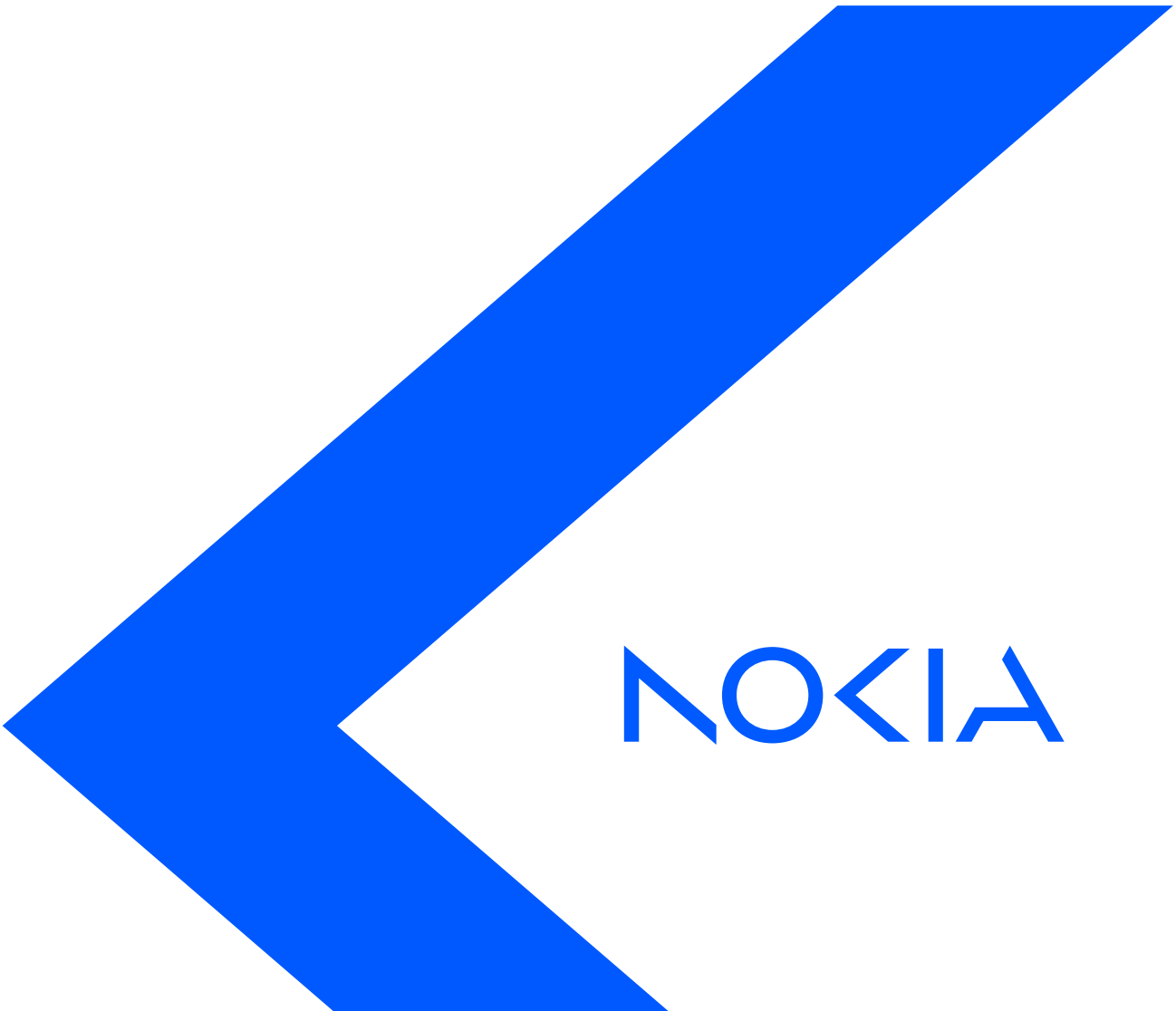
Multivendor IP network management with the Nokia Network Services Platform (NSP)

Application note



Abstract

Most IP networks use network equipment from multiple suppliers. Operating this equipment in supplier-based silos leads to delays in end-to-end service delivery, inefficient operations and costly OSS integration.

