Nokia Network Services Platform

Release 25

The Nokia Network Services Platform (NSP) enables operators to automate, manage and control multilayer transport networks. By accelerating service fulfillment and simplifying network management, assurance and optimization, the NSP maximizes the agility, efficiency, reliability and security of IP, optical and microwave networks.

Introduction

With the NSP, telecommunication providers and enterprises can rely on one fully integrated, modular and programmable platform to gain a single-pane-of-glass view of the entire network and build customized automation use cases for any operational need.

The NSP offers a comprehensive solution for automating and operating networks across multiple domains (access, metro, core), technologies (IP/MPLS, optical, microwave), applications (Carrier Ethernet, mobile backhaul, IP transit, business services) and equipment suppliers.

Features

- Comprehensive multivendor network[1] management and automation based on model-driven principles

- Intent-based network infrastructure configuration and service fulfillment following agile and DevOps best practices, supported with an extensible library of artifacts that can be deployed and updated at runtime

- Powerful assurance and analytics capabilities that incorporate machine learning (ML) algorithms to provide deep, real-time insights into the network for reporting, planning, predicting and troubleshooting, along with the possibility of triggering automatic corrective actions

- Scalable network path control and optimization using closed-loop automation based on network utilization, latency, availability and packet loss

- Automated correlation and coordination with unified network visualization across IP and optical layers

- Programmable network operations with a workflow-based approach for automating repetitive and error-prone tasks

- User-centric web interface with customizable network health dashboards that provide a bird's-eye view of the entire network and support easy navigation for inventory and deep-dive troubleshooting

- Support for open and standards-based APIs to provide flexible integration into northbound operational environments, including web portals, OSS/BSS and orchestration systems

Benefits

- Minimize the human errors, time and cost associated with delivering services in multi-technology and multivendor ecosystems through consistent and unified operations

- Rapidly introduce new services across IP networks

- Reduce testing and implementation times for network maintenance operations

- Increase productivity and flexibility with an open and programmable management solution that simplifies and automates network operations

- Proactively prevent service and network problems before they impact end users and applications

- Simplify problem isolation to quickly understand its service impact and engage remedial actions at the push of a button

- Improve network availability and operational efficiency across multiple domains and layers

- Maximize the use of network resources while ensuring bandwidth guarantees, congestion avoidance and adherence to service-level agreements (SLAs)

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1 Nokia IP routing portfolio (Service Router Operating System and Service Router Linux) and equipment from other suppliers.

Product offerings

The flexible and modular approach of the NSP enables it to meet the specific operational requirements of every network operator. The NSP provides a reliable and robust platform for a set of feature packages. Each feature package provides a particular set of operational capabilities that are accessible through a user-friendly web interface and standard or open application programming interfaces (APIs).

Feature packages are grouped within software suites that address the needs of specific user types, as shown in Table 1.

Table 1: Structure of NSP software suites and feature packages

	NSP software suites		
	Network operations	**Resource control**	**Network programming**
Feature packages	Network infrastructure management	Control and visualization starter	Intent-based networking framework
	Service activation and configuration	Path control and optimization	Workflow automation engine
	Service assurance	Enhanced optimization	
	Network operations analytics	Simulation	
	Transport slice operation	Multilayer discovery and visualization	
		Multilayer control coordination	
Target users	Network operations teams	Network engineers, architects, and planners	Developers
	To increase productivity and reduce errors for a broad set of network management, fulfillment and assurance use cases	For operational IP path planning, control, and optimization as well as IP/optical correlated operation and maintenance	To customize, extend and further automate the NSP's operational service management and resource control capabilities and build upon the functionality delivered by the other software suites

Depending on the specific network operation requirements, feature packages from multiple NSP software suites can be deployed. They can be installed simultaneously or added over time to accommodate network growth and adapt to changing conditions. This flexibility makes the NSP a safe choice for the future, one that allows network operations teams to evolve at the pace that best supports the business needs.

In some cases, a feature package may require the installation of additional feature packages. These dependencies are indicated in the descriptions of the feature packages below.

