



**APPOSITE**  
TECHNOLOGIES

# A STEP-BY-STEP GUIDE TO GETTING SD-WAN RIGHT THE FIRST TIME



# LEVERAGING SD-WAN IN 2022

---

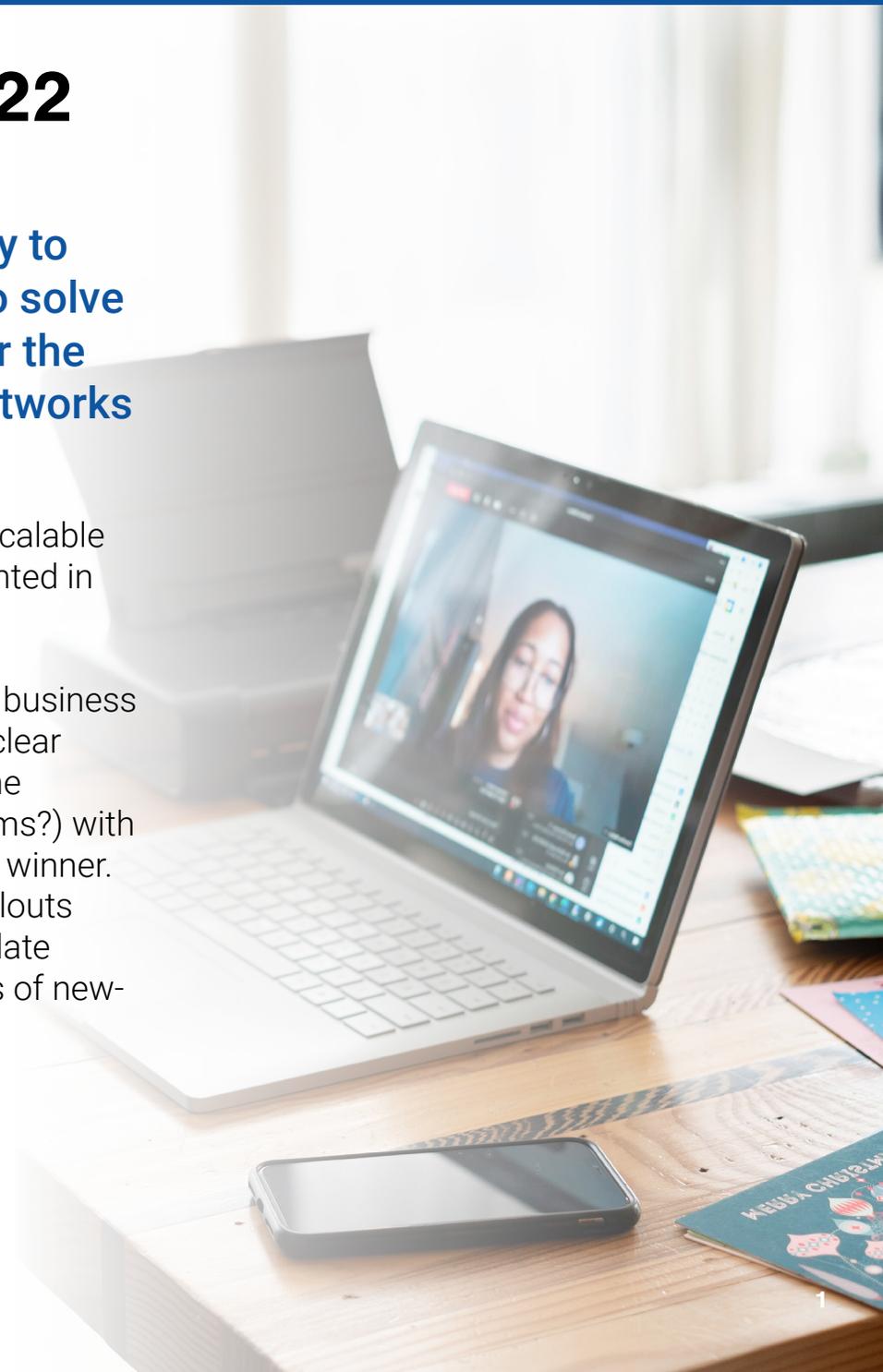
**Many new technologies storm the scene as a way to slash costs. Those that hang around longest also solve real problems or change the way we do things for the better. Done right, software-defined wide area networks (SD-WAN) can do both.**

Even before the frenetic changes of 2020, business-critical applications and high-value assets had begun to leave the building, migrating from traditional data centers to a mix of public and private clouds. The Work From Home phenomenon ratcheted up transformation exponentially as remote workers used consumer-grade setups to access collaborative applications like Salesforce and Zoom.

