SYMBEEO

PUBLIC

DESIGN STUDY

L3VPN activation across a two-vendor provider edge, one transaction per order

Complete design on current platforms

CAPABILITY	INDUSTRY	SETTING
Automation	Global Service Providers	Regional carrier
DOCUMENT	**VERSION**	**DATE**
AUT-003	1.1	Oct 10, 2026

WRITTEN BY

Mark Winston, Principal Network Architect

© 2026 Symbeeo. All rights reserved.

Document control

Document	AUT-003	Version	1.1
Issued	Oct 10, 2026	Status	Issued by Symbeeo
Classification	Public	Supersedes	1.0, Sep 27, 2026
Capability	Automation	Industry	Global Service Providers
Author	Mark Winston	Role	Principal Network Architect
Credentials	CCIE, CISSP, CCSP, CCISO, CISM, Adopting Zero Trust (Forrester)		
Approval	Approved by Edwin Ozer, Founder, Oct 10, 2026. Issued by Symbeeo, Oct 10, 2026. Design study: every figure is vendor-published, a design target or a marked assumption.		
Sign-off	"An engagement under this design is signed by the practice lead before any build proceeds."		

Contents

1 · Scope 3
1c · Public implementations this design follows 4
2 · Requirements register 4
3 · Architecture overview 5
4 · Design by subsystem 6
5 · Failure behavior 7
6 · Limits 7
7 · Lessons learned 7
8 · The author 8

© 2026 Symbeeo. All rights reserved. · Public

CONVENTIONS

Source tags. [S] figure read from the vendor's or project's own current page on Sep 24, 2026 · [S*] figure from the page's published summary where the page itself could not be opened or could not be read · [A] design assumption, to be confirmed by the signing engineer · [T] design target: the record's outcome figure and anything derived from it. No figure comes from any engagement, file or asset. A row with more than one tag is counted once: as a published figure if any tag is [S] or [S*], otherwise as an assumption if any tag is [A], otherwise as a design target.

Table 1. Revision history

Date	Version	Change
Sep 27, 2026	1.0	First issue.
Oct 10, 2026	1.1	Approval line now reads: approved by the Founder, issued by Symbeeo. Mark Winston remains the author.

1 · Scope

Who it is for. The head of service delivery at a carrier whose L3VPN orders are built by hand on two router vendors, take days to activate, and leave half-configured provider-edge routers when an order fails part-way.

Typical buyer [A]. A regional carrier selling managed L3VPN to 1,200 enterprise customers with 14,000 VPN sites. 180 provider-edge (PE) routers: 110 on Cisco IOS XR and 70 on Juniper Junos. About 900 new or changed attachment orders a month, each touching one or two PEs. An order system with an API already holds the customer, site and circuit.

What is in. The L3VPN service model; the device drivers for both vendors; the northbound integration with the order system; pre-commit review; rollback; out-of-band change detection; the pipeline for changes to the service model itself; operational state by subscription. **What is out.** The MPLS or segment-routing core design; PE hardware; customer premises equipment; billing; the order system.

Assumptions. NETCONF is enabled on every PE [A]. The carrier's inventory and number allocations (route distinguishers, route targets, link addresses) move into a source of truth during Phase 1 [A]. Changes are made in the carrier's standing maintenance windows except for standard attachments [A].

Related documents, read Sep 24, 2026.

- SRA-AUT-001, Symbeeo reference architecture for infrastructure automation (the pattern this design applies)
- Cisco Crosswork NSO 6.7, What's New — `https://nso-docs.cisco.com/guides` (read Sep 27, 2026; version-less page; read again when NSO 6.8 ships)
- NSO Device Manager guide — `https://nso-docs.cisco.com/guides/operation-and-usage/operations/nso-device-manager`
- NSO release schedule — `https://nso-docs.cisco.com/releases`
- NSO software lifecycle support statement — `https://nso-docs.cisco.com/releases/software-lifecycle-support-statement`
- NSO NED READMEs — `https://nso-docs.cisco.com/neds`
- containerlab kinds (Cisco XRd, Juniper vJunos-router) — `https://github.com/srl-labs/containerlab/tree/main/docs/manual/kinds`
- Batfish supported devices — `https://batfish.readthedocs.io/en/latest/supported_devices.html`

© 2026 Symbeeo. All rights reserved. · Public

- Cisco NSO case study listing — https://www.cisco.com/c/en/us/products/cloud-systems-management/network-services-orchestrator/case-study-listing.html

1c · Public implementations this design follows

Each row is labeled. **Public deployment**: a named operator's real deployment, published and dated by the operator, its vendor or a partner, used where one exists. **Our own design**: the dated vendor or standards documentation this design was built from, where no public deployment of the design exists. Labels and dates checked Sep 27, 2026.