High availability and disaster recovery

The high availability solution is used to withstand a single failure within a single site. It provides redundancy for NSP components through 3:1 container clustering, load balancing or instantiating a new instance when a failure occurs.

The disaster recovery solution is used to ensure the NSP is available when multiple failures occur within a single site. It is provided using two independent NSP systems in active and warm standby states, running in geographically diverse sites. The failover can be controlled or triggered automatically.

Optical transport integration

The NSP automates and manages IP and microwave networks. The NSP also provides support for integrating Nokia WaveSuite as well as third-party optical controllers using The Linux Foundation (former ONF) Transport Application Program Interface (TAPI) to enable an optimized, single-pane-of-glass solution for operators that want combined management and control capabilities for their IP and optical networks.

The NSP and WaveSuite applications can run in a shared management mode. This enables them to provide single sign-on capabilities, a common look and feel and common assurance functions (network supervision and fault management) across the IP and optical layers.

A seamless evolution of legacy networks and services is enabled by the NSP and WaveSuite by using ZR+ digital coherent optics (DCO) technology to deliver the value of IP over Dense Wavelength Division Multiplexing (IPoDWDM). Nokia enables coherent routing by coordinating the IP and optical network utilizing routers and transponders connected over an open optical line system using IPoDWDM.

Network operations suite

The NSP network operations suite offers a complete set of ready-to-use feature packages that help simplify and automate day-to-day network operations through fast provisioning, monitoring and troubleshooting of network infrastructure and services.

This suite also works across multiple network domains and layers, physical/virtual network functions, and with equipment from third-party suppliers.

Automated network services delivery maximizes performance and reliability and places services on optimal network paths and resources based on SLA policy.

Ease of integration within the existing operational environment helps network operators get the most from their existing OSS and BSS investments through abstraction and unification of device-specific models.

Network infrastructure management

The NSP network infrastructure management feature package supports discovery, configuration, maintenance and inventory of the network infrastructure. It also provides fault and performance management based on real-time streaming telemetry and uses key performance indicators (KPIs) to efficiently monitor network resources.

Feature	Description	Benefits
Network discovery	• Provides open, flexible mediation for the discovery of devices from Nokia and other suppliers • Supports CLI/SNMP and model-driven (IETF NETCONF/YANG, OpenConfig gNMI) management protocols • Supports Automatic Discovery Protocol (ADP) available in Nokia devices such as 7705 SAR-Hm/c	• Provides a common management platform across multivendor networks with a consistent, easy-to-use web user interface • Significantly reduces the time and cost of network operations by eliminating errors and training associated with the use of multiple network management systems or command-line interfaces (CLIs) • Provides the flexibility to support the deployment of model-driven multivendor networks with consistent and seamless network operations • Provides customizable Network Health Summary dashboards that offer a bird's-eye view of the entire network with easy navigation for deep-dive troubleshooting
Network topology	• Supports real-time discovery of layer 2 and layer 3 topology • Provides network map topology views of physical and logical network layers that are mediation-agnostic with grouping and GeoMap capabilities, along with the highest alarm severities and states on devices and links • Includes a variety of status indicators that enable access to other NSP functions	
Network configuration	• Enables intent-based physical and logical network configuration with an extensible library of software artifacts to simplify network provisioning for the entire Nokia IP routing portfolio • Provides auditing to detect misalignment between the intended configuration and the actual deployment	
Network maintenance	• Supports workflow-based deployment automation for network provisioning, performance validation, upgrades and regular backups of device configurations for rollback scenarios	
Network inventory	• Enables discovery, maintenance and reporting for the complete, network-wide network element (NE) equipment, logical inventory and service inventory	
Fault management	• Monitors, correlates and troubleshoots network alarms • Performs root cause analysis and alarm impact assessments for network problems	
Performance management	• Collects real-time streaming telemetry data from the Nokia IP routing portfolio and third-party devices using gRPC Remote Procedure Calls (gRPC/gNMI) and uses SNMP to collect performance statistics from supporting devices • Stores collected data from the network in a database and makes it available (e.g., over a Kafka bus) for a variety of use cases, such as enabling users to visualize real-time and historical telemetry data to enable rapid trend analysis and troubleshooting with a single click • Supports network OAM functions for the Nokia IP routing portfolio and is open to support third-party devices • Supports automated OAM test suite creation and testing through Ethernet connectivity fault management (ETH-CFM) and TWAMP Light • Enables other NSP functions and third-party management components to request and manage OAM tests, either ad hoc or continuously in the managed network • Uses indicators such as simple statistical counters or complex user-defined KPIs to measure network health • Enables user-defined thresholds with assigned automated closed-loop actions when violations occur	
Subscriber management	• Provides a single pane of glass that can be used to monitor, inspect and troubleshoot Broadband Network Gateway (FWA/BNG CUPS) network resources, KPIs, on-demand subnet allocation (ODSA) pools and subscriber details	
Network group encryption	• Enables configuration of network group encryption (NGE), a mechanism for end-to-end encryption of MPLS- or Generic Routing Encapsulation (GRE)-based traffic at the service level on supported Nokia routers	