This application note describes how the Nokia Network Services Platform (NSP) can manage network equipment from multiple suppliers to accelerate the automation of service rollouts, OSS integration and network operations. NSP uses a model-driven mediation layer that abstracts service-specific configurations from multiple vendor implementations.

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Challenges of multivendor networks

Networks are heterogeneous. They are made of network elements from a variety of suppliers and use different models, interfaces and protocols. Most network operators use a specialized management platform for the equipment from each supplier. But operating network elements in supplier-based silos makes OSS integration more complex, increases the effort required for day-to-day operations and duplicates training needs.

Network operators are also facing several issues regarding end-to-end operations across multiple supplier domains. Many want to automate the introduction of new services. But this automation requires a significant amount of custom development on each platform, which causes delays in the deployment and provisioning of new services. A significant portion of these operations are manual, which increases the chances of errors that can cause even more delays. All of this makes it difficult to achieve cost-effective and timely network-wide automation for typical operations such as provisioning and assurance.

Network operators can benefit from multivendor management solution that will allow them to directly manage equipment from all suppliers across the end-to-end network. With this type of solution, they will be able to unify and automate their operations to reduce time to market and costs.

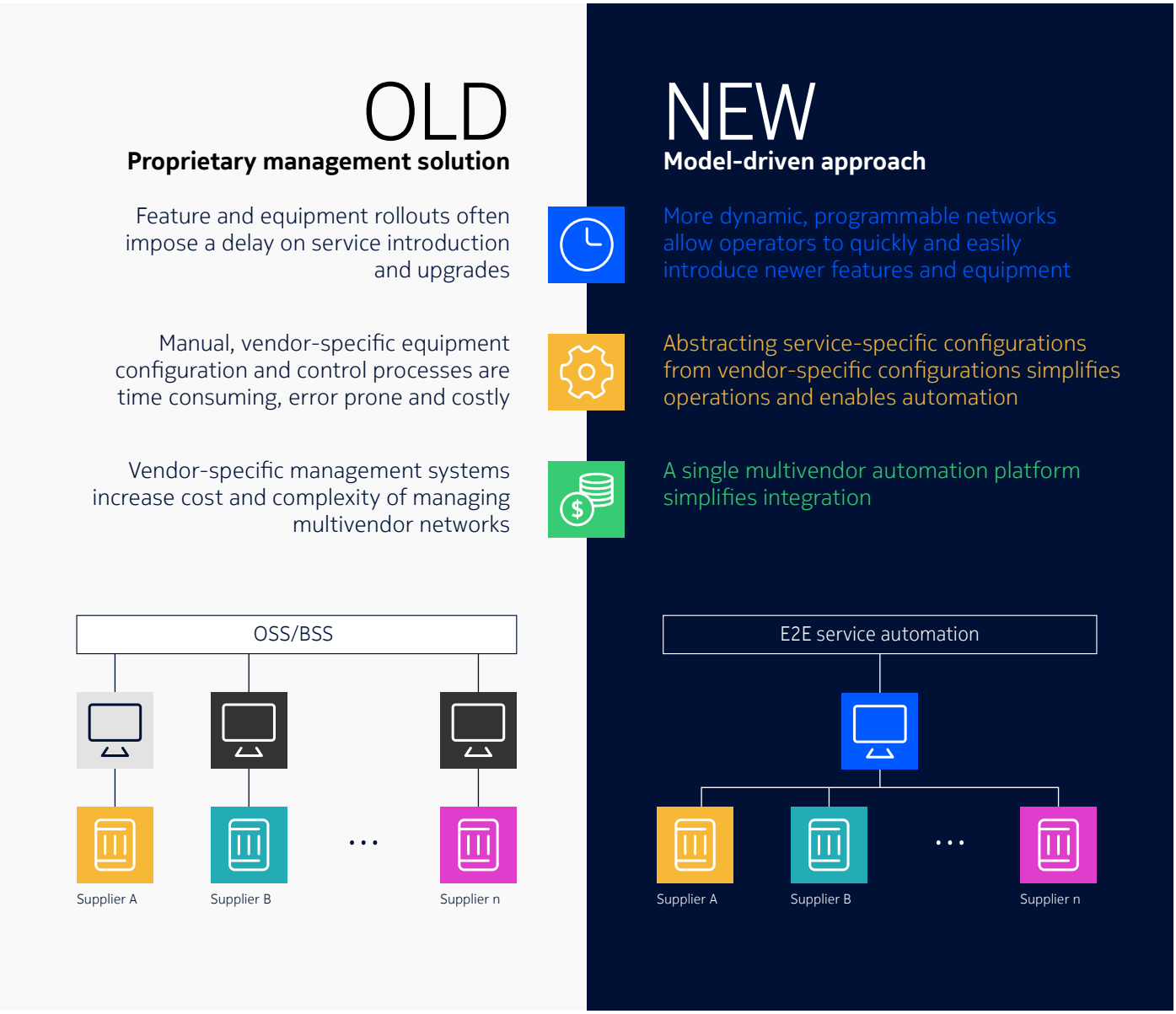
From proprietary solutions to the model-driven approach