Table 2. Public implementations this design follows

Implementation	Who published it · date	What it settles for this design	URL
Our own design, built from published documentation. NSO Device Manager: a transaction either ends up on all participating devices or is aborted as a whole; commit dry-run shows the native CLI and NETCONF per device; reverse diff restores CLI devices; check-sync finds out-of-band changes cheaply	Cisco · NSO documentation, page last updated Jun 2, 2026	R4–R7: all-or-nothing activation, per-device preview, rollback and drift detection are product behavior, not engineering added by this design	https://nso-docs.cisco.com/guides/operation-and-usage/operations/nso-device-manager
Our own design, built from published documentation. NSO 6.7: native consumption of NETCONF YANG-Push streams from managed devices; an Adaptive MCP Server exposing selected NSO data and operations	Cisco · NSO 6.7 released Apr 23, 2026; guide page last updated Jun 23, 2026, read Sep 27, 2026	R8 and R12: subscription instead of polling, and a bounded AI surface, on the release this design uses	https://nso-docs.cisco.com/guides (version-less page; read again when NSO 6.8 ships)
Public deployment. A US cable operator: NSO integrated with the operator's OSS and a technician activation app; network updates moved to a CI/CD model; adoption built step by step over 24 months	Heavy Reading case study, hosted by Cisco · November 2020 (date printed on the PDF, read Sep 27, 2026)	§4.2 and §4.5: OSS-driven activation on NSO and a pipeline for the service code, at an operator larger than this design	https://www.cisco.com/c/dam/en/us/products/collateral/cloud-systems-management/network-services-orchestrator/case-study-sp-cox-network-automation.pdf

The cable operator's figures are from the published summary of the PDF, which could not be read directly on Sep 24, 2026 [S*]; its printed date was read on Sep 27, 2026; none of them is carried into this design's register. The case study is of November 2020.

2 · Requirements register

Table 3. Requirements register

#	Requirement	Value	Source
R1	Estate	180 PEs · 110 IOS XR · 70 Junos · 14,000 VPN sites	[A]
R2	Order volume	≈ 900 attachment orders a month	[A]

© 2026 Symbeeo. All rights reserved. · Public

#	Requirement	Value	Source
R3	Order to committed configuration, standard attachment	≤ 15 min	[T]
R4	Every PE an order touches changes, or none does	100 % of orders	[S] NSO network-wide transaction
R5	Per-device native preview before commit, normal changes	100 %	[S] commit dry-run
R6	Failed transaction leaves each PE as it was	confirmed commit on every PE (both NEDs are NETCONF); reverse diff where a PE is later driven by CLI	[S] NSO Device Manager
R7	Out-of-band change detected	all 180 PEs checked every 15 min	[S] check-sync; [T] interval
R8	Operational state by subscription	no polling where the PE supports YANG-Push	[S] NSO 6.7
R9	Service-model change proven on a replica first	IOS XR and Junos PEs in the replica	[T]; [S] containerlab XRd and vJunos-router kinds
R10	Order deletion leaves no residue	PE configuration after delete equals configuration before the order	[T]
R11	Orchestrator availability	HA pair; orders queue, none lost, ≤ 5 min failover	[A]
R12	AI access to the orchestrator	read-only operations only	[T]; [S] NSO 6.7 MCP server exposes selected data and operations
R13	Audit	every transaction tagged with its order ID; 13 months	[A]

Thirteen rows; seven carry a vendor figure, four are design assumptions, two are design targets.

3 · Architecture overview

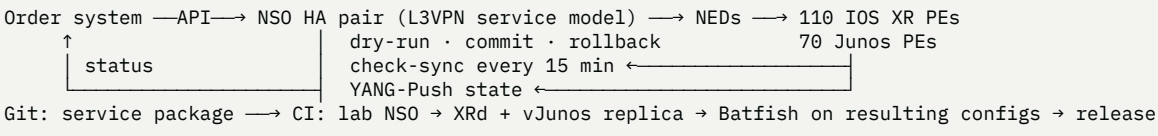


Figure 1. L3VPN service activation

One service model for both vendors. The order system asks for a VPN attachment in business terms; NSO turns it into one transaction across every PE it touches, previews it in each vendor's own syntax, and either commits it everywhere or nowhere. The service model is itself code, changed through the pipeline like any other artifact.

© 2026 Symbeeo. All rights reserved. · Public

Table 4. Architecture overview

Role	Product (exact version)	Qty	Capacity used	Why this unit
Orchestrator	Cisco Crosswork NSO 6.7 [S]	2 (HA pair) [A]	180 devices, ≈ 45 orders a working day [A]	network-wide transactions, YANG-Push southbound [S]
IOS XR driver	NSO NED `cisco-iosxr_nc` (NETCONF) [S*]	1	110 PEs	Cisco-provided NED [S*]
Junos driver	NSO NED `juniper-junos_nc` [S*]	1	70 PEs	uses Junos YANG modules from the device [S*]
Source of truth	NetBox 4.7.1 [S]	HA pair [A]	180 PEs; RD, RT and link-address pools [A]	allocations outside the orchestrator [A]
Replica	containerlab v0.79.0, XRd and vJunos-router kinds [S]	1 host	6 nodes [A]	both vendors' PEs in software [S]
Configuration model check	Batfish v2026.08.27 [S]	1 service	replica configurations [A]	IOS XR and Junos supported [S]