Service activation and configuration

The service activation and configuration feature package enables provisioning and activation of layer 2 and layer 3 services.

Feature	Description	Benefits
Service fulfillment	• Supports common provisioning for different service types (layer 2 and Carrier Ethernet, layer 3 MPLS VPNs and MPLS-TE) • Provides intent-based templates defined in YANG and supports rules-based configuration to ensure consistency • Provides an off-the-shelf library of product service artefacts (intent types) that can be modified or extended to support additional service-related attributes or third-party devices	• Enables rapid introduction of new services and service definition types across IP/MPLS and Carrier Ethernet network domains • Continuously preserves the network in the desired state • Reduces the cost of delivering multi-technology network services by minimizing the risk of misconfigurations through consistent intents and workflows
Service life cycle management	• Offers service life cycle state management, which enables users to plan and reserve resources in the NSP database and deploy them when ready • Provides a high level of flexibility to automate service operations processes using NSP's workflow manager • Supports configuration assurance by auditing service configurations, which enables users to improve service fault isolation caused by configuration drift and align the NSP and the network if needed • Supports service tunnel management using service distribution paths (SDPs) with the ability to accept or correct configuration drifts caused by onsite engineering operations	

Service assurance

The service assurance feature package delivers a comprehensive set of capabilities to ensure continuous SLA compliance. These capabilities provide visualizations of service health, performance monitoring, service topology and service impact alarms with correlation of services to infrastructure for ease of troubleshooting. This feature package enables operators to verify end-to-end services as well as individual service segments.

Feature	Description	Benefits
Service health monitoring	• Provides real-time, service-specific and mediation-agnostic health summary views to monitor and report with correlation and analysis of service-impacting alarms	• Simplifies problem isolation to quickly diagnose and resolve service-impacting problems and ensure SLAs
Service performance	• Enables proactive service connectivity and performance monitoring using OAM testing capabilities for troubleshooting purposes • Uses simple or complex user-defined service-related KPIs to measure the health of services and enable automated actions based on those KPIs	
Service troubleshooting	• Provides operators with the tooling they need to troubleshoot potential service-impacting issues, including: – Aggregated alarms on all service components – An event timeline for forwarded and dropped traffic on service endpoints – A multilayer service map that includes support for auto-bind services – On-demand OAM testing and workflow execution	

Network operations analytics

The network operations analytics feature package provides a pre-integrated solution that enables operators to better understand how their network performs. It provides detailed visualizations and real-time analysis of the network—from hardware inventory to services—by collecting, warehousing and aggregating event, performance and volumetric data.