A few years ago, most management systems had hard-coded object models that were closely aligned with the vendor's network element features and architecture. Each new network element release required a new management software release to support the added features. This led to a roadmap co-dependency that has become increasingly difficult to manage as the numbers of network elements and feature configurations have increased.

The industry has addressed this issue by introducing model-driven architectures that use a common modeling language such as YANG to decouple network element and management software release cycles. The model-driven approach makes it easier to integrate new network elements into the management software because it abstracts service-specific configurations from vendor-specific implementations. This allows operators to use vendor-independent software to control and monitor network elements from multiple suppliers.

With a model-driven approach, operators can add new network elements by integrating the corresponding resource models, and without modifying the management software. In this way, the network elements become hot pluggable. Operators can then configure them using programmatic interfaces such as NETCONF, gRPC or a model-driven command line interface (MD-CLI).

Figure 1: Comparing a proprietary management solution to a model-driven approach



A complex reality

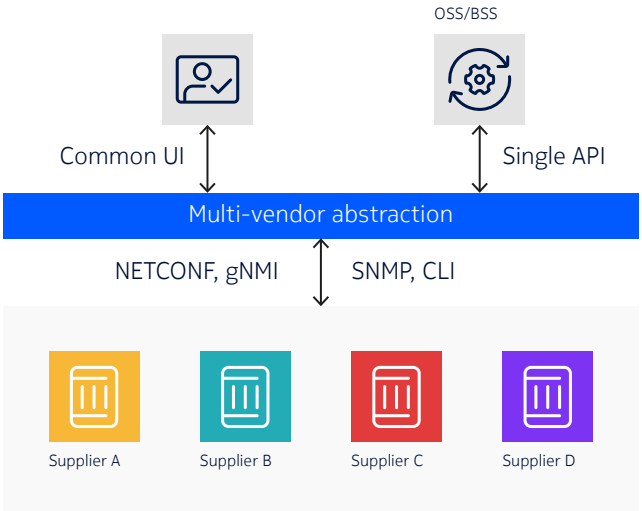
Open interfaces are critical for multivendor support and for enabling automated onboarding of network functions without protocol mediation. The IETF and OpenConfig have worked to complement NETCONF with a range of standardized YANG models.

However, not all network elements support these standards. Suppliers and operators still require proprietary extensions and additional models to fully manage all their product capabilities while allowing for innovation and differentiation.

Operators also rely on many legacy devices that do not support the most recent standards. Should they replace these devices and throw away years of investment? In most cases, this will not be a realistic option from an economic point of view.