Users were patient at first, grateful to connect to office resources at all, but by 2021 most came to expect

the same stable, secure, scalable systems they took for granted in the office.

The scramble to digitalize business processes created some clear winners and losers (anyone remember life before Teams?) with SD-WAN emerging a clear winner. Its popularity grew and rollouts accelerated to accommodate hundreds, even thousands of new-normal “branches of one.”



## HOW BIG OF A DEAL IS IT?



According to estimates by the Dell'Oro Group, the SD-WAN market **spiked more than 30 percent in 2020**



Recent IDC surveys found **42 percent of businesses had already deployed SD-WAN** and **up to 95 percent will be using the technology within two years**



IDC expects the **market to reach \$4.5 billion in 2022**, growing at a rate of more than **40 percent per year**

# WHY SD-WAN? WHY NOW?

---

**SD-WAN delivers unprecedented wide area network flexibility by allowing traffic to burst directly from the branch office to the internet rather than backhauling it over expensive MPLS links to a central site. Migration delivers powerful benefits, starting with the obvious:**

**Substantial savings.** Replacing traditional MPLS with broadband connections can save companies 25 to 30 percent of their annual bandwidth costs. Increased use of automation can also minimize tickets and costs associated with support.

**Speed of deployment.** New branches can be brought online within minutes or hours instead of days, weeks, or months, a massive advantage for remote work and for alternating between office and home.

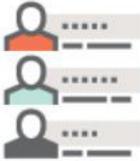
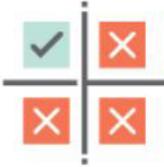
**Satisfaction.** In many cases, and depending on the quality of internet service available, SD-WAN improves both performance and reliability, making for a better, more stable customer experience.

**Versatility.** Newer-generation SD-WAN does more than merely tie branches together. In the wake of permanent, pandemic-driven change, enterprises now look to feature-rich SD-WAN offerings to replace traditional firewalls, routers, and other physical devices—and to reduce cost and complexity more than ever.

## ...but not without challenges.

Like every business-critical technology, SD-WAN needs to deliver the ultimate application experience anywhere and everywhere it's used. But the grander the vision, the greater the risk of falling short. If you're considering trusting more of your traffic and operations to SD-WAN, IT needs to uphold a rock-solid plan for meeting expectations and realizing returns from the get-go.

# 5 common SD-WAN challenges

Vendor selection	Underlay provisioning	Cloud connectivity	Cost reduction	Management
<p>SD-WAN marketing can be overwhelming and confusing, making it difficult for IT teams to filter vendors, analyze the options, and document your business requirements.</p>	<p>When choosing SD-WAN architecture and procuring connectivity, pay attention to network performance, support and IP backbones.</p>	<p>Most enterprises require cloud access to public cloud environments. Evaluate each vendor's strategy for providing this access.</p>	<p>Cost savings with SD-WAN don't always show as quantifiable figures on the budget. Look at overall business benefits as well.</p>	<p>Vendors and service providers offer DIY, co-managed and fully managed SD-WAN options. Choose the model that fits your resources and requirements.</p>
				

Source: [TechTarget](#)

# GETTING IT RIGHT OUT OF THE GATE

---

**For too long, most enterprises had no choice but to over-rely on vendors, service providers, product reviews, and “industry best practices” in making decisions of paramount importance.**

Organizations that do not maintain high-caliber dedicated test labs have struggled to implement reliable, repeatable testing.

As much sense as it makes to do your own testing in-house, barriers to entry included prohibitive equipment costs, lab/real estate requirements, and the complexity or expertise required to configure and run tests. These barriers no longer exist.