Feature	Description	Benefits
Analytics reports	• Provides prepackaged, mediation-agnostic analytics reports and dashboards that provide real-time layer 0 to layer 7 analysis • Includes insightful ad hoc reports and dashboards for self-service reporting using web-based tools	• Proactively identifies and prevents potential service-affecting problems before they impact end users and applications
Baseline analytics	• Leverages ML algorithms to automatically learn and adapt to changing patterns in key network resources • Detects and reacts to network anomalies faster than traditional methods	

Transport slice operation

The transport slice operation feature package provides an intent-based framework for the management and control of transport slices. It provides life cycle management for transport slices, proactive monitoring and analytics for existing transport slices and closed-loop optimization if SLA violations occur.

NSP interworks with the Nokia Altiplano Access Controller, to manage the lifecycles of transport slices across IP and fixed-access domains.

Note: The transport slice operation feature package must be used with the following feature packages:

- Service activation and configuration
- Control and visualization starter
- Path control and optimization

In addition, the service assurance feature package is required for assurance of network slices. The enhanced optimization feature package from the resource control software suite is required for telemetry-based optimization of network slices.

Feature	Description	Benefits
Slice creation	• Enables transport network slice configuration using technologies such as IP/MPLS, passive optical network (PON) and microwave • Supports a layered architecture with a technology-agnostic northbound interface (NBI) towards the end-to-end network slice orchestrator and a southbound interface (SBI) towards the transport network	• Provides a programmable and flexible solution for managing and ensuring SLAs for 4G/5G slices in the transport network
Slice monitoring	• Monitors and analyzes transport slices using efficient tools to quickly identify root causes and troubleshoot problems	
Slice optimization	• Enables proactive closed-loop optimization for transport slices	

Resource control suite

The NSP resource control suite provides real-time visualization and control of network traffic to enable operators to make better use of existing network assets, offer deterministic quality of service and coordinate resources across multiple technology domains.

Network engineers and architects can use the resource control suite to build responsive, reliable and high-performing networks through automation and closed-loop optimization. This suite augments the NSP with software-defined networking (SDN) control to traffic-engineer the network, balance utilization, improve resiliency and reduce latency. Acting as a centralized Path Computation Element (PCE), the NSP ensures the best path placement and load balancing for path distribution throughout the network.

The NSP resource control suite enables optimal path computation across multiple network domains and layers of large-scale multivendor networks. In particular, NSP cross-domain coordination provides unified network visualization and coordination across IP and optical layers.

Powerful correlation and automation capabilities enhance the operations and resiliency of multilayer, multidomain networks.

Control and visualization starter

The control and visualization starter feature package offers multidomain IP/MPLS visualization and control functions.

Feature	Description	Benefits
Topology discovery	• Provides visualization of multi-area and multi-autonomous system (AS) IP networks • Discovers topology though IGP peering or Border Gateway Protocol-Link State (BGP-LS) • Provides visualization of existing label switched paths (LSPs) overlaid on the discovered topology • Discovers and provides visualization of Segment Routing and SRv6 parameters	• Visualizes all network resources to prevent potential problems and facilitate planning for future network growth

Path control and optimization

The path control and optimization feature package enables automation of traffic placement and path optimization.

Note: The path control and optimization feature package must be used with the control and visualization starter feature package.

Feature	Description	Benefits
Path optimization	• Supports Resource Reservation Protocol for Traffic Engineering (RSVP-TE) and Segment Routing technologies • Provides optimal path selection of LSPs within an area or across areas and ASs based on hop count, TE metrics or bandwidth requirements • Employs various path optimization algorithms to ensure the best path placement, including the Nokia Bell Labs Self-Tuned Adaptive Routing (STAR) algorithm, which is proven to be able to place 24 percent more paths on the network than current modes of operation using Constrained Shortest Path First (CSPF) • Supports the creation of diverse and symmetrical LSPs • Supports open and standards-based interfaces and can communicate with Nokia and third-party IP routers using the Path Computation Element Communication Protocol (PCEP) • Supports multiple solutions for the Maximum Stack Depth (MSD) limitations in segment-routed networks. • Supports innovative features such as Traffic Engineered Equal Cost Multi-Path (TE-ECMP) and the ability to create tertiary paths	• Maximizes network usage on existing assets to reduce OPEX and CAPEX • Enables revenue growth by offering premium services with traffic-engineered SLAs • Plays a significant role in meeting the requirements and bandwidth demands of 5G, the cloud and the Internet of Things • Achieves the highest network reliability and quality

Enhanced optimization

The enhanced optimization feature package offers automated closed-loop optimization based on real-time telemetry and OAM test results.