Having the flexibility to support a mix of standard and proprietary interfaces is essential in a multivendor network. Management software systems need this flexibility to support recent network elements that deviate from standards, and to onboard legacy equipment that has been in the network for several years. To become more flexible, these systems need the ability to abstract proprietary device specifics or models so that operators can automate the provisioning and assurance of network services that use equipment from multiple suppliers. Abstracting these differences simplifies and accelerates service rollouts, troubleshooting and IT integration, which leads to faster time to market and lower CAPEX and OPEX.

Figure 2: Abstraction of network elements from different suppliers

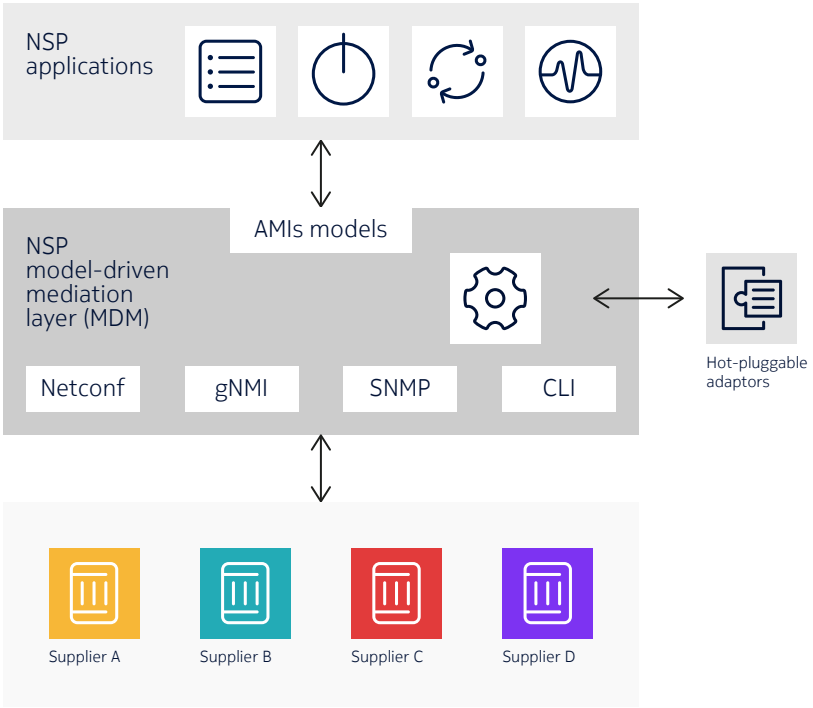


Abstraction is the solution

The Nokia Network Services Platform (NSP) is an automation platform that abstracts the variations between individual products to simplify operations across multivendor networks.

NSP includes a model-driven mediation (MDM) layer that is responsible for protocol capability alignment and normalization of data models across a multivendor network. It provides auto-generated application programming interfaces (APIs) and user interfaces (UIs) that simplify the introduction and integration of new features and equipment.

Figure 3: NSP MDM architecture



Modular MDM components

The MDM layer includes adapters that are responsible for translating and supporting standard and proprietary equipment data models. It also supports a comprehensive range of management protocols.

In addition, the MDM layer includes an application mediation interface (AMI) that provides a common interface for NSP applications such as Fault Management, Network Supervision, Insight Administrator and Device Administrator. It abstracts the communications between these applications and the network elements. As a result, the applications do not need to determine which network element management interfaces are enabled or which data models are supported. All of the required protocol/model translation is hidden and abstracted within the MDM layer.

Vendor equipment support

The vendor-agnostic MDM layer adapts native device models (configuration and state) to YANG-defined application models. It also provides the translation and abstraction that automated applications need to interact with the YANG model and manage network elements.

NSP software release independence

The MDM layer is software release agnostic and easy to update. Adaptors and data models can be installed or updated in a hot-pluggable way at runtime. This means the MDM layer can support upcoming network element releases and features without the need to upgrade or restart the NSP or any of its components.

