



Orchestrated Virtualized Multi-Vendor SD-WAN Services



SD-WAN momentum and market demands

Software defined wide area networking (or SD-WAN) is one of the highest growth segments in our industry, helping enterprises to transform their WAN connectivity in alignment with their digital transformation and cloud initiatives. Applications are dispersed in multiple public and private cloud platforms, on premise and in data centers. Enterprises expect on-demand, secure and easy access to their applications and network services delivered with the highest performance assured.

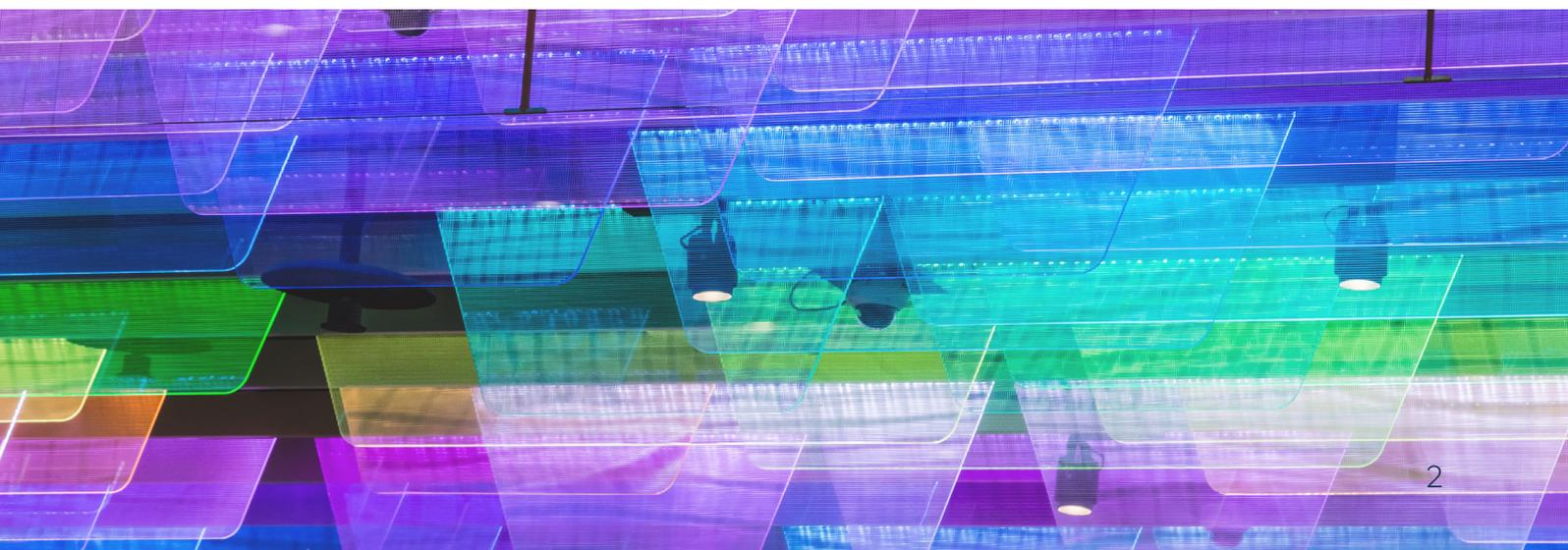
Communication Service Providers (CSPs) have a tremendous opportunity to become strategic partners to their enterprise customers with a competitive managed SD-WAN offering. While CSP managed SD-WAN deployments are starting to gain traction, differentiation is critical in this highly competitive market, requiring CSPs to:

- Offer a choice of SD-WAN and value-added virtualized services from multiple vendors to meet the specific needs of their enterprise customers.
- Empower enterprises to control their own services with full visibility and assurance, along with the ability to easily purchase new services.
- Eliminate the dependency between the SD-WAN application and the CPE device by allowing the customer to choose from a wide range of open, commercial-off-the-shelf hardware platforms.
- Be able to react to new service requests, changes and problem resolution in an agile fashion.

