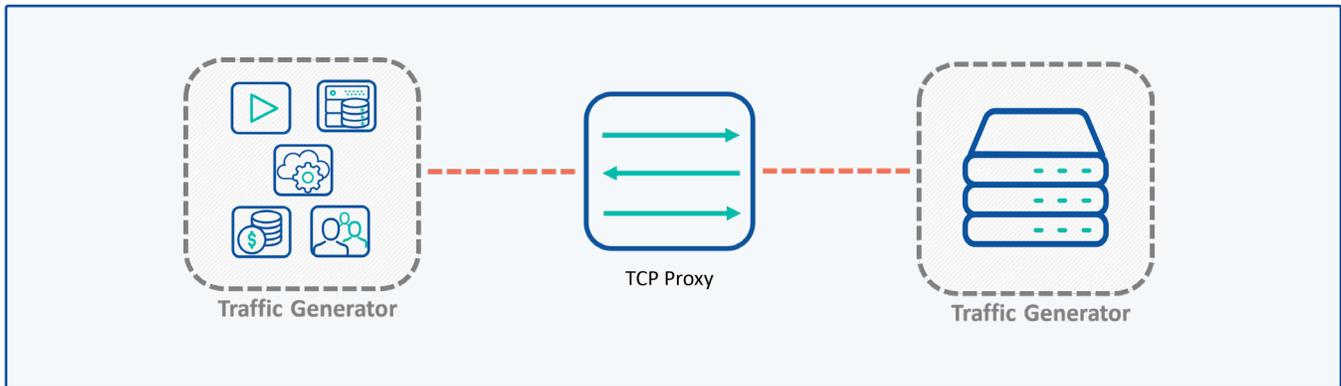
Validate the performance of TCP proxies by using a traffic generator to generate a high volume of TCP queries. Measure performance benchmarks like the maximum number of simultaneous TCP connections the device can support and how fast it can set up and tear down TCP sessions.

By using a traffic generator to set up TCP sessions and transfer data over the connections, you can establish whether the TCP proxy is accelerating the data performance rate. Simulate the upload or download of data files to measure how well the proxy is able to improve application performance and overcome the difficult conditions of satellite networks.

ISOLATING AN SD-WAN GATEWAY
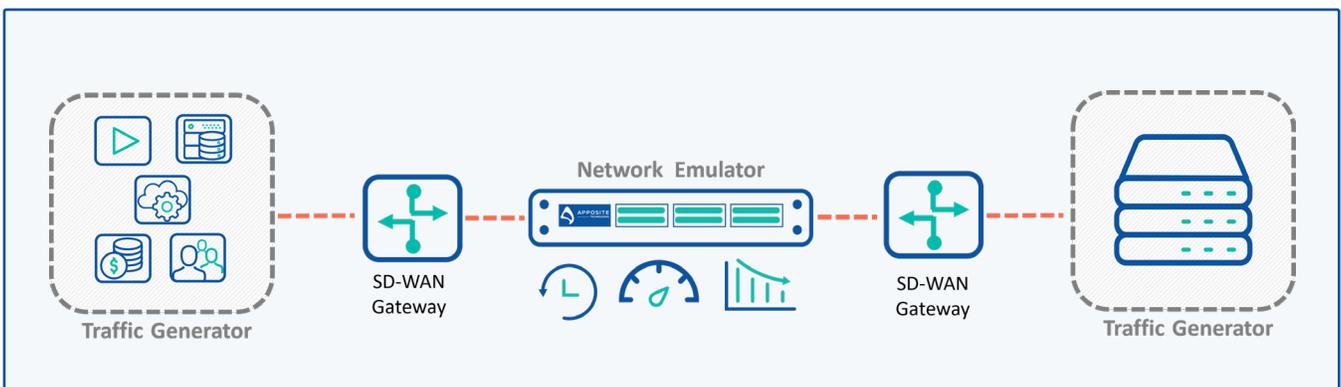
Using both a network emulator and traffic generator allows you to isolate the performance of the SD-WAN gateway. The traffic generator emulates the expected application traffic being sent through the network, like video streaming, web browsing, and VoIP. The network emulator allows you to create multiple links with individual network conditions like latency, jitter, and loss to imitate a complex and volatile satellite network.

Generate a high-scale mix of application traffic and send it through the SD-WAN gateway across the emulated network to isolate and accurately measure device performance. You can determine whether the gateway is correctly prioritizing application traffic according to QoS policies and whether it is selecting the best alternative link in the case of an outage. This controlled test environment helps assess both application performance and the quality of user experience to ensure the SD-WAN gateway is performing as expected.

SUMMARY

Satellite networks present unique and complex challenges. Apposite's solutions help organizations minimize performance degradation, improve quality of experience, and reduce costs associated with satellite testing. Using traffic generators and network emulators, testers can replicate the real-world conditions of a live satellite environment in the test lab so they can mitigate the impact of poor network quality and optimize application and device performance before they are deployed

WHY APPOSITE?

Apposite has been in business for over 15 years and has helped satellite customers around globe from military organizations to system integrators and large enterprises. Our modern, easy-to-use test solutions enable teams to set up performance tests quickly and easily and trust the results.

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