Note: The enhanced optimization feature package must be used with the control and visualization starter feature package and the path control and optimization feature package.

Feature	Description	Benefits
Telemetry-based path optimization	• Provides utilization-based and latency-based telemetry optimization to automate LSP placement on network resources to continuously meet SLAs, even in dynamic environments where network topology and traffic patterns are changing	• Enables fully automated closed-loop control of traffic steering throughout the network

Simulation

The simulation feature package delivers an offline simulation tool.

Note: The simulation feature package must be used with the control and visualization starter feature package.

Feature	Description	Benefits
Path simulation	• Simulates typical operations such as adding a link, taking down a node for routine maintenance or creating new LSPs to verify their impact • Provides what-if scenarios to discover specific problem areas of the network • Provides worst-case-failure analysis • Enables the operator to import a copy of the topology, LSPs and utilization from the live network into the simulator tool and use it to view and adjust the demand matrix, including the bandwidth (booked and utilized) and the corresponding LSPs. The operator can then visualize the impact of the adjustments on the overall network utilization and understand which LSPs would fail to find sufficient bandwidth or a path to satisfy SLA requirements.	• Predicts where future bottlenecks will occur in the network by using the increase in utilization demands to forecast traffic growth • Helps the operator avoid network traffic interruptions by verifying potentially high-impact configuration changes in a safe environment

Multilayer discovery and visualization

The multilayer discovery and visualization feature package enables automatic, real-time discovery of the way IP traffic is carried over optical networks. To enable these capabilities, the NSP interworks with Nokia WaveSuite or third-party optical domain controllers through the Linux Foundation (former ONF) TAPI.

Note: The multilayer discovery and visualization feature package must be used with the control and visualization starter feature package to support IGP/LSP IP-optical topology visualization.

Feature	Description	Benefits
Cross-domain topology and discovery visualization	• Uses an industry-standard methodology called Link Layer Discovery Protocol (LLDP) snooping or a patented non-intrusive discovery method for optical nodes that do not support LLDP snooping • Provides rich troubleshooting capabilities such as visualization of LSP mapping in the optical domain, top-down and bottom-up navigation of IP and optical services, and three-dimensional network views • Highlights layer 2 connections between router ports, optical services and LSPs	• Reduces time to resolution and OPEX • Enables disparate domains and management functions coherence, resulting in lower total cost of ownership (TCO), improved mean time to repair and higher overall customer satisfaction • Improves network availability • Simplifies troubleshooting • Enables tighter latency control
Cross-domain diversity analysis	• Analyzes path diversity of logical link identifiers and LSPs in real time • Ensures LSPs are physically disjoint by learning the Shared Risk Link Group (SRLG) values of the optical network and establishing diverse paths as necessary	

Multilayer control and coordination

The multilayer control and coordination feature package provides active IP/optical operations such as coordinated maintenance, floating port protection, elastic link aggregation group (LAG) and optical-aware IP routing (SRLG and latency) between the IP and optical domains.

NSP configures coherent optical plugs in routers with information related to the optical domain that carries the signals. It leverages the Nokia WaveSuite optical controller to support end-to-end life cycle management with intent-based Infrastructure Configuration Management (ICM).

Note: The multilayer control and coordination feature package must be used with the multilayer discovery and visualization feature package. All features in the control and coordination package are valid for Nokia and third-party IP routers, and for optical nodes controlled by Nokia WaveSuite and third-party optical domain controllers.