Challenges to delivering new virtualized services

Conventional router-centric WAN architectures are highly complex and time consuming to deploy and configure, requiring manual intervention from specialized engineers using command line user interfaces. By adding more vendors to a CSPs offering, including security and WAN acceleration applications, this complexity increases exponentially resulting in the following challenges and requirements:

- Different sales and distribution channels for SD-WAN CPEs from different vendors need to be established.
- OSS/BSS systems need additional development and customization for each new solution that is introduced.
- Specialized engineers need to be trained separately for different solutions from multiple vendors due to inconsistencies in SD-WAN service definitions.
- Manual service provisioning and configuration makes it difficult and time consuming to add new sites and scale services.
- Virtualization introduces uncertainty, especially considering the wide variety of NFV Infrastructure ranging from public clouds to uCPE.
- Additionally, current solutions make it challenging for enterprises to change SD-WAN vendors in the future without “fork-lifting” the previous solution.



Proof of concept goals

In order to address these challenges, this proof of concept (PoC) has been established to demonstrate the next innovation in SD-WAN with the following goals:

Reduce the complexity of offering multi-vendor SD-WAN and value-added services by:

- Using a common uCPE platform to host multivendor SD-WAN and value-added services.
- Automating service provisioning, lifecycle management, CPE provisioning and simplifying OSS/BSS integration using a single orchestration platform, common uCPE manager and end-to-end assurance across multiple SD-WAN vendor solutions.
- Showing how a digital user experience can simplify how services are purchased and managed, enabling CSPs to delegate control to their enterprise customers with full visibility of their services.

Advance MEF LSO APIs and service definitions to speed-up commercial adoption

- The PoC uses established MEF LSO APIs, including Legato from the service orchestrator to the portals, as well as new APIs such as Presto between the service orchestrator and SD-WAN controllers. The aim is to provide MEF with valuable feedback to advance and mature the Presto API to enable commercial deployments.
- The PoC also demonstrates the recently standardized MEF 70 service definition for SD-WAN. The aim is to validate conformance with MEF 90 and provide MEF with feedback to help with the next versions of MEF 70.

Participants

Company	Role	Product Names
	PoC lead including implementation, integration and testing	
	Service orchestration, self-service portal and digital marketplace	Netcracker Service Orchestration, Netcracker Self-Service Portal, Netcracker Digital Marketplace
	SD-WAN solution	Versa Director and Analytics, Versa FlexVNF
	SD-WAN solution	Silver Peak Unity EdgeConnect™, Silver Peak Unity Orchestrator™, Silver Peak Unity Boost™
	SD-WAN solution for legacy CPEs	NEC Smart SD-WAN / Security
	uCPE platform and manager	ADVA Ensemble Connector, ADVA Ensemble Virtualization Director, ADVA Ensemble Orchestrator
	Testing and validation of MEF 70 SD-WAN services and LSO APIs	VisionWorks Controller, VisionWorks VTA

PoC Overview

This PoC demonstrates the next innovation in SD-WAN, which accelerates adoption of orchestrated and assured multi-vendor SD-WAN and value-added services through automated operations and a new digital user experience. Powered by a unified marketplace, self-service portal and NFV-based uCPE platform, MEF 70 compliant SD-WAN services from different vendors can be selected independently of the CPE hardware and seamlessly deployed with little-to-no intervention from the service provider or end-user. Through this new “digital user experience”, SD-WAN services are orchestrated, activated, assured and managed using zero touch provisioning (ZTP) and end-to-end service automation in alignment with MEF’s LSO framework.

