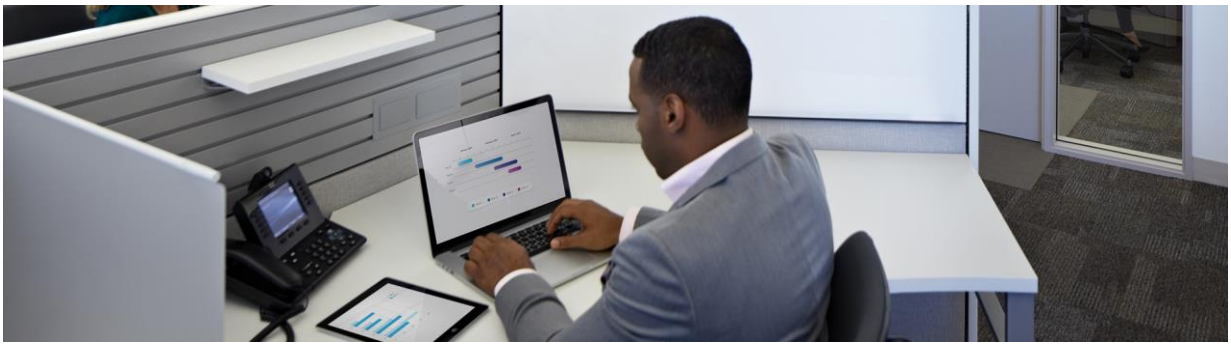
Solution Overview



Virtual Private Networks with Cisco Network Services Orchestrator Enabled by Tail-f - Fast, Simple, and Automated

BENEFITS

- **Accelerate new VPN services** with automated, self-service, on-demand provisioning that reduces activation times from weeks to minutes
- **Increase business agility** with the ability to create, reconfigure, and repurpose VPN services in real time
- **Simplify your network operations** by automating the end-to-end VPN service lifecycle and reducing manual configuration steps by up to 90 percent, based on Cisco estimates
- **Differentiate your services from the competition** with the ability to automate advanced device features and easily bundle VPN with other network services
- **Promote nonstop operations** with surgical control over network changes and the ability to reconfigure VPN devices and services during live production
- **Avoid recurring device integration cost** with the Cisco NSO Network Element Drivers (NEDs)
- **Assure your services** by defining key performance indicators (KPIs) in your service model, provisioning probes as part of the service, and through close interaction with the assurance system

What if you could deliver network services at the speed of software? Now you can create differentiated, on-demand VPN solutions for your customers and activate them in minutes.

For modern network operators, success is all about speed. Your customers want to capitalize on new opportunities, enter new markets, and respond to changes faster than their competition. Virtual Private Network (VPN) services are a key element in your customers' competitive arsenals. But to give them the agility they need, you have to be able to deliver new Layer 2 and Layer 3 VPN services and features to them on demand, in minutes. And to do that, you need to automate the entire VPN service lifecycle. In today's complex network environments, that's a daunting challenge. Until now.

Cisco® Network Services Orchestrator (NSO) enabled by Tail-f provides end-to-end automation to design and deliver services much faster. It lets you easily create and change VPN offerings using standardized models - without lengthy custom coding or service disruptions. With Cisco NSO, you can automate the full range of multivendor devices across your physical and virtual environments. And you can continually refine and repackage VPN services at the speed of software.

A Need for Speed in VPN Services

Your customers are looking to new cloud and virtualization technologies to help them roll out new products, break into new markets, and react to changing demand faster than ever. But in today's business environment, they can no longer wait weeks for an operator to deploy a new VPN service or months to introduce a needed new feature.

Using network innovations like programmable networks and network functions virtualization (NFV), you can gain the agility to meet your customers' growing demands. And with new DevOps business models, your product developers can work closely with operations teams to take new ideas from concept to rollout in a few weeks.

To capitalize on these new technologies and operating models, everything in your environment has to be automated. And in most operator networks - characterized by multivendor devices, hybrid physical and virtual resources, and complex manual processes - automating VPN services is extremely difficult.

Why? Because most network orchestration solutions rely on:

- **Extensive hardcoded Command Line Interface (CLI) templates and scripts,** which are inflexible and require a lot of time and manual labor
- **Fragile programmatic adapters** that don't let you automate many advanced features on physical and virtual devices, limiting you to a subset of features that apply across every vendor's device - which in turn limits the ways you can differentiate your VPN offerings
- **Inaccurate views of the network and limited transaction control,** so making changes often leads to broken configurations and orders that don't get filled and require manual intervention

The typical result: complex manual processes, service disruptions and delays, and unhappy customers.

To satisfy your customers and remain competitive in your own dynamic network services market, you need a better way to automate. You must be able to deliver new VPN services on demand - in as little as a few minutes - with a few clicks on a web portal. You should be able to add new VPN devices and features through fast, centralized changes, without disrupting running services. And easily bundle VPN and other features with other value-added services to differentiate your offerings.

Introducing Cisco NSO enabled by Tail-f

We think Cisco NSO is the most advanced and flexible cloud service orchestration platform in the industry. Enabled by Tail-f cloud service orchestration software, it provides a sleek, highly efficient abstraction layer between your network services and the underlying network components. You gain the speed and network simplicity to:

- **Design and change VPN services using standardized models** and configure your network automatically to radically accelerate service provisioning and activation
- **Add new VPN services and devices much faster and more easily,** without time-consuming custom coding efforts
- **Automate the full range of VPN services you want to deliver** across both physical and virtual devices, in multivendor brownfield environments, so you can support DevOps and other modern ways of working

Used by major Tier-1 operators around the globe, Cisco NSO provides the agility, automation, and reliability you need to deliver more differentiated and competitive VPN services at the speed of software.

