White Paper

IT/Networking

flexiWAN Tests Data Security on 4th Gen Intel® Xeon® Scalable Processor

Higher speed SD-WAN and more sophisticated security are driving demand for higher performance branch office networking; flexiWAN IPsec tests[1] achieve more than 10Gbps on a single processor core

Virtualized SD-WAN and branch office security services are must-have technologies for branch office computer networks. flexiWAN offers its SD-WAN and security services edge (SSE) software running on Intel® processor-based branch office servers. For the past few years, the company has been documenting its performance on these servers.

Starting with the 2nd Gen Intel® Xeon® Scalable processors, the company has shown how its software has leveraged the added CPU performance and features of each CPU generation to deliver better SD-WAN and SSE performance. Continuing that trend, this paper is focused on testing flexiWAN software optimized to run on servers powered by 4th Gen Intel® Xeon® Scalable processors.

Branch Networks Need More Compute

Many organizations are adopting edge cloud networks to locate compute resources close to where data is being generated. In addition to these business workloads, using these powerful CPUs is important for branch office environments that need to stay ahead of the growing complexity of SD-WAN routing and traffic prioritization, which require robust computational resources to process real-time decisions efficiently.

In parallel, the rise of cyber threats and the shift to zero-trust security models and SSE is reshaping branch office cybersecurity infrastructure. These functions often run concurrently with SD-WAN capabilities, increasing the computational load. The integration of security services with SD-WAN requires servers capable of performing complex encryption, decryption, and traffic analysis without introducing latency.

flexiWAN Delivers Branch Office Networking

Founded in 2018, flexiWAN, an Intel® Industry Solution Builders member, is on a mission to disrupt the SD-WAN and SSE markets. flexiWAN SD-WAN is open source SD-WAN and security software that integrates with cloud security SSE applications. This solution allows for the delivery of advanced SSE services that give more control to service providers and IT administrators with regards to data routing and security policy selections.

flexiWAN comes with a native application-based firewall and application-aware routing policies. These allow service providers and IT administrators to decide which traffic type / application to send through the cloud SSE and which to send directly to the Internet. This routing intelligence improves traffic optimization by avoiding SSE delay while also controlling operational costs. The software also features support for applications, including network management, orchestration, and automated platform deployment capabilities.