PoC Demonstration

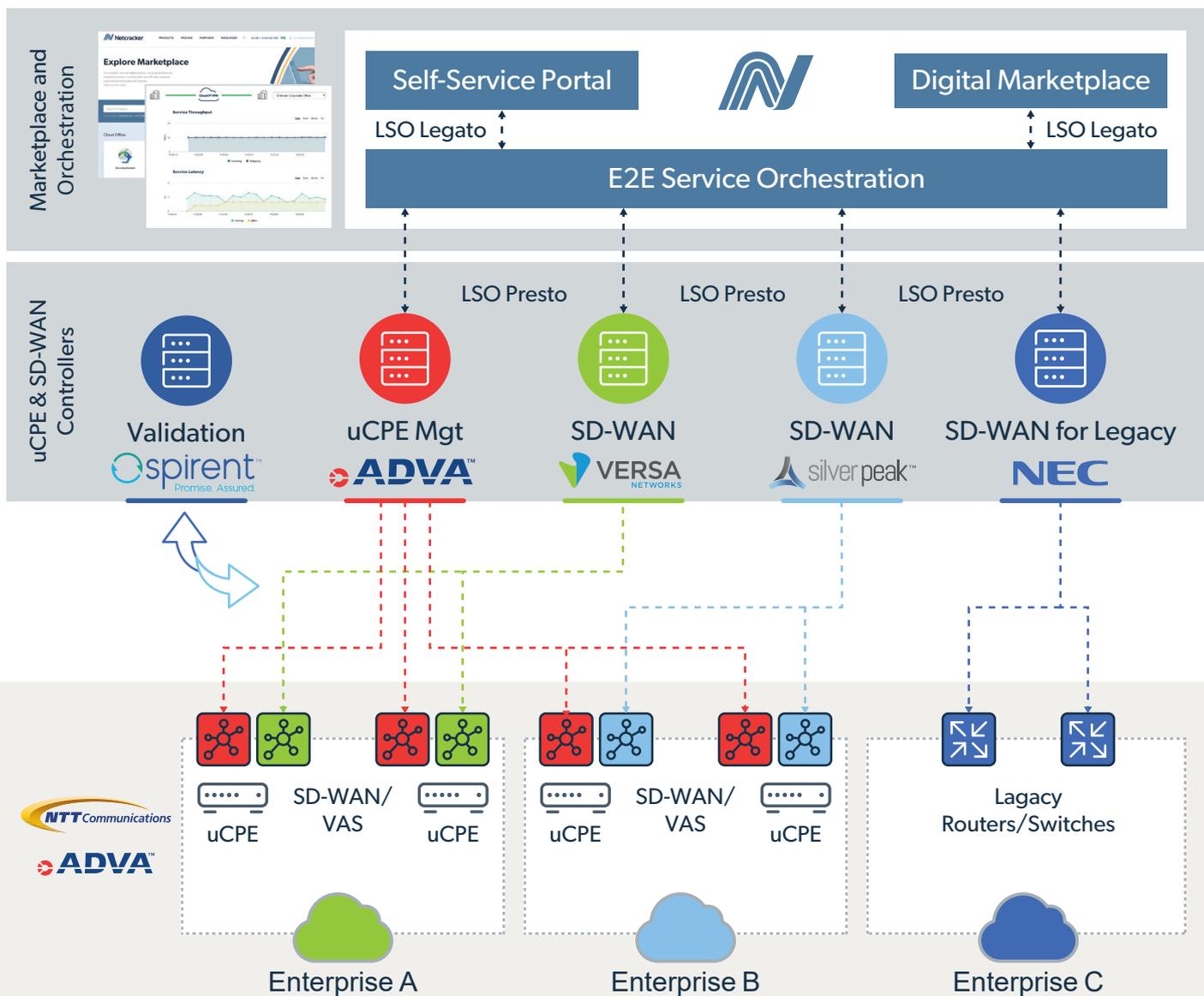
The PoC will show the journey of a business customer who wants to connect remote branch sites with an SD-WAN overlay network and use value-added virtualized functions such as advanced security or WAN optimization. The demonstration scenario starts with the procurement of vendor neutral uCPE devices and SD-WAN services and security applications with different vendor options from the self-service portal. The services are then dynamically loaded onto the uCPEs remotely using ZTP and validated through service activation testing. Given the SD-WAN services are MEF 70 compliant, they are configured in a standardized and unified way for different vendors, such as configuration of application-aware routing and internet breakout. The demonstration then shows how the service can be seamlessly modified when the user decides to add a WAN optimization application from a different vendor via the portal.