Today, innovative solutions such as traffic generators and WAN emulators level the playing field by making real-world testing viable for companies and IT departments of any size. Taking matters into your own hands means going beyond online due diligence to run your own suite of tests to validate performance and benefits throughout the deployment life cycle.

## BENEFITS INCLUDE:



**Validating** SD-WAN architectures, controllers, gateways and other devices before you invest



**Conducting** vendor/provider bake-offs



**Performing** regular health-checks



**Optimizing** day-to-day management



**Validating** changes as

In this eBook, Apposite Technologies' SD-WAN experts will share a five-step approach to ensuring SD-WAN rollouts unfold with no major hitches and deliver the benefits your business expects on day one. We'll show you how fast, realistic, repeatable testing proves vital at every stage, from selecting the right partners to designing for diverse network conditions, traffic mixes, and budget constraints.

**LET'S GET STARTED...**



## STEP 1: SET CLEAR EXPECTATIONS

---

The biggest expectation is that SD-WAN will save the company money. And while savings calculations might seem straightforward, at-a-glance comparisons can prove misleading. Real cost reduction reflects more than monthly subscription fees and must be evaluated for its ultimate impact on the health of the business.

Are users more or less able to access critical applications quickly and securely? Can multiple devices and features be consolidated, making apples-to-apples comparisons harder but value greater?

Nor is SD-WAN still a sheer savings play, which makes perceived success even more subjective. IT should set very clear expectations, particularly for network and application performance and manageability, in order to avert before-and-after disappointments.

Is SD-WAN making it easier or harder for IT to manage large, distributed networks, troubleshoot incidents, and detect and contain potential cyber threats? Are fewer incidents being escalated to Level 2 and Level 3 engineers to remediate?

## UNDERSTAND PERFORMANCE TRADE-OFFS

We don't want performance trade-offs, ever, but if they're part of the deal we need to understand and evaluate them going in. That means establishing a benchmark based on your current situation and testing current and intended application flows over realistic SD-WAN networks.

## BE PREPARED TO ASSUME OR REDISTRIBUTE RESPONSIBILITIES

Traditional network operations centers (NOCs) employ well-defined, road-tested troubleshooting and management practices. Not every ISP can say the same, so don't be shy.

**Ask questions.** Conduct extensive due diligence to ascertain how well each provider can meet the requirements of service-level agreements for monitoring as well as connectivity.

With clear and realistic goals in hand, IT can move on to Step 2, evaluating prospective providers, and best practices for validating claims and quantifying benefits.

## STEP 2: SELECT THE BEST PROVIDERS

---

Adopting SD-WAN frees IT to choose the best local internet providers (and best deals) rather than trust the entire business to one or two MPLS carriers. This translates into greater flexibility, bargaining power, and scalability, but also into more choices, contracts, and SLAs to navigate.

Recent market consolidation and broader goals for SD-WAN make it more challenging than ever to choose the right providers in each region and to keep them honest. The more you have riding on SD-WAN—like core feature functionality such as firewalls and routing—

the more proactively you need to validate and select the right providers.

Look beyond cost reduction to rate vendors' ability to sustain peak application performance and promote strong cybersecurity.

