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Nokia WaveSuite Service Enablement

Release 22.02

The Nokia WaveSuite Service Enablement (WS-SE) application enables increased network operator revenue through new types of optical network services, virtualization of optical network connectivity and innovative new business models for bringing optical Network-as-a-Service (NaaS) to market.

Overview

The WS-SE application uses a Nokia patented data model for multi-tenanted optical network service virtualization that enables increased network utilization to support new sources of service revenue and automation for faster optical network services delivery. The WS-SE application helps increase revenue by enabling a more consumable network that supports more customers and new channels to market.

The WS-SE application also reduces network TCO using automation to get optical network services into customers' hands faster.
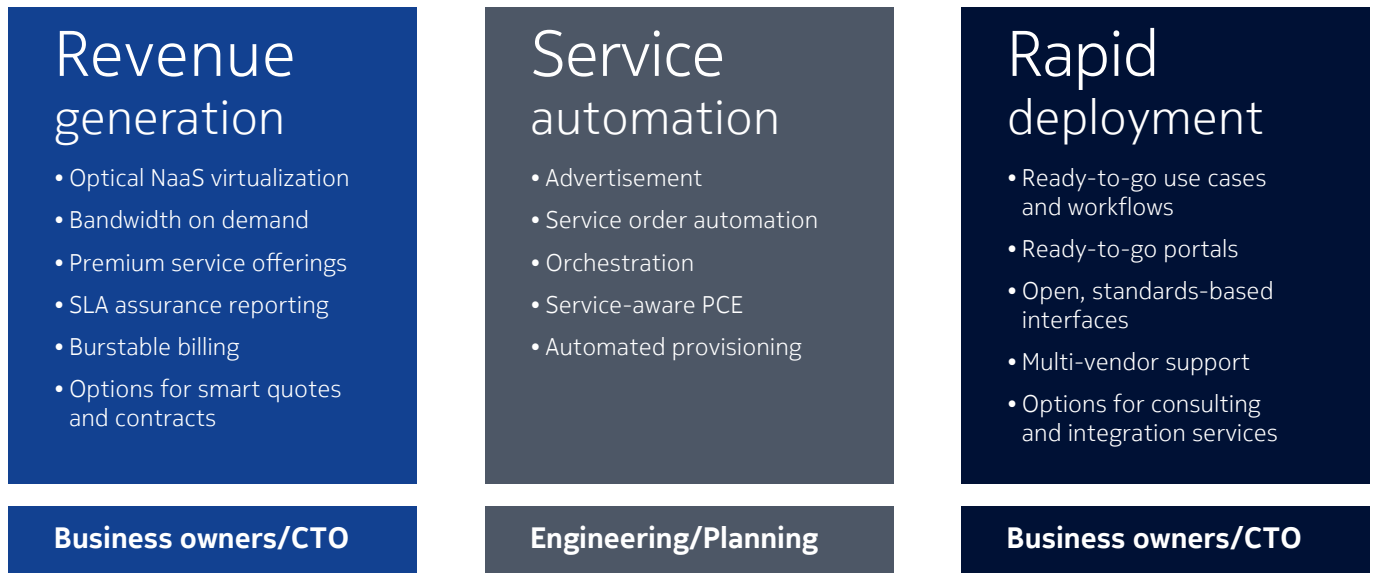
Automation capabilities and professional services help service providers rapidly integrate WS-SE into network operations environments.
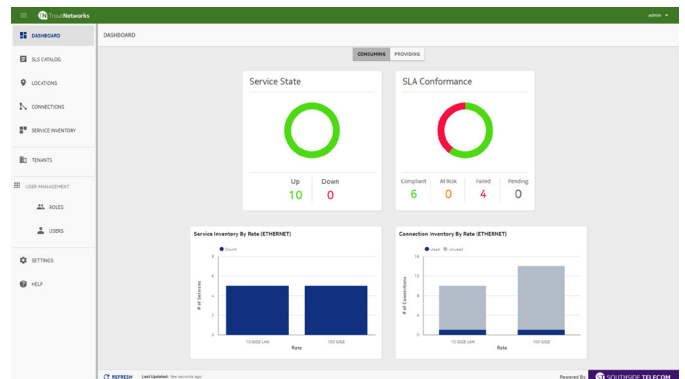
As shown in Figure 1, the WS-SE application helps all network operator stakeholders for optical network services to succeed:

- Network services business owners: New services and more revenue
- Optical network engineering and planning groups: Service delivery automation
- Operations and IT groups: Rapid network services deployment

Figure 1. Nokia WS-SE business benefits and stakeholders

Revenue generation

- Optical NaaS virtualization
- Bandwidth on demand
- Premium service offerings
- SLA assurance reporting
- Burstable billing
- Options for smart quotes and contracts

Business owners/CTO

Service automation

- Advertisement
- Service order automation
- Orchestration
- Service-aware PCE
- Automated provisioning

Engineering/Planning

Rapid deployment

- Ready-to-go use cases and workflows
- Ready-to-go portals
- Open, standards-based interfaces
- Multi-vendor support
- Options for consulting and integration services

Business owners/CTO

Key capabilities and benefits

Tables 1, 2 and 3 highlight WS-SE capabilities to increase revenue, reduce network TCO and rapidly integrate into network operator operations environments.

