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Segment Routing Offers Turnkey Edge-Based WAN Services for CoSPs

As cloud services grow, NoviFlow's segment routing solution, powered by Intel® Xeon® Scalable processors and Intel® Tofino™ Intelligent Fabric Processors, eliminates latency, bandwidth challenges

For many communication service providers (CoSPs), wide area network (WAN) service offerings to enterprise customers have undergone dramatic changes to accommodate high volumes of data exchanged with hyperscale data centers. Originally based on multi-protocol label switching (MPLS), these WANs were designed for point-to-point connections between headquarters and branch offices. However, this architecture makes it challenging to support enterprises with more data and workloads placed over internet and in cloud-based services.

As a result, CoSPs have deployed complex WANs, which are expensive and inefficient. Furthermore, the legacy network equipment used to deliver these services was designed decades ago and is difficult to install, service, and scale.

MPLS WANs also contribute to a high latency problem. The point-to-point nature of MPLS-based WANs require data to travel long distances from the branch end user to the source server in the data center and back again. This is a sub-optimal architecture for globally dispersed corporate users to access cloud-based applications.

Analysts have long been predicting the phasing out of MPLS. Indeed, among 1,600 IT professionals surveyed in Europe, Asia, and the Americas, 85% of them said their businesses would not be reinvesting in MPLS.[1]

Edge computing has recently gained traction because it addresses the latency challenge. Rather than ship packets all the way from source to destination, edge servers process information close to the origination point. As a result, CoSPs reduce backbone network traffic and can support more lower-latency applications.

To take advantage of these edge network features, CoSPs must evolve their WAN toward segment routing (SR). However, as many CoSPs have invested significant resources, time, and money in their MPLS networks, they seek new functionality that can integrate with MPLS networks. Ripping out and replacing older equipment is simply not an option.

Segment Routing Extends the Life of MPLS

Segment routing is a next-generation internet protocol that leverages the source routing paradigm and extends the life of legacy MPLS. It supports easy-to-use network programming and flexible, agile extensions.

The protocol creates a network domain with predefined network segments that can be set up within an IPv6 or MPLS network anywhere that segment-based traffic steering is desired. An SRv6 domain is composed of three types of nodes:

- The ingress head-end node encodes SRv6 header data into each packet.
- The transit node routes a packet based on information in that added segment routing header (SRH).
- The egress end node removes the SRH and forwards the packet using the packet's original protocol.

SRv6 allows CoSPs to layer new intelligent networking services on top of both new and legacy equipment. It reduces the number of required protocol types, creates greater extensibility and programmability, and supports diversified new network services. Furthermore, it provides high levels of reliability and works with cloud services.

CoSPs must also integrate robust security functionality. Securing these new services can be a challenge due to the complexity of integrating access, core, and cloud network elements. Firewalls are typically a first line of defense, but next-generation solutions are needed to guard the edge.

NoviFlow* Offers an SRv6-based Solution

Rather than pull all these complex elements together themselves, CoSPs have turned to NoviFlow, an Intel® Network Builder ecosystem member, who has worked with Intel to define an SRv6-based multi-access edge computing (MEC) network SR solution based on Intel technology.

The hardware for this SR platform is a scalable, all-in-one, zero-touch configuration, software-defined switch-server system that offers compute, storage, and top-of-rack switching functionality to provide the agility and performance.

Intel® Xeon® Scalable processors and the Intel® Tofino™ Intelligent Fabric Processors (Intel® Tofino IFPs) deliver more functionality at a faster speed by leveraging Intel's flexible and programmable compute and networking technologies.

The 3rd Generation Intel® Xeon® Scalable processors are advanced CPUs built for enterprise, cloud, and edge networks.

The latest generations of Intel Xeon Scalable processors deliver edge application, service, and control plane processing; high-performance packet processing; and signal processing. The virtualized, software-defined infrastructure supports legacy and cloud workloads.

Intel® Tofino™ IFPs utilize the P4 programming language, an open-source programming language for defining packet forwarding data flows in a wide range of networking systems. The programmability of Intel® Tofino™ IFPs makes them ideal for handling dynamic workloads at the edge. Using Tofino IFPs allows CoSPs to customize the data plane for various workloads, support new protocols, run networking programs on the switch fabric, and deliver detailed in-band network telemetry, creating real-time network visibility.

With the P4 programmable switching fabric, this SRv6 edge service engine provides scalable compute resources, load balancing, security, and carrier-grade network address translation (CG-NAT) functionality.

NoviFlow's solution is built on Red Hat® OpenShift®, an enterprise-ready Kubernetes container platform with full-stack automated operations for managing edge deployments. It includes container runtime, networking, monitoring, container registry, authentication, and authorization features.

NoviFlow NoviFabric™ and NoviAnalytics™

In addition to SRv6 routing, NoviFlow delivers unique service chaining, load balancing and visual analytics capabilities.