New custom or standard data models can be added to the MDM layer at any time. Existing data models can be extended or augmented – for example, to support new features or capabilities provided in the new network element.

Technology, protocol and data model support

The MDM layer is technology agnostic and supports a variety of protocols and data models. For example, the southbound management interface towards the network element supports NETCONF, CLI, SNMP and gNMI.

The preferred way to integrate with NSP is through NETCONF and gNMI. This simplifies integration with NSP by leveraging model-driven principles.

NSP provides a YANG-driven gRPC interface for application mediation.

High availability and geo-redundancy

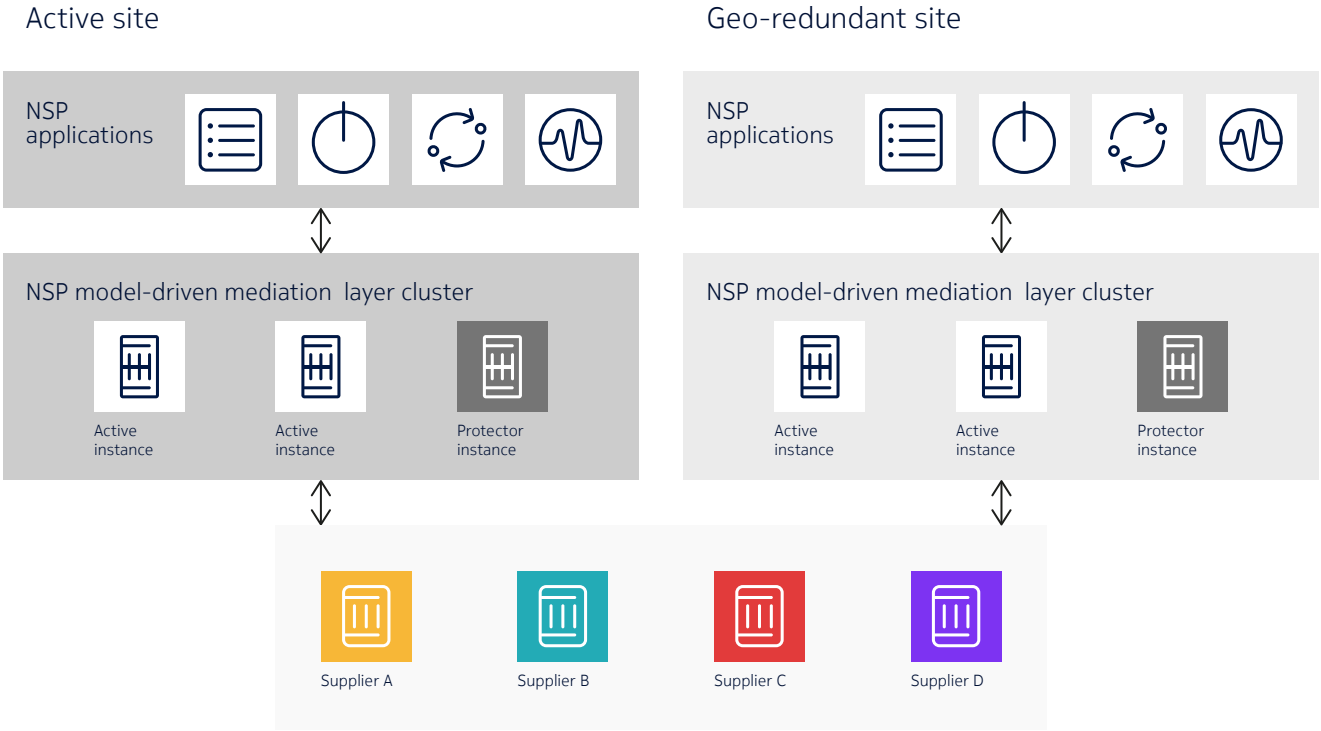
NSP uses a clustering mechanism to provide high availability and horizontal scaling for MDM in the following configurations:

- Standalone
- 1+1 active/standby redundancy
- N+M active/standby high-availability clusters

Multiple MDM instances can be deployed, and each instance is responsible for a certain group of network elements. In this configuration, N represents active instances and M represents protector instances.