Feature	Description	Benefits
Cross-domain coordination	• Enables streamlined and automated link layer interconnect provisioning for traditional gray optical plugs and ZR+ DCO coherent optical plugs • Incorporates operational tasks such as optical connectivity discovery, maintenance and troubleshooting into the scope of overall router management • Provides advanced simulations of optical failures in the network and the associated impacts on customer traffic	• Enhances interworking between IP routing and optical transport for the 400G era as IP routers cross over into the domain of coherent optical transport and are exposed to new port and link management practices that were traditionally in the jurisdiction of the optical transport network • Improves network planning and resiliency • Reduces the time required to turn up a complete transport service • Reduces the risk of service outages
Cross-domain correlation	• Enables floating port restoration between IP and optical domains to reduce the overall port count on router and optical nodes • Enables dynamic bandwidth adjustment by automating the number of LAG members that can be triggered through network Threshold Crossing Alerts (TCAs) for various performance parameters • Enables optical-aware IP routing by providing visibility into required diversity within the optical domain and leveraging SRLG and latency data to optimize path selection. Through the cross-domain coordinator, SRLG and latency metrics can be extracted via TAPI, and the PCE resource controller can compute optimal paths	

Network programming suite

The NSP network programming suite consists of a set of automation frameworks and tools that enable network engineers and developers to build and adapt their own automation use cases and to define and customize intent-based network configurations and operations.

This suite brings additional flexibility and customization capabilities to operations that are available through other NSP software suites.

Through network resource abstraction, developers can hide the specific details of network design and configuration from the network operations team.

Through programmability, developers can create customized, highly automated methods of procedure (MOPs) to increase execution efficiency and reduce the risk of human error. MOPs can be executed on demand, scheduled or automated, with single or bulk execution triggered by network events.

Intent-based networking framework

The intent-based networking framework feature package enables operators to create configuration templates called "intents," which get converted into detailed network and service implementations.

Feature	Description	Benefits
Declarative programming	• Provides a comprehensive intent-based networking programming engine • Has a YANG-based programming interface that enables developers to create complex declarative configurations or service definitions, while simplifying integration with OSSs and applications • Enables enrichment of intent definitions by associating state data and customized operations • Supports integration with Visual Studio Code to provide a better coding experience and to leverage its native Git integration • Supports adding the intent model and business logic at runtime • Decouples the life cycles of the intent types and intents and supports versioning and migration to provide developers with full control • Supports fully configurable, customized layer 2 and layer 3 combined service definitions for Nokia and third-party devices by applying model-driven principles • Leverages the NSP resource administration function to use resource pools as a utility to automatically assign predefined network parameters such as IP addresses • Supports full programmability, provides developers with access to other NSP APIs such as the workflow manager function, and enables automation across all NSP functions and external systems	• Enables developers to design and implement complex network services, policies or network actions with service persistency • Enables consistent network configuration across Nokia and third-party devices, leading to better quality and cost-effective maintenance • Allows operators to abstract and simplify configuration operations, and validate and maintain desired network configuration states through audits • Simplifies integration with IT systems by offering standards-compliant, transactional, YANG-defined northbound interfaces

Workflow automation engine

The workflow automation engine feature package enables developers to program and execute workflows on demand or have them be automatically triggered by planned schedules or network events.

Feature	Description	Benefits

Imperative programming	• Provides developers with a web UI as the programming interface for automating complex action sets (OpenStack Mistral-based)
	• Supports integration with Visual Studio Code to provide a better editing coding and to leverage its native Git integration
	• Supports typical workflow use cases including device operations such as:
	  – NE software management
	  – NE backup
	  – NE certificate, key and password management
	  – Mass operations
	  – Reporting
	  – MOP automation
	  – Closed-loop scenarios
	  – Troubleshooting procedures
	• Supports complex automation scenarios with combined workflows and intent interactions while also supporting use of the NSP resource administration function
	• Supports workflow execution triggered automatically (scheduled) or triggered by events at scale, with operational views and troubleshooting tools
		• Allows developers to automate complex repetitive tasks for concurrent mass operations

Network automation use cases

In addition to feature packages, NSP provides a comprehensive catalog of proven, industrialized use cases that cover all aspects of the network services life cycle. Each use case solves a business challenge and achieves business outcomes that drive operational efficiency and profitability.