Table of Contents

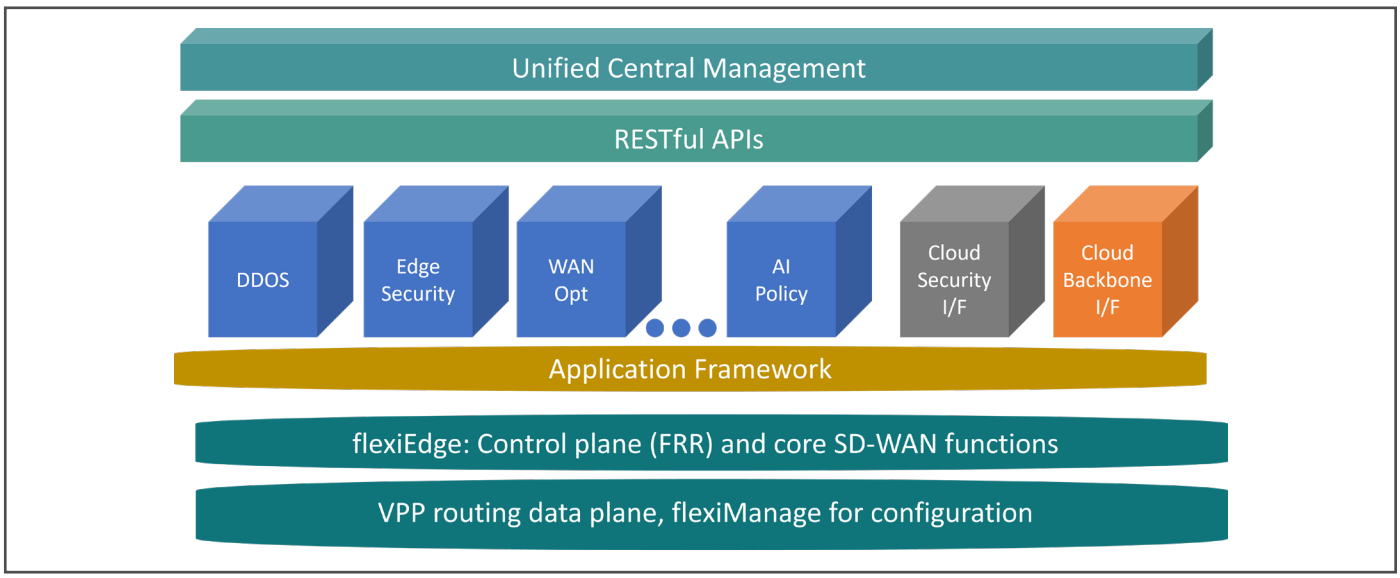

Figure 1. flexiWAN functionality.

flexiWAN routing policy is centrally configured in the cloud and executed at the edge resulting in both SD-WAN and an application-aware security firewall at the edge, as well as easy integration with cloud SSE applications. The result is a hybrid, optimized, and cost-effective networking and cybersecurity deployment where some of the traffic can exit to the internet directly from the branch while other traffic is transported over a dedicated backbone to the cloud security SSE. This architecture delivers more control and differentiation in the hands of the service provider, system integrator and IT staff.

The architecture for the flexiWAN solution (see Fig. 1) includes the flexiEdge software that provides routing, SD-WAN, and security services in a branch office and runs on servers powered by a full range of Intel® Xeon® Scalable processors.

As depicted in Fig. 1, the network layer includes three software-based networking components: a routing data plane, a routing control plane, and a flexiManage agent for remote and central configuration.

Fast Data Project (FD.io) vector packet processing (VPP) provides the routing data plane. VPP is an open source user-space router that speeds up layer two / three switch-routing by processing multiple packets at a time.

For the routing control plane, the flexiEdge features an instance of Free Range Routing (FRR). This software makes routing and policy decisions and communicates these decisions to other layers and to other routers. FRR implements standard routing protocols such as BGP, RIP, OSPF and IS-IS.

In addition, the networking layer features a flexiWAN agent for communicating system status with the central flexiManage instance. flexiManage enables remote and central configuration as well as life cycle management to the system.

Above the networking layer is the application framework that runs flexiWAN or third-party applications. The application framework is a general framework for managing applications that can run in the data flow of the flexiEdge router, as Linux applications in flexiEdge, or even in the flexiManage cloud management system, allowing for real-time policy processing applications, management and monitoring applications, and other types of services to be easily added to the system.

The next layer upholds the RESTful APIs that enable communication with the flexiManage unified central management and can be used for integration with other management or orchestration systems. Every function available in the flexiManage cloud management system can also be performed through these APIs.

The flexiWAN router is called flexiEdge, and it can be installed on bare metal hardware devices as well as on virtual machines as virtual network functions (VNFs), and also on Kubernetes pods using Kubevirt and in the cloud instances from major cloud providers.

Figure 2. Illustration of the hub-and-spoke network design used in the tests.

flexiManage provides central configuration, zero touch provisioning (ZTP), software upgrade, and orchestration of flexiEdge devices and applications. The software's interface lets a network administrator manage devices and the network. flexiManage also collects statistics from each device for analysis and provides reports on system health and throughput.

Testing flexiWAN on 4th Gen Intel Xeon Scalable Processors

Using the Intel® Network Builders Edge and Networking Testbed, a flexiWAN team tested IPsec VPN performance using flexiWAN version 6.4.32 and Intel® Xeon® Gold 6438N processors. The test network design was a hub and spoke with three virtual machines (VMs) on VMware ESXi.

The flexiWAN test environment is built on a single server utilizing dual 4th Gen Intel Xeon Scalable processors. VMware ESXi was chosen as the virtualization platform and was used to create three flexiWAN routers on the server under test (SUT). These routers are arranged in a hub-and-spoke topology to simulate real-world networking scenarios as seen in Figure 2.