SD-WAN services are continuously monitored and visualized in real time, including branch locations, traffic volume and bandwidth utilization per application. For enterprise sites that are not yet SD-WAN-enabled, the PoC demonstrates a migration scenario that uses legacy CPEs with an open source SDN controller to create SD-WAN like networks as a transition step to full a SD-WAN deployment.

The key technology innovations being demonstrated include:

- Software (SD-WAN applications) and hardware (CPEs) separation by utilizing common white box servers and an open uCPE network operating system.
- ZTP of the uCPE platform and lifecycle management of SD-WAN applications enabled by the uCPE manager.
- Automated SD-WAN service provisioning and service lifecycle management from leading SD-WAN and value-added service vendors using catalogue-driven service orchestration.
- Easy procurement of SD-WAN services and applications via an online marketplace.
- Unified operations and maintenance of SD-WAN solutions from multiple vendors in an intuitive self-service portal.
- The adoption of standard system design
 - System architecture based on MEF standard framework (LSO Reference Architecture and Framework).
 - Standard service terminologies and menus aligned with industry-first SD-WAN service specification (MEF 70).
 - Unified management and orchestration of different SD-WAN controllers based on standard MEF Presto and MEF Legato APIs.
 - Model-based orchestration using standard IETF YANG models.
- Demonstration of a clear migration step from legacy CPE to full SD-WAN deployment using an Open Source SDN controller.

PoC Architecture



Benefits

For CSPs

- Accelerates the adoption of managed SD-WAN services and applications with a broad ecosystem of partners.
- Lowers operations costs by:
 - Significantly reducing integration complexity through automation.
 - Simplifying deployment via zero touch provisioning.
 - Streamlining deployment through systematic validation and testing.
- Enables CSPs to better differentiate with highly competitive offers emphasizing customer choice.

For vendors

- Simplifies management integration by conforming to common APIs and service definitions.
- Demonstrates the end-to-end fulfillment process from customer order through fully automated ZTP deployment of multi-vendor solutions.
- Verifies operation of multi-vendor service chains comprising different SD-WAN and VAS application vendors.
- Enhances vendor solution differentiation in the crowded SD-WAN market.

To enterprise customers

- Complete visibility and control of services procured through a CSP as a managed service.
- Wider choice of features and applications that better match the business requirements.
- Ability to set up branch networks in minutes and make services changes on the fly.
- Ability to change service configuration at any time without the need to fork-lift existing solutions.
- Confidence that services and changes are validated prior to becoming operationalized.

MEF Standards Supported

MEF 3.0 LSO Architecture

As a whole, the system design and implementation conforms to the MEF 3.0 LSO Reference Architecture and Framework as follows:

- Business Application Layer:** Netcracker's marketplace and self-service portal enables agile, on-demand and customer-initiated SD-WAN service orders.
- Service Orchestration Function:** Netcracker's SD-WAN service orchestrator decomposes the service request and orchestrates uCPE configuration and activation and SD-WAN connectivity provisioning.
- Infrastructure Control & Management (ICM):** This PoC involves multiple ICMs from different vendors including ADVA's Ensemble NFVI platform and uCPE manager as well as SD-WAN controllers from 3 companies: Silver Peak, Versa Networks and NEC.