The use cases are treated as products with their own life cycles to reduce risk, speed up implementation and ensure predictable results. They provide the following benefits:

- Reduction of service creation time and mean time to repair
- Improvement in operational efficiency and productivity
- Cost savings (CAPEX and OPEX)
- New revenue opportunities

The following table lists the automation use cases in the catalog for each category of the network life cycle.

Categories	Description	Use cases
Plan and evolve	• Automates the design, build and upgrade of network configurations to meet customer demand	• Mass-scale NE upgrade • Mass-scale NE backup • Service move – port/LAG/card • Service move – tunnels • Closed-loop automation/capacity growth • Coordinated maintenance
Fulfill	• Automates the provisioning of networks and services, preferably intent-driven	• Enterprise Bundle • E-Line • C-Line • E-LAN EVPN • L3 VPN • Internet enhanced services • Composite services • Bandwidth on demand • pLTE provisioning – Day 0 • NE Provisioning – Day/Phase 0 for ZTP enabled nodes • NE provisioning – Day/Phase 1 • NE provisioning – Day/Phase 2 • 400ZR point-to-point • ZR+ Managed alien with ROADM
Slice	• Automates the creation and assurance of multiple network slices over a common physical infrastructure	• Transport slice enablement • Transport slice monitoring • Transport slice enablement across IP and FN domains • Transport slice monitoring across IP and FN domains

Categories	Description	Use cases
Discover and visualize	• Automates discovery and visualizes network and service topology, inventory and performance	• Physical topology discovery • IP/optical topology discovery • IGP topology discovery • IP/MPLS (LSP/path) topology discovery and visualization • Brownfield service discovery • Brownfield configuration discovery • Telemetry enablement • Pre-packaged reports • Custom reports
Assure	• Automates the measurement and monitoring of network and service performance in conformance with customer expectations	• Fault and network assurance • Service assurance • Network performance monitoring
Heal	• Automates the resolution of network and service failures from network disruptions and impairments. Solutions range from manual assist to fully automated self-healing.	• IP-optical diversity analysis • 1:N floating port restoration • Wavence Interference Detection Alarm for Wi-Fi 6
Predict	• Automates the prediction of future network status based on current and historical data	• Custom alarm correlation • LSP network simulation • What-if analysis
Optimize	• Automates the improvement of network performance	• Elastic IP/optical bandwidth • LSP path placement • LSP enhanced path control • Optical-aware IP routing

Technical specifications

Platform

The NSP software can be deployed in operators' virtualized environments in a variety of ways. It includes a basic platform that supports the centralized collection, browsing and visualization of system logs, metrics and the overall health of the system. These capabilities simplify the troubleshooting and recovery activities required when issues arise.

The NSP Appliance is available for limited-scale networks, with the NSP software already installed in standalone and redundant configurations. Alternatively, the NSP Server can be purchased by operators seeking a readily available platform to host the NSP.

Platform specifications[2]	
Operating system (OS)	• Red Hat Enterprise Linux 8
Hypervisors	• Linux Kernel-based Virtual Machine (KVM, KVM with OpenStack or VMware ESXi™)
CPU	• Intel® Xeon®-based x86-64 processor • AMD EPYC x86-64
Messaging	• Events via Apache® Kafka® • REST gateway for locating and authorizing REST and RESTCONF APIs

2   See the NSP Planning Guide for specific platform requirements.

Logging	• User activity and system logs can be sent to syslog
Single sign-on (SSO)	• Oauth2 using Keycloak
User management, access control	• Role-based access control (RBAC) model