Each flexiWAN virtual machine is paired with an Ubuntu server acting as a LAN client and replicating local network traffic. The VMs are connected through a virtual switch in VMware ESXi.

The virtualized flexiWAN instances are connected using encrypted tunnels, allowing administrators to evaluate secure traffic handling across the network. Each spoke server was connected to an iPerf 3 traffic generator that generated wire speed traffic.

A separate LAN client connected to each flexiWAN instance serves as the traffic generator and testing endpoint. This enables administrators to measure key performance metrics, such as NAT efficiency, tunnel-to-tunnel encryption throughput, and overall system responsiveness.

This setup provides a controlled environment for assessing the performance and scalability of flexiWAN's virtual routers. It helps identify how the system operates under encrypted traffic loads and highlights considerations for deployment within virtualized infrastructures.

The testing involved creating a hub-and-spoke network design connecting two flexiWAN edge servers (flexiWAN-02 and flexiWAN-03 in Fig. 2) to a centralized flexiWAN edge server.

Each of the three VMs was configured with four CPU cores and 4GB RAM. However, flexiWAN utilized only a single core per VM for routing, meaning the results reflect the maximum throughput achievable per core in a VMware environment.

This is significant, as flexiWAN's multicore functionality—recommended for datacenter hubs managing three or more tunnels—allows one core to be allocated per tunnel for optimized performance.

Testing included two tunnels in total: one from the flexiWAN-01 to spoke 1 (flexiWAN-03) and another from flexiWAN-01 to spoke 2 (flexiWAN-02). Each tunnel's throughput was assessed using various configurations of IPsec with different cryptographic methods:

- IPsec tunnels with "AES-CBC-256" encryption.
- IPsec with IKEv2.
- IPsec without encryption for baseline comparison.

Throughput performance was measured with iPerf3 software, yielding the results in Figure 3.

Tunnel Type	Max Download (Gbit)	Max Upload (Gbit)
IPsec PSK (aes-cbc-256)	6.75	10.3
IPsec IKEv2	10.5	10.7
IPsec without Encryption	9.29	9.19

Figure 3. Table of test results across two encryption types and non-encrypted baseline.

Observations and Conclusions

The SD-WAN and data security needs of branch office networks are driving a need for more compute power in servers aimed at this marketplace. flexiWAN has further designed its flexiWAN software to take advantage of the performance and features of the 4th Gen Intel Xeon Scalable processor. The results of these tests indicate that flexiWAN achieved line-rate performance on tests run with IKEv2 and IPsec with no encryption on a single core, demonstrating its ability to handle significant throughput even within the constraints of being virtualized and tested in the same environment. The PSK (AES-CBC-256) configuration showed slightly reduced speeds, as expected with 256-bit encryption overhead, but performance remained robust.

The multicore functionality, allowing as few as one core per tunnel, is particularly valuable for datacenter hubs managing three or more tunnels, where throughput requirements are especially demanding.

With up to 60 cores in the 4th Gen Intel Xeon Scalable processor, flexiWAN hub sites can easily scale to 100Gbps per processor with many tunnels.

Compared to testing conducted in 2023 on 3rd Gen Intel® Xeon® Scalable processors, where AES-CBC-128-encrypted tunnels reached only 1.73 Gbps[2], this generation achieved close to six times that throughput per tunnel.

Learn More

flexiWAN Homepage

Intel® Industry Solution Builders

4th Gen Intel® Xeon® Scalable processors

[1] Config SUT: 1-node, 2x Intel® Xeon® Gold 6438N processor with 32 cores and 64 threads. Software: OS was Ubuntu 22.04. Workload software: flexiWAN v 6.4.32. Other software: VMware ESXi 7.0, iPerf3 Test conducted by FlexiWAN on Oct. 31, 2024.

[2] flexiWAN Improves Networking and Security Performance with Intel® Xeon® Scalable Processors; https://flexiwan.com/white-papers/flexiwan-improves-networking-and-security-performance-with-intel-xeon-scalable-processors/

Notices & Disclaimers

0225/CG/DJA/PDF Please Recycle 364450-001US