4 · Design by subsystem

4.1 Service model.

One L3VPN service: customer, VRF, attachment (PE, interface, VLAN, addressing, routing protocol, QoS profile) [A]. The model is vendor-neutral; per-vendor templates live inside the service package [A]. NSO's YANG-based service models are Cisco's published approach for multivendor VPN activation [S] `https://www.cisco.com/c/en/us/products/collateral/cloud-systems-management/network-services-orchestrator/solution-overview-c22-734917.html`. Rejected: one script per vendor — two code paths drift, and neither is transactional across both.

4.2 Order integration.

The order system calls NSO's northbound API with the order ID; NSO allocates route distinguisher and route target from the source of truth, builds the transaction, and returns status [A]. Standard attachments on an existing VRF commit without a human; anything that creates a VRF or touches a hub PE waits for a named approver (SRA-AUT-001 R10) [A].

4.3 Transaction, preview and rollback.

Every order is one NSO transaction: it lands on all participating PEs or the whole transaction is aborted [S]. Normal changes are reviewed as commit dry-run output, which shows the native CLI and NETCONF sent to each device [S]. On failure NSO restores NETCONF devices by confirmed commit — every PE here, as both NEDs are NETCONF — and CLI devices by reverse diff [S] (R6). Deleting an order removes exactly what it created, checked in the replica for every service-model release (R10) [T].

4.4 Drift and state.

`check-sync` compares transaction IDs and checksums rather than reading whole configurations, which makes a 15-minute sweep of 180 PEs cheap [S]; an out-of-sync PE raises a ticket and blocks new orders to it until `compare-config` is reviewed [A]. Operational state (session up, prefixes received) arrives by NETCONF YANG-Push where the PE supports it [S], instead of polling (R8).

© 2026 Symbeeo. All rights reserved. · Public

4.5 Service-model pipeline.

The service package is in Git; every change is a merge request with a reviewer who is not the author [A]. CI loads it into a lab NSO, activates a test order set against a six-node replica — two XRd and two vJunos-router PEs, two route reflectors — built with containerlab **[S][A]**, checks the resulting configurations with Batfish [S], and deletes the orders to prove R10 [T]. Only a release that passes is installed on the production pair.

4.6 Availability and AI surface.

Two NSO nodes in HA; during failover the order system retries and no order is lost (R11) [A]. NSO 6.7's MCP server exposes selected NSO data and operations [S]; the design exposes read operations only — service status, device sync state, dry-run output — and no commit (R12) [T].

5 · Failure behavior

Table 5. Failure behavior

Failure	Behavior	Source
One PE rejects its part of an order	whole transaction aborted; other PEs unchanged; order returned to the order system as failed	[S] network-wide transaction
PE unreachable at order time	transaction fails before commit; order retried later	[A]
PE changed by hand	check-sync reports out-of-sync ≤ 15 min; new orders to it blocked until reviewed	[S] check-sync; [T] interval
Active NSO node down	standby takes over; order system retries; ≤ 5 min	[A]
Bad service-model release reaches production	orders use the previous release after package rollback; affected orders re-run	[A]
Order system sends a duplicate	service instance already exists; NSO returns no change	[A]

6 · Limits

- The PE counts, order volume and vendor split are assumptions; a month of order records sets the real mix.
- NSO 6.7's support dates were not in Cisco's lifecycle statement on Sep 24, 2026, which lists releases to 6.6; the release choice is confirmed against that statement before build.
- The replica proves the service model on software images, not PE hardware forwarding or scale.
- YANG-Push support differs by PE software; PEs without it stay on polled state.
- 15 minutes per order is a target for standard attachments only; a new VRF waits for an approver.

7 · Lessons learned

None yet — this is a design study; populated after the first build against it.

© 2026 Symbeeo. All rights reserved. · Public

8 · The author

WRITTEN BY

Mark Winston

Principal Network Architect

CCIE, CISSP, CCSP, CCISO, CISM, Adopting Zero Trust (Forrester)

Signed off by Edwin Ozer, Founder.

© 2026 Symbeeo. All rights reserved. · Public

SYMBEEO

Each vendor's tool shows you their option. We show you all of them against one requirement.

Compared. Then Delivered.

hello@symbeeo.com · symbeeo.com

© 2026 Symbeeo. All rights reserved.

Product and company names and logos are their owners' trademarks, shown only to identify the lines Symbeeo sources. Naming a vendor or showing its logo does not mean the vendor sponsors or approves Symbeeo's comparisons or any recommendation Symbeeo makes.

Figures are as published by their sources on the dates given in this document; figures marked [A] are assumptions.

AUT-003 · Version 1.1 · Oct 10, 2026