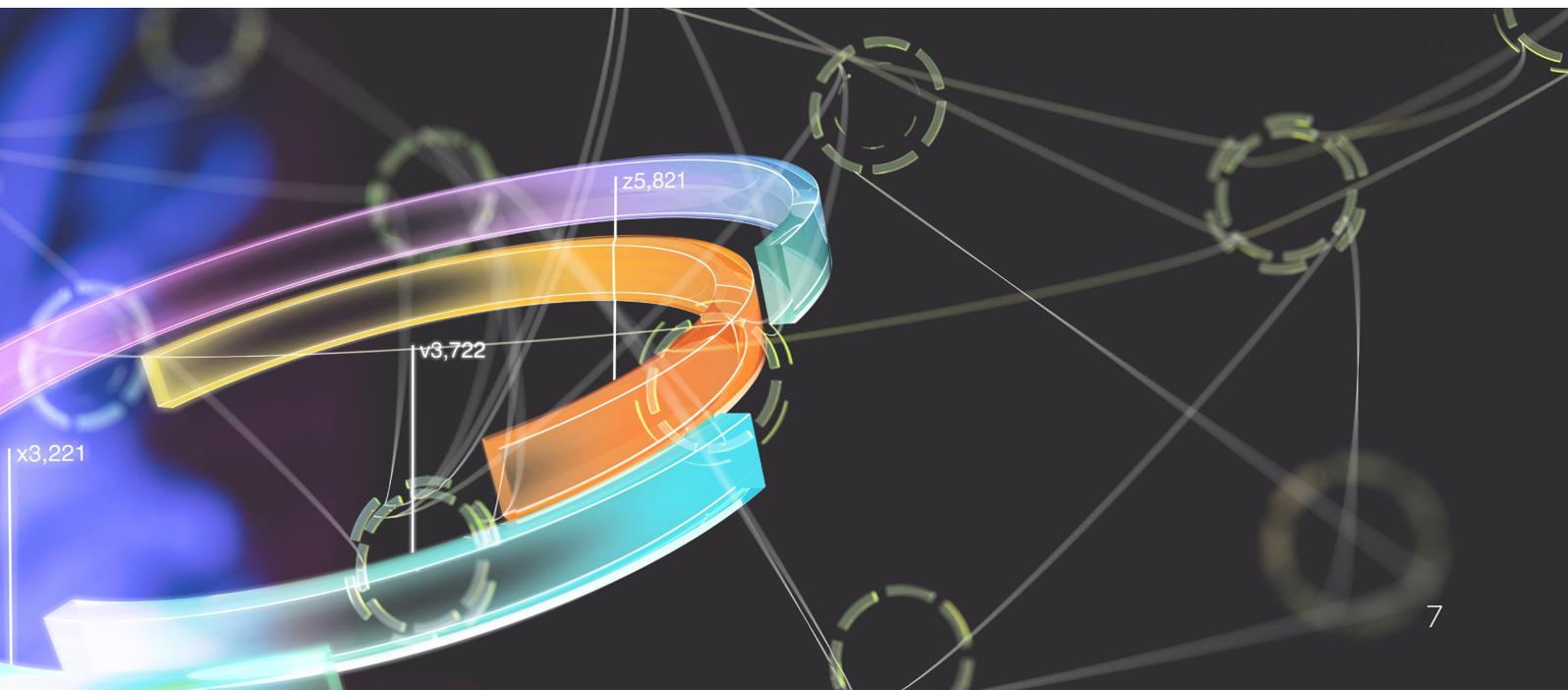
MEF 3.0 Services

To guarantee the agile, unified and automated service provisioning of multiple vendor SD-WAN offerings and accelerate the adoption and certification of MEF 3.0 SD-WAN services, this PoC will leverage and demonstrate practical implementation of MEF's industry-first SD-WAN service specification, MEF 70. As a PoC member, Spirent will be the test vendor to certify the specification alignment.

MEF 3.0 LSO APIs

Legato APIs: Continuing our commitment to further adoption of MEF standards, this PoC will utilize as well as facilitate the pre-standard work of the MEF Services Common Model (MSCM) and Legato Service API (MLSAPI) projects currently underway in the MEF LSO committee.