---

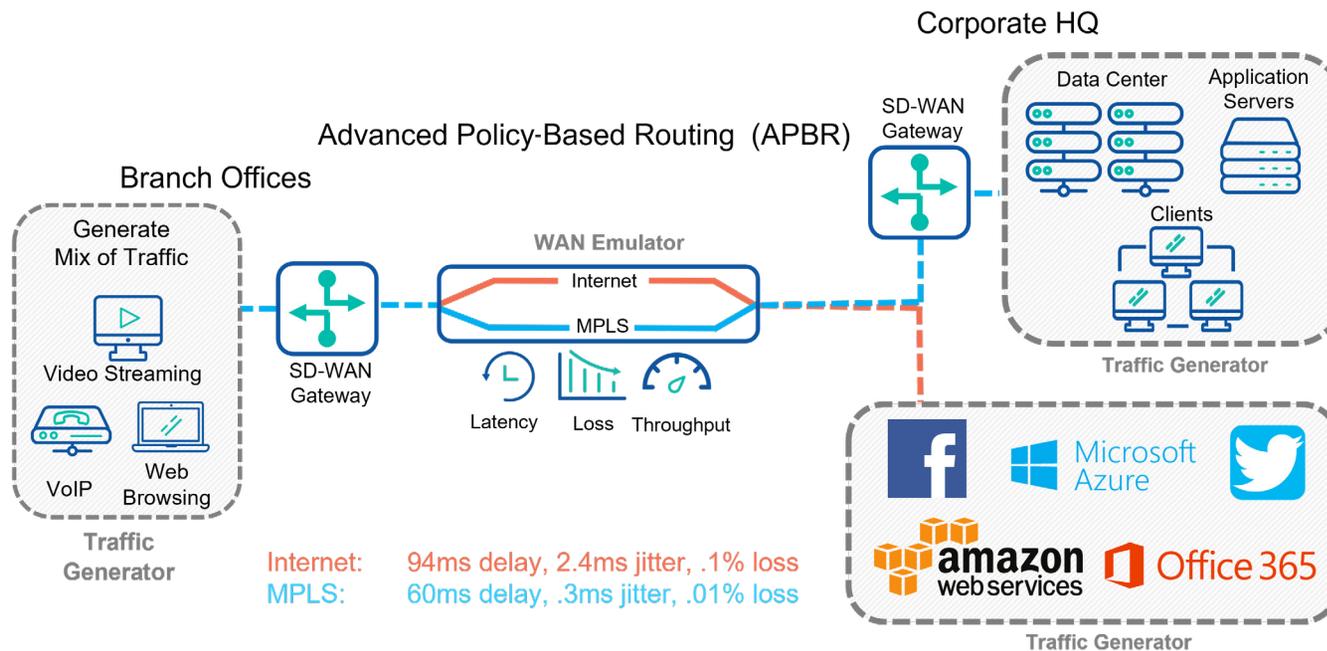
**For those who want to take advantage of this new functionality, choosing and deploying the right SD-WAN solution has become a more complicated endeavor because SD-WAN cuts across security, networking, application performance and cloud services.**

*[Network World, July 2021](#)*

---

## CHOOSE THE IDEAL PARTNERS

The only way for enterprises and government agencies to preview and compare how well prospective solutions will fare in the real world is to subject them to it. Solutions like traffic generators and WAN emulators equip virtually any organization to conduct revealing vendor bake-offs within minutes.



**Figure 1. Putting Gateways to the Test.**

Traffic generators are used to create and send realistic traffic from your unique mix of applications, and if desired, malicious exploits. Traffic gets sent to the device under test (DUT) – in this case an SD-WAN gateway – across an emulated SD-WAN or other network connection. Administrators can easily configure realistic WAN conditions and impediments such as latency, loss, and jitter to measure when and how much application performance degrades.

## EMULATE THE HYBRID WAN

---

Once you resolve not to rely on vendors relating their findings of testing done under ideal conditions, you need a way to recreate and test performance against all foreseeable network conditions, on your own. WAN emulation must encompass all types of links – Internet, MPLS, cable, satellite, wireless, etc.—with the ability to easily configure and model changing conditions.

As noted earlier, this includes exploring performance when faced with network impairments like latency, loss, and jitter. You may also want to evaluate how well prospective systems integrate with your existing infrastructure, management and monitoring systems, and security defenses.

WAN emulation combines with traffic generation to let IT fully experiment and validate the performance of critical applications achieved using each competing vendor's or provider's solution.

## MAKE THE FINAL CUT

Testing plays a powerful role in reaching a short list of potential providers, but don't go by numbers alone. Changing ISPs may seem less intimidating than ripping out MPLS circuits, and it can be, but change is never easy.

## KEEP YOUR PRIORITIES STRAIGHT

Why would anyone want to generate more application and attack traffic? Because doing so lets IT measure the performance of individual applications in intended networks under specific conditions.

That includes gauging SD-WAN solutions' ability to prioritize (and de-prioritize) the right applications as you define them. For example, they might prioritize voice and video ahead of data, or business applications over personal ones.

Administrators can set priorities according to business impact, network requirements, or user roles and responsibilities.