Technologies

Standards compliance	
APIs	• ONF TR-547-TAPI v2.1.4 Reference Implementation Agreement • RFC 8040: RESTCONF Protocol • Representational State Transfer (REST)
Data models	• draft-ietf-teas-yang-te: A YANG Data Model for Traffic Engineering Tunnels, Label Switched Paths and Interfaces • RFC 6020: YANG – A Data Modeling Language for the Network Configuration Protocol (NETCONF) • RFC 6021 and RFC 6991: Common YANG data types • RFC 6087: Guidelines for Authors and Reviewers of YANG Data Model Documents • RFC 7223: A YANG Data Model for Interface Management • RFC 7224: IANA Interface Type YANG Module • RFC 7950: The YANG 1.1 Data Modeling Language • RFC 7951: JSON Encoding of Data Modeled with YANG • RFC 7952: Defining and Using Metadata with YANG • RFC 8072: YANG Patch Media Type • RFC 8345: A YANG Data Model for Network Topologies
	• RFC 8525: YANG Library • RFC 8528: YANG Schema Mount • RFC 8795: YANG Data Model for Traffic Engineering (TE) Topologies
Flows	• IPFIX – RFC 5101: Specification of the IP Flow Information Export (IPFIX) Protocol for the Exchange of IP Traffic Flow Information – RFC 5102: Information Model for IP Flow Information Export
NETCONF	• RFC 6241: Network Configuration Protocol (NETCONF) • RFC 6242: Using the NETCONF Protocol over Secure Shell (SSH)
Telemetry	• Simple Network Management Protocol (SNMP) • IP Flow Information Export (IPFIX) • gRPC Remote Procedure Calls (gRPC)
Network services	• VPN (point-to-point, point-to-multipoint, any-to-any) and complex multi-technology services: – Layer 2 (Virtual Private LAN Service (VPLS)) – Ethernet VPN (EVPN) – Layer 3 (IP-VPN, EVPN) – Ethernet Line (E-Line) – E-Line stitched services – Circuit emulation (C-Pipe) – Ethernet services into layer 3 VPN with VLAN handoffs to form a single VPN service (all supporting common QoS tunnel policy) • Bandwidth-on-demand • Service Call Admission Control (CAC) at access interface granularity
Network slicing	• draft-ietf-teas-ietf-network-slices • draft-wd-teas-ietf-network-slice-nbi-yang

Standards compliance	

Network path computation
 	
(Based on the Nokia IP routing portfolio supporting IETF standards and drafts)
	• BGP-LS
	   – RFC 7752: North-Bound Distribution of Link-State and Traffic Engineering (TE) Information using BGP
	   – RFC 8476: Signaling Maximum SID Depth (MSD) Using OSPF (node MSD)
	   – RFC 8491: Signaling MSD using IS-IS (node MSD)
	   – RFC 8571: BGP-LS Advertisement of IGP Traffic Engineering Performance Metric Extensions
	   – RFC 8814: Signaling MSD Using BGP-LS
	   – RFC 9085: BGP Link-State Extensions for Segment Routing
	• IS-IS/OSPF extensions
	   – RFC 8665: OSPF Extensions for Segment Routing
	   – RFC 8667: IS-IS Extensions for Segment Routing
	• PCE
	   – RFC 4655: A Path Computation Element (PCE) - Based architecture
	   – RFC 5440: Path Computation Element Communication Protocol (PCEP)
	   – RFC 7420: PCEP Management Information Base (MIB) Module
	   – RFC 8231: PCEP Extensions for Stateful PCE
	   – RFC 8281: PCEP Extensions for PCE-initiated LSP Setup in a Stateful PCE Model
	   – RFC 8664: PCEP Extensions for Segment Routing

	– RFC 8697: PCEP Extensions for Establishing Relationships Between Sets of LSPs
	   – RFC 8800: PCEP Extension for LSP Diversity Constraint Signaling
	   – RFC 9005: PCEP Extension for Associating Policies and LSPs

IP-optical cross-domain	• TAPI 2.1.3
Network programming	• OpenStack Mistral-based • Integration with Visual Studio Code

Related materials

- Web page: Nokia Network Services Platform
- Video channel: Network Services Platform (includes NSP demo videos and product tours)
- Data sheet: NSP for Industry and the Public Sector
- Data sheet: NSP Appliance
- Data sheet: NSP Server