Presto APIs: Furthermore, we will incubate (future) Presto API for SD-WAN between the orchestrator and the multi-vendor SD-WAN controllers. In addition, we plan to conduct other incubations including Presto API for uCPE, service specification and Presto API for Security as a Service (SECaaS).



Overview of PoC Components



Netcracker Service Orchestration

End-to-end service orchestration that provides automated service provisioning and lifecycle management using catalogue driven orchestration, standards-based models and a cloud-native architecture. Provides a smooth integration of the virtual environment and existing infrastructure, tying together all the pieces—SD-WAN controllers, MANO and existing BSS/OSS. Provides cross-domain service lifecycle management across all hybrid network domains, including legacy IP/MPLS networks, SDN networks, cloud and NFV Infrastructure (NFVI) environments.

Netcracker Self-Service Portal and Digital Marketplace

Netcracker Self-Service Portal unifies all the vendor offerings into a single, intuitive portal providing self-service capabilities for the CSP and enterprise including service ordering, service administration and service monitoring. The Netcracker Digital Marketplace provides a portal-driven e-commerce shopping experience, based on a centralized product catalog, enabling enterprise customers to purchase service bundles and benefit from the latest offers using a well-governed partner ecosystem of digital products.



Versa Networks Solution

Versa has developed a cloud-native multi-tenant software platform that delivers software-defined Layer 3 [routing] to Layer 7 [security] services with full programmability and automation. With our Secure CloudIP software platform, we address SD-WAN, SD-Security and SD-Branch use cases for the WAN edge today. Versa Networks delivers a full-featured Secure SD WAN with an integrated and native security architecture that addresses WAN edge services for any market and any size enterprise, whether DIY or managed by a SP.

Versa Director

Versa Director simplifies and automates the creation, delivery, management and operations of network and security services of the Versa Cloud IP software platform. It provides integrated lifecycle management, orchestration and monitoring in a single application that is tightly integrated into leading OSS/BSS, service orchestrators and NFV orchestrators.

Versa Analytics

Versa Analytics provides holistic visibility, base-lining, correlation and predictive analysis for network, application usage and security events. Analytics provides real-time and historical contextual insights with policy-driven usage analysis from Layer 3 [routing] to Layer 7 [security]. It seamlessly integrates with third-party systems for easy deployment in IT environments.

Versa FlexVNF

Versa FlexVNF is a multi-service, multi-tenant software platform built from the ground up on cloud principles to deliver scale, segmentation, programmability and automation. It provides both networking and security functions in a single software along with service chaining capabilities and support for third-party VNFs. It can be deployed as bare metal on any number of commercial off-the-shelf servers and white box appliances. It can also be deployed as the uCPE platform and has a growing ecosystem of certified third-party VNFs. All Versa software components can be deployed as VMs for any virtualization environment, private cloud or public cloud.



Silver Peak Unity EdgeConnect™ SD-WAN edge platform

The Silver Peak Unity EdgeConnect™ SD-WAN edge platform liberates enterprises from the limitations of conventional network approaches by shifting to a business-first networking model. EdgeConnect brings routers, unifying SD-WAN, firewall, segmentation, routing, WAN optimization and application visibility and control onto a single platform. EdgeConnect continuously learns and adapts to meet the requirements of the business, delivering the highest quality of experience to enterprise users and IT organizations. EdgeConnect enables service providers to bring new, differentiated, managed SD-WAN services to market quickly and cost effectively to drive new revenue streams, expand market reach and deliver SLAs in and out of region.

Available as physical or virtual appliances, the EdgeConnect platform supports industry standard hypervisors and can be deployed as a single VNF on a range of uCPE appliances. EdgeConnect can be deployed across enterprise branch offices, regional hubs, data centers and public cloud instances, including the industry's four leading cloud marketplaces, Amazon AWS, Google Cloud, Microsoft Azure and Oracle Cloud.