---

**IT teams are often constrained by their existing commitments and network complexity. For example, security vendor contracts don't often terminate at the same time as WAN services. In this scenario, teams should consider vendors that offer good integration with third-party security services.**

*[TechTarget](#)*

---



## STEP 3: PREVIEW THE USER EXPERIENCE

---

**When the dust settles, the ultimate success or failure of SD-WAN deployment hinges on how well critical applications and services deliver.**

- *How clear is the audio from customer call centers?*
- *How stable is the video from the kitchen table?*
- *How many simultaneous conferencing sessions can the network or gateways support?*

After choosing technologies but prior to pulling the trigger on SD-WAN, IT needs a viable, repeatable way to benchmark, model, and compare the “before” and “after” results of moving from MPLS to Internet-based connections. As we’ve already noted, comprehensive assessments should test application and service performance across all network technologies for all critical and challenging applications like voice, video, unified communications (UC), and software-as-a-service or SaaS-based applications such as Salesforce.

Proactive performance testing might also encompass SD-WAN routing functionality, virtual private network (VPN) performance, and support for management capabilities and protocols such as NetFlow, logs, IPsec, SNMP, and OSPF. Other aspects to explore include:

**Ease-of-use.** Can remote workers turn up SD-WAN on their own or with minimal remote IT support?

**Automating operations.** How difficult is it to orchestrate monitoring, troubleshooting, reporting, and other functions across the entire WAN?

**Streamlining complexity.** SD-WAN usually means managing more regional providers and distributed services and devices. Depending on the features and functions offered, it may also mean subscribing to additional services for monitoring and security.



## MAINTAIN HYBRID DEPLOYMENTS

---

**SD-WAN networks connect corporate headquarters and data centers with local offices and SaaS applications through multiple WAN links—but it doesn't all happen at once. For a time, or perhaps even permanently, IT may choose to combine reliable but high-cost MPLS connections to carry time-sensitive data along with lower-cost broadband SD-WAN connections carrying lower-priority data.**

Companies may maintain both technologies in tandem for months or years as rollouts progress, or even long-term where reliable internet service does not exist. To ensure resilience and prioritization, IT should emulate all of your WAN connections to validate performance before risking your business in real-world scenarios.

Testing beforehand helps align rollout plans with expectations, but it needs to continue as new technologies hit the field. Continue to incorporate user feedback, and to record live network conditions to drive testing that optimizes deployments every step of the way.

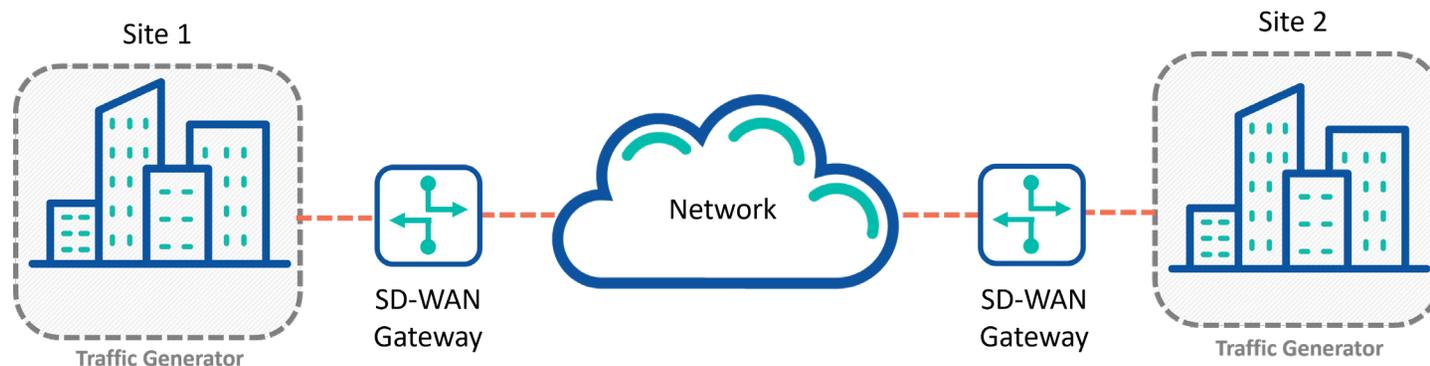
And once your new “product” hits the field, define a plan for making sure performance, return on investment (ROI), and cybersecurity don't get lost in the frenetic shuffle of day-to-day operation.