Agile VPN Services

Cisco NSO uses fully standardized, clearly-defined YANG-based models to render all of your business logic for any VPN device or service. Compare that to other orchestration solutions that rely on hardcoded CLI templates and scripts. That translates to 90 percent less code that you have to build, maintain, test, and integrate. Which results in significant savings in time and manual effort.

Using our patented FastMap technology, Cisco NSO lets you update models for VPN services or devices in a matter of hours - while the platform is running - to give you unprecedented speed and flexibility. You can continuously refine, repackage, re-bundle, and re-provision your network services on the fly to meet your customers evolving needs.

End-to-End Automation

Cisco NSO provides a single network abstraction layer for your entire environment, making it much easier to automate the full lifecycle of your VPN services. We do this through:

- **Open, standardized northbound and southbound integrations:** Southbound, Cisco NSO's standardized YANG models let you automate almost any Layer-2/Layer-3 VPN service or device. Northbound, the solution provides APIs for operations support systems and business support systems (OSSs/BSSs), as well as any other UIs or a manual CLI needed to support DevOps and other new business approaches. You can achieve full automation from your business systems to your multivendor infrastructure, all running through the same solution and interface to the network.
- **Realtime network information:** Too often, existing orchestration solutions rely on offline and inaccurate network information, which increases the likelihood that making a change to a VPN service will result in broken configurations and dropped orders. Cisco NSO maintains an active network view so it's always in sync with actual state of the networks.
- **The industry's broadest multivendor support:** Cisco NSO supports a wide range of ready-made models of physical and virtual devices from dozens of vendors, with more added all the time. The solution maintains a clear separation between vendor protocol-specific code, to handle device CLI and legacy protocols and its strict YANG models to preserve a clean decoupling between your VPN services and the underlying devices and networks. With this extensive multivendor support, you can extend end-to-end automation to virtually any use case or device.

World-Class Reliability

To keep up with your customers' VPN needs, you need to frequently add new devices and update device software to introduce new features. With most existing orchestration solutions, this process entails a huge manual effort - and a significant risk of breaking configurations and disrupting services. For example, if you update a model for a complex, multi-device service and there's one bad configuration, you can end up bringing down multiple network components and services in your environment. And trying to roll back those changes to every affected device can be a time-consuming and often disruptive project. Cisco NSO provides fully automated, end-to-end atomic transaction control. If you make a change to a VPN service or device, either everything goes through to the network or nothing does and the system reverts back to the previous stable state to keep your customers' services running.

Cisco NSO also includes a minimum diff engine to automatically calculate the minimum configuration changes needed to go from one state to another. This intelligence dramatically reduces the code you have to deal with when automating VPN services while improving the overall stability of your environment.

Also, with most orchestration solutions, making a change means manually reconfiguring each network device, or at best, constantly creating new CLI templates to reflect all the different activities associated with a VPN service. Either of these activities provides ample opportunity for errors. Instead, Cisco NSO modifies only those fields in the existing models that need to be updated to reflect a change. And it does this automatically, in real-time, so you can change service attributes dynamically as needed, without impacting the performance of services that are running.

These are not experimental concepts. Cisco NSO automation is used at scale in some of the largest Tier-1 service provider environments in the world and is producing real-world results.

> "Cisco NSO is a key part of our foundational programmable network and allows us to provide multi-cloud services in an agile and vendor-neutral way."
> **— Ihab Tarazi, Chief Technology Officer, Equinix**

Use Cases

Multivendor VPN Automation	• Bring new Layer 2 and Layer 3 VPN services to market fast, using physical and/or virtual devices from any vendor, and deliver them under strict SLAs
Differentiated VPN Offerings	• Use Cisco NSO's flexible YANG modeling to deliver advanced VPN features in Cisco and third-party devices that your competitors may have trouble automating
VPN Service Bundling	• Bundle VPN with other value-added services such as firewalling and application acceleration and deliver them on demand
On-Demand VPN Services	• Empower customers to order VPN services and upgrade features through a web portal with a few clicks and activate them in minutes

Why Cisco?

Cisco is committed to enabling new business models and disrupting old ones, combining the flexibility of programmable networks with intelligent software. With the integration of Tail-f cloud service orchestration into our industry-leading network and data center portfolio, we're helping providers like you automate and accelerate network services to solve your most pressing business challenges.

We provide a powerful set of capabilities to capitalize on innovations like NFV, software-defined networking (SDN), and DevOps. And we let you introduce these innovations into the multivendor network and data center infrastructure you already have in place. You get the scale, speed, and application-centric networking capabilities you need to compete, while preserving the carrier-class reliability your customers expect.

Cisco Capital

Financing to Help You Achieve Your Objectives

Cisco Capital can help you acquire the technology you need to achieve your objectives and stay competitive. We can help you reduce CapEx. Accelerate your growth. Optimize your investment dollars and ROI. Cisco Capital financing gives you flexibility in acquiring hardware, software, services, and complementary third-party equipment. And there's just one predictable payment. Cisco Capital is available in more than 100 countries. Learn more.

Next Steps

To learn more about the business and technical requirements for successful automation in real-world operator networks, see http://info.tail-f.com/hr-whitepaper-service-orchestration.

To find out what Cisco NSO enabled by Tail-f can do for your business, visit http://www.cisco.com/c/en/us/products/cloud-systems-management/network-services-orchestrator.

Americas Headquarters
Cisco Systems, Inc.
San Jose, CA

Asia Pacific Headquarters
Cisco Systems (USA) Pte. Ltd.
Singapore

Europe Headquarters
Cisco Systems International BV Amsterdam,
The Netherlands

Cisco has more than 200 offices worldwide. Addresses, phone numbers, and fax numbers are listed on the Cisco Website at www.cisco.com/go/offices.

Printed in USA C22-734917-01 08/15