Unity OrchestratorSP

The EdgeConnect SD-WAN edge platform is centrally managed using the Unity OrchestratorSP, a secure, cloud-hosted, multi-tenant management Software-as-a-Service. OrchestratorSP enables service providers to centrally manage and monitor their managed SD-WAN services deployments on a global basis for thousands of unique customers. Orchestrator enables service providers to centrally configure, manage and secure managed SD-WAN services deployments, each customized to the unique requirements of each individual enterprise customer.

Unity Boost™

Unity Boost is an optional WAN optimization software performance pack that unifies Silver Peak WAN optimization techniques with the EdgeConnect platform to create a single, unified SD-WAN edge platform. Boost enables enterprises to accelerate performance of latency-sensitive applications and minimize transmission of repetitive data across the WAN. Service providers can offer Boost as a value-add or higher-tier service and within a single multi-function VNF that unifies SD-WAN, routing, security and WAN optimization in a single VNF.



ADVA uCPE Platform (Ensemble Connector)

Ensemble Connector is a highly scalable, high-performance virtualization platform for hosting multi-vendor VNFs. It delivers pure-play virtualization, which enables the ability for open software to operate on open, commercial off-the-shelf servers. This eliminates vendor lock-in so that service providers are free to mix and match best-of-breed software and hardware. Ensemble Connector provides all of the tools necessary to simplify the deployment of uCPE applications with industry proven ZTP and "day-N" management capabilities.

ADVA uCPE Management (Ensemble Orchestrator and Ensemble Virtualization Director)

Ensemble Orchestrator is an ETSI MANO-compliant NFV orchestration platform that is responsible for supporting end-to-end network service and VNF lifecycle management including VNF onboarding, service design and service deployment. It provides a framework for day-0 and day-N configuration for VNFs and integration with third-party VNF managers (where appropriate). Ensemble orchestrator dynamically tracks cloud resources, offers advanced VNF placement algorithms and supports cross-cloud VNF service chaining, multi-tenancy and per-tenant quota management.

Ensemble Virtualization Director is a centralized uCPE management solution that enables end-to-end configuration, management and surveillance of virtualized network infrastructure and services. Ensemble Virtualization Director provides a single pane of glass for managing NFV operations. It supports end-to-end ZTP, uCPE inventory and topology, fault and performance management and tools for NFV troubleshooting. Ensemble Virtualization Director also provides software management (upgrade and reversion) of Ensemble Connector instances.



Spirent Testing and Validation

Spirent is a leader in Automated Assurance of MEF 3.0 Services, supporting the development of the MEF LSO specifications and providing solutions that leverage its open APIs. Spirent Automated Assurance solutions consist of Analytics, Controller and Test Agent components for automating network functions and operational workflows. Our microservices-based controller interfaces with orchestration functions to automate testing and assurance of layers 2-7 using both virtual and physical test agents. Our Automated Assurance solutions measure both the underlay and overlay components of various network environments to ensure high-quality SD-WAN services can be automatically activated and monitored within a single provider or across providers. Proactive testing ensures SD-WAN service issues can be rapidly identified and resolved to minimize the impact on customers and maintain compliance with SLAs.



NEC Smart SD-WAN/Security

NEC provides a vendor agnostic SD-WAN controller that works with existing legacy routers, switches, firewalls and endpoint detection and response solutions to provide SD-WAN like functionality as an evolutionary step before adopting full SD-WAN. NEC's SD-WAN Controller manages and controls a variety of existing legacy equipment to provide basic SD-WAN and SD-Security services. However, the degree of service capability depends on the legacy equipment, which may be limited in terms of latency and virtualization.

This SD-WAN solution is proposed as an entry point to stimulate the SD-WAN market and help the acceleration towards a full SD-WAN transformation. The solution also provides a seamless and gradual migration from legacy towards full SD-WAN, with the help of Netcracker's Service Orchestration.