NoviFlow NoviFabric™ provides service programming in an SRv6 network. It includes SRv6 proxy, load balancing and service chaining functionality for service insertion in a SRv6 network. The SRv6 proxy allows for SRv6 unaware services to be inserted. A large number of service chains (service policies) may be defined as ordered lists of up to five independently load balanced services. Each service policy is identified with a unique 16b C-SID and thus individually addressable within the SRv6 domain.
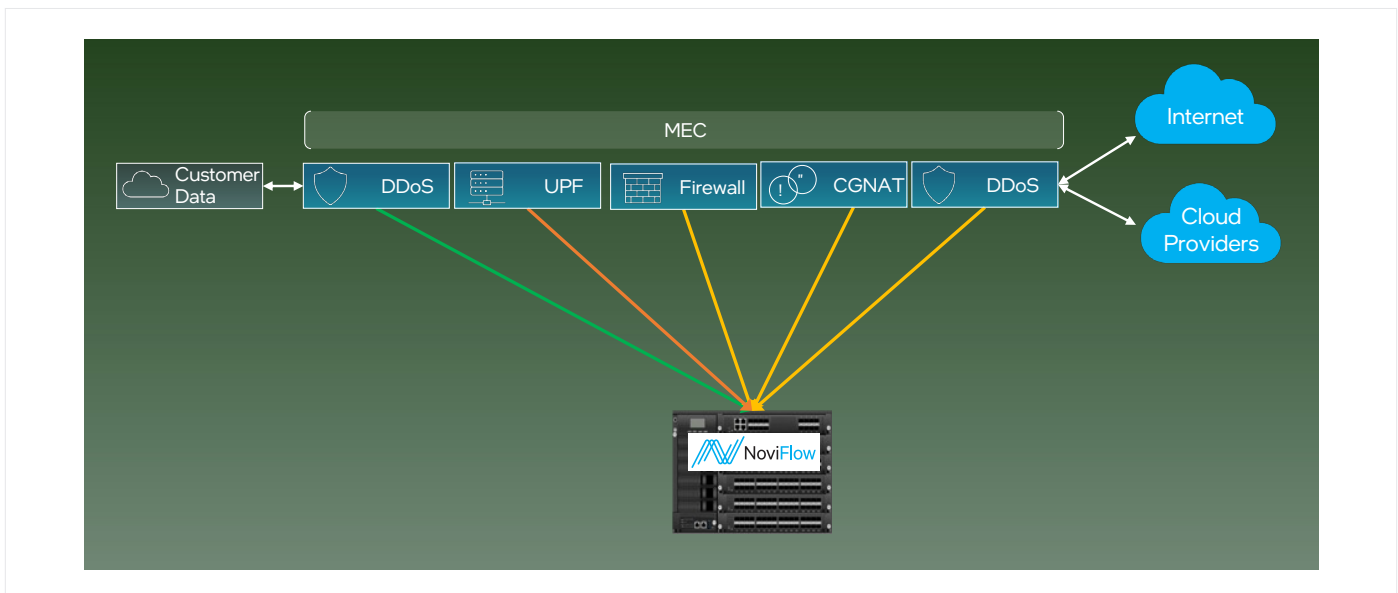

Figure 1. Block diagram showing the type of NoviFlow network functions that can be processed in the data plane.

NoviFlow NoviFabric™ implements load balancing and service chaining directly in the network forwarding plane, enabling services to elastically scale across multiple virtual machines and across multiple servers for high performance. This design provides low latency, frees up CPU compute cycles for other processing chores and eliminates the need for standalone load-balancing hardware, reducing solution costs, footprint and energy consumption.

NoviFlow NoviAnalytics™ provides an end-to-end view of the platform for hardware and software troubleshooting. It simplifies the operations, administration, and management of the platform and reduces onsite and preventive maintenance needs and costs. All the collected information is stored in a time series database on the platform to enable high-fidelity troubleshooting. The "green-to-go" visual interface simplifies the operations, administration, and management (OAM) of the edge server, reduces onsite support costs, and implements preventative maintenance to minimize expensive truck rolls.

The NoviFlow SRv6 solution can be used with third-party cybersecurity virtual machines (VMs) and appliances to deliver multi-cloud security protection from a broad array of network security threats, including protection from distributed denial-of-service (DDoS) attacks.

Business Results

The solution has been deployed at a North American CoSP in its production 5G network since November 2021.

The CoSP deployed SRv6 programmable network devices to reduce service cost at the edge and to create a network that supports future services, scales on demand, and simplifies service deployment and network management.

The NoviFlow solution reduced capital expenses, device acquisition costs, network equipment footprint, and power consumption. Because the turnkey system was integrated, the CoSP no longer had to run cabling among its servers, load balancers, and switches. They were all connected in the backplane. In addition:

- The new solution seamlessly integrated with the existing network infrastructure.

- The CoSP was able to set policies in software, eliminating the need to tinker with any hardware whenever updates are needed.

- The solution automatically balances workloads, avoiding any potential bottlenecks and improving system performance.

By deploying the SRv6 solution, the CoSP retooled its network and became more agile, cost effective, and proactive. The change positions the CoSP to deliver future network services no matter how they evolve.

Conclusion

MPLS-based WANs make it challenging for CoSPs to support the explosion in internet and cloud-based services at globally dispersed locations, resulting in higher costs and latency. For CoSPs that want to extend the life of their MPLS networks, rather than replace them, segment routing is a next-generation internet protocol that leverages the source routing paradigm and extends the life of legacy MPLS.

Powered by Intel Xeon Scalable processors and the Intel Tofino IFP, NoviFlow provides a SRv6-based MEC network turnkey solution. With the P4 programmable switching fabric, this SRv6 edge service engine provides scalable segment routing, service chaining, load balancing, security, and CG-NAT functionality. NoviFlow's solution offers the agility and performance required for today's complex, high-performance network edge and positions CoSPs to deliver future network services no matter how they evolve.

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Intel® Xeon® Scalable processors

Intel® Tofino® programmable Ethernet switch ASIC

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