NSP also supports geo-redundancy. This means that another MDM cluster needs to be set up at the geo-redundant site. This cluster will take over in alignment with other NSP functions if the active site fails.

Figure 4: Highly available geo-redundant mediation clusters (2 active, 1 protector)



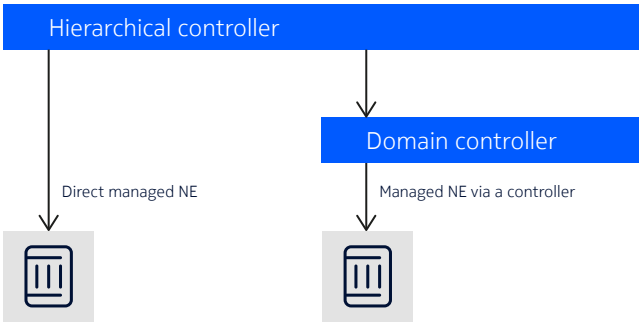
Direct management and hierarchical control

NSP can also automate multivendor networks by connecting through other domain controllers using proprietary or standard interfaces.

Network operators may consider this hierarchical control approach for various reasons, such as to accommodate per-domain organizational boundaries or to enable seamless evolution of an existing deployment that already uses domain controllers.

Operators can also use a hybrid deployment model in which NSP connects directly to the nodes for some IP domains, and connects through some controllers for other domains, including optical domain controllers that use the Transport API (T-API).

Figure 5: Combination of direct management and management through another domain controller



Key benefits of Nokia NSP for the automation of multivendor networks

Rapid onboarding provides flexibility

If legacy network elements or new models deviate from standards, the programmable NSP mediation layer gives operators the flexibility to quickly build pluggable adaptors and introduce them into the network.

Faster upgrades reduce effort and cost

When there is a new network element software release, only the affected adaptors need to be upgraded. Northbound interfaces and applications are not affected if no new functionality is required.

Rapid fulfillment simplifies operations

NSP provides unified service fulfillment workflows and sets of rules that apply to network elements from all suppliers. Operators can customize services and other operations to match a specific way of working.

Unified assurance resolves problems faster

Unified assurance workflows simplify troubleshooting across network elements from multiple vendors. Operations teams can view and manage equipment from a single pane of glass instead of having to monitor several applications and screens. This reduces mean time to repair and downtime. It also minimizes service-level agreement (SLA) overruns and the resulting penalties.

Unified reporting and analytics reduce inventory costs

A unified inventory reporting format covers the full network for all network elements, and a single historical performance management database helps with trend analysis and network planning. These capabilities reduce the cost of maintaining multiple inventory databases. They also reduce errors that can occur when inventory is spread across multiple databases.

Simplified OSS integration reduces CAPEX for OSS probes

NSP eases OSS integration with a modern, standards-based and consistent northbound interface that covers services, fault management, performance management, configuration and inventory. This reduces project integration costs, risk and subsequent maintenance effort.

A single management platform reduces CAPEX and OPEX

The NSP management platform supports bare metal, virtualized and cloud-based deployments. It helps operators reduce CAPEX and OPEX by simplifying implementation planning, deployment and upgrades.

Why choose Nokia?

Fulfillment is not enough

NSP is an integrated automation solution that provides multivendor fulfillment, correlated network and service assurance, and resource control.

Experience

Nokia has delivered multivendor solutions to customers networks for more than 12 years. We know how to build and support carrier-grade solutions that enable our customers to simplify operations and get the most from their networks.

Comprehensive UI and operations

NSP supports unified fulfillment and assurance operations with common workflows for Nokia and multivendor equipment, all from a single pane of glass. This reduces errors and eliminates the need for operators to learn multiple systems and processes.

Nokia OYJ
Karakaari 7
02610 Espoo
Finland
Tel. +358 (0) 10 44 88 000

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