# STEP 4: OPTIMIZE FOR MANAGEMENT AND SCALE

Needless to say, the fun doesn't stop when SD-WAN goes live. Testing to make IT's job easier should never stop, either.

SD-WAN comes with its own native monitoring capabilities but they tend to be less comprehensive compared with traditional data center systems and tools. Conduct regular health-checks to validate provider performance against SLAs and address ongoing operations and management challenges.

Administrators can use traffic generation to capture, reproduce, and experiment with recordings of production traffic to enhance performance as your business-critical workloads, connectivity options, and threat landscape fluctuate.



**Figure 2. Site-to-Site Performance Testing.**

Validate the performance of optimization tools such as SD-WAN gateways in site-to-site scenarios by emulating both sites and generating realistic traffic at scale.

## MAKE SURE TO TEST AGAIN:

As cliché as it sounds, the one constant in networking is change. IT will benefit greatly from being able to test anytime:

- Networks scale to include new sites or technologies
- Mergers and acquisitions extend resources to many more sites
- New services, applications, features, and devices get introduced
- Cyberattacks succeed

**THIS LAST BULLET BRINGS US TO STEP 5 ...**

## CAPABILITIES TO LOOK FOR IN A TRAFFIC GENERATION SOLUTION

---

**Benchmark** the raw packet-level performance of networks and devices with classic performance measurements.

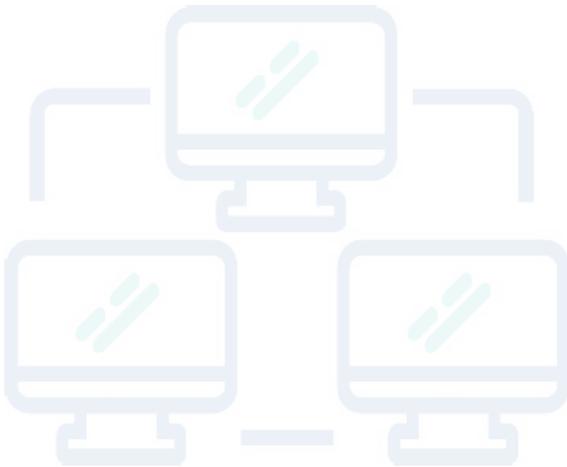
**Capture, reproduce,** and **amplify** production traffic in a controlled lab environment.

**Optimize** the performance and functionality of application-aware devices and systems.

**Evaluate** the session-holding capabilities of stateful network devices and servers.

## STEP 5: BULLETPROOF CONNECTIVITY

---



Despite their increasingly prohibitive cost, dedicated circuits retain one relevant bragging point: **privacy**. Replacing MPLS with two-way links between the internet and branch offices costs less but can produce an undesirable byproduct: **risk**.

As you connect more branch offices via the public internet (versus regional central offices), migration gives rise to potential, highly dynamic digital exposure. Adversaries have come out of the woodwork to capitalize on companies' growing external attack surfaces by leveraging weak branch or home office cyber defenses and launching new phishing, ransomware, and email-based attacks at warp speed.

The upshot for IT? Now cybersecurity must be built into your infrastructure and distributed to even the smallest and least active sites. Near-term, IT might implement micro-segmentation to restrict lateral movement.

Source: [Cato Networks 2021 Networking Survey](#)

## SASE delivers significant benefits to early adopters during COVID-19

While the SASE market continues to be young, early adopters were vocal in their support:



86%

reported increased security



70%

time savings in management and maintenance



55%

overall cost savings



55%

greater agility in adapting to new conditions or challenges

SASE solves the IT security skills shortage by harnessing the power of security best practices, skilled experts, and cloud self-maintaining architecture.

Longer-term, secure access service edge (SASE) architectures are emerging to unify SD-WAN, secure remote access, and cloud-based security. In a recent survey by CATO Networks, 37 percent of respondents reported being able to protect locations and site-to-site connections from threats after deploying SD-WAN. When more advanced SASE deployments were in place, that number jumped to 64 percent.

Though promising, SASE and Zero Trust will not happen overnight. In the meantime, enterprises need a way to ensure business and cyber resilience as they operationalize SD-WAN, and as SD-WAN itself evolves.

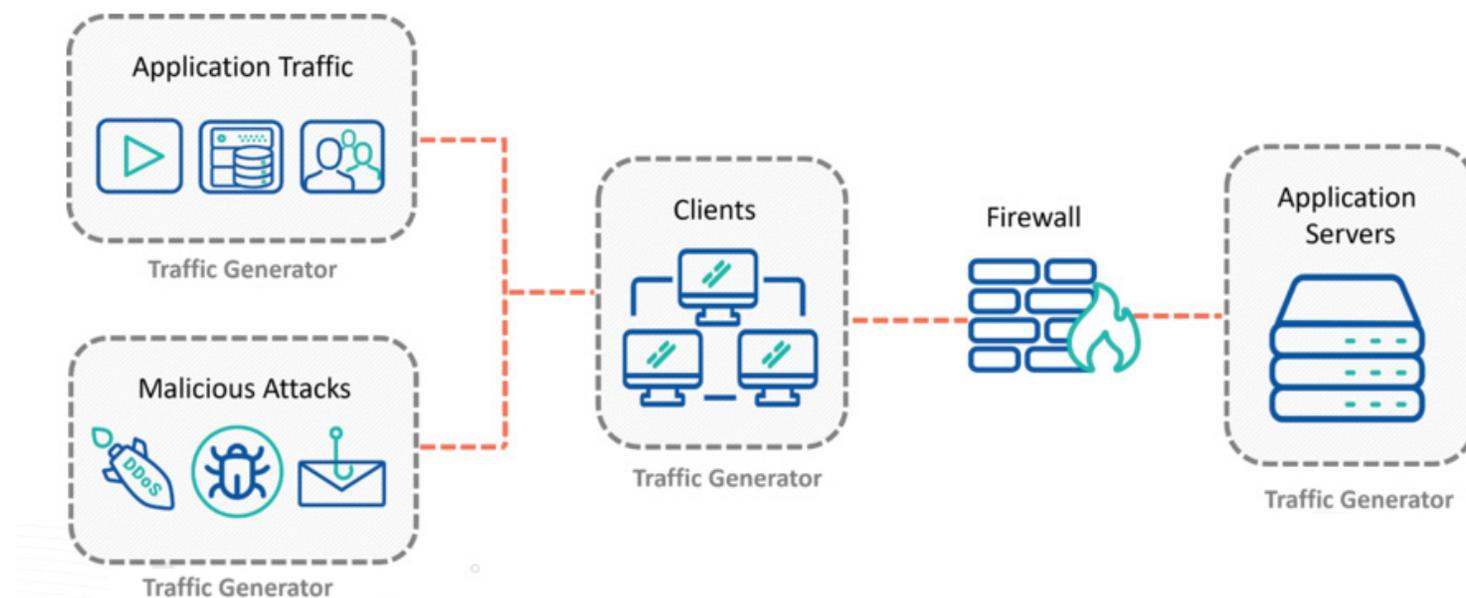
## ONCE AGAIN, TESTING PLAYS A VALUABLE ROLE.



## ENSURE NETWORK SECURITY

Often SD-WAN gateways have integrated firewall functionality, such as enforcing traffic policies and blocking sessions. Businesses need to optimize these gateways and other security devices to ensure that they are protected against malware, phishing, and advanced security threats.

Using traffic generation, organizations can replicate real-world application traffic and malicious attacks at scale to validate the performance of SD-WAN gateways and next-generation firewalls. By emulating application servers and thousands of simultaneous users, traffic generators simulate realistic attack scenarios to test whether malware is stopped while legitimate traffic passes through to its destination.



**With traffic generation and network emulation in place, you can test deployments, performance, and day-to-day operation to ensure long-term success.**

# HOW APPOSITE CAN HELP

---

Apposite Technologies has helped 1,000s of the world's leading enterprises, technology vendors, gov & mil agencies, and service providers roll out new technology with confidence for over 15 years.

Using Apposite's modern test solutions, businesses can optimize network, application, and security performance to ensure they meet and exceed expectations for SD-WAN. Speed time to deployment, maximize ROI and deliver a world-class user experience to both customers and employees.



Simplify testing and evaluation of SD-WAN systems by replicating real-world networks in the lab with Apposite's WAN emulators



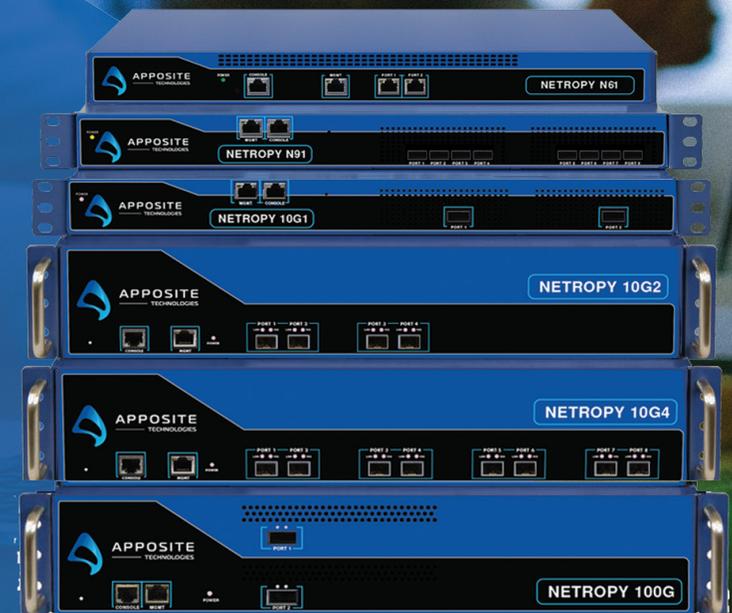
Validate SD-WAN vendor solutions under realistic traffic conditions with Netropy Traffic Generation



Configure SD-WAN optimization efforts for your specific network conditions, devices, and applications

Netropy Traffic Generation and WAN Emulation solutions were designed to introduce economically and technically viable enterprise-class testing. **Compared with high-end approaches used by vendors and service providers, Apposite's solutions stand out as:**

- Easy to use without a PhD or certification in testing
- Modern, with a browser-based user interface so testing is accessible anywhere
- Affordable and cost-effective to run anytime and as much as needed
- Comprehensive in scope to create meaningful tests
- Deterministic, accurate and repeatable



## NETROPY WAN EMULATION

### FEATURES

**Easy of use.** Netropy network emulators are quick to install, intuitive to configure, and easy to operate

**Visual network environment.** Create and visualize up to 30 network paths and label unlimited endpoints representing clients, data centers, remote offices, and more

**Bandwidths up to 100 Gbps.** Accurately simulate links from 100 bps up to 100 Gbps

**Network impairments.** Emulate latency, jitter, packet loss, bandwidth constraints, and more to replicate real-world networks

**Reporting.** View in real-time or download up to 24 hours of throughput graphs and link statistics

**Automated testing.** Automate testing using the fully RESTful API

**Preset network profiles.** Select from preloaded network types such as good or bad 5G, Wi-Fi, satellite, and more to get testing quickly

## NETROPY TRAFFIC GENERATION

### FEATURES

**Browser-based UI** with an intuitive wizard-driven test approach that walks you step by step through the configuration process

**Extensive library** of pre-defined application flows and malicious attacks

**Support** for a city-scale of traffic with up to 1 million emulated clients

**Amplification** of a single traffic capture into thousands of flows

**One consistent interface** for all test applications

**Detailed logs and reports** for off-line analytics that help pinpoint performance problems

**Performance metrics** for throughput, packet loss, min, max, and avg latency, jitter, etc.

**Layer 2-7** header templates including IPv4, IPv6, TCP, UDP, HTTP, SIP, and RTP



**APPOSITE**  
— TECHNOLOGIES

## SEE FOR YOURSELF

---

To experience the benefits of emulating your dynamic networking environment to optimize use of SD-WAN— as well as satellite, wireless, and other technologies— visit [www.apposite-tech.com](http://www.apposite-tech.com).

Browse the site or [arrange a demo](#) with an expert to arm yourself with insights that ensure the success of rollouts and maintain satisfaction with new technologies and investments.