Optical network operators can use the increase revenue capabilities individually or bundled together to create a full range of network service offers.

Table 1. Key capabilities to increase revenue

Capability	Description	Benefits
Bandwidth on demand	Enables on-demand optical network service order fulfillment	• Gets optical network services into customers' hands quickly by shortening service order fulfillment cycles from weeks to minutes
Bandwidth on demand with burstable billing	Tracks port-based optical network service utilization using aggregated packet frame counters	• Enables burstable, consumption-based billing for optical network services
Bandwidth on demand with optical NaaS virtualized connectivity	Virtualizes optical connectivity using a patented multi-tenancy data model that understands how optical services are sold between the network operator/ service provider, partners and end customers	• Enables monetization of optical connectivity through optical NaaS virtualization to support business-to-business to-any end user (B2B2X) models for wholesale/ retail channel partners • Provides secure and private subscriber optical network service slices to support optical NaaS offers • Provides differentiated service assurance views and reports for SLA attributes (e.g., availability, latency, utilization)
Bandwidth on demand with automated low-latency and high-availability connectivity	Enhances optical network service SLAs with support for automating the establishment of low-latency and high-availability connectivity; includes support for end-customer latency and availability reports and the ability for end customers to see abstract views of primary and secondary service connectivity routes throughout the network	• Enables optical network service differentiation with SLAs that support low-latency and high-availability connectivity: – Faster delivery of optical network services with differentiated latency and availability SLA support – Service-level reporting of measured service utilization, availability and latency over a monthly billing period – The ability to visualize abstract views of service primary and secondary routes throughout the network

Table 2. Key capabilities to reduce network TCO

Capability	Description	Benefits
Optical NaaS virtualization	Provides automation to virtualize optical connectivity using a patented multi-tenancy data model that understands how optical services are sold between the network operator/service provider, partners and end customers	• Lowers network TCO by automating the monetization of optical connectivity through service virtualization and B2B2X models for wholesale/retail channel partners
Service order automation	Automates on-demand service order fulfillment for the consumers of optical network services	• Shortens order fulfillment cycles from weeks to minutes
Service-aware PCE	Automates route computation for advanced service types, including high availability, ultra-low latency and route diversity	• Reduces OPEX by automating service fulfillment for services with premium optical service connectivity
Service connectivity advertising	Advertises available network services connectivity, capacity and their geographic locations to consumers of optical network services	• Lowers network TCO by enabling rapid consumption of optical network capacity • Automates the monetization of optical connectivity services

Table 3. Key capabilities for rapid integration

Capability	Description	Benefits
Ready-to-go use cases and workflows	Pre-integrated Nokia WavePrime professional services workflows and tested APIs	• Enable rapid deployment and integration of WS-SE into network operators' business processes and support systems • Enable Nokia WaveHub partner applications for smart optical network services quotations and contracts to further accelerate the delivery of optical network services
Ready-to-go service portals	Ready-to-go web portals with the ability to display the brands of the providers of network services and their customers	• Enable the deployment of WS-SE revenue-generating services without needing to wait for the full integration of WS-SE into network operators' support systems
Open, standards-based interfaces	All WS-SE capabilities are available via open, standards-based interfaces; interfaces can also be tested using Nokia WaveHub Labs virtual networks	• Enable further automation and customization of optical network services delivery • Enable operators to more easily realize their open network initiatives, to accelerate optical network service delivery and reduce network TCO
Options for software consulting, integration and customization	Nokia WavePrime professional services includes a full suite of services to help enable deployment of WS-SE, including network Digital-Twin-as-a-service (DTaaS), which creates network digital twins to support the software deployment life cycle	• Consultation, integration and customization services accelerate software delivery, including support for multivendor equipment networks • Proven Digital Process Automation (DPA) workflows and software artifacts to accelerate software customization and delivery • The creation of network digital twins lowers the dependencies and costs of physical networks and equipment labs

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Optical NaaS: Service virtualization and assurance

The Nokia WS-SE application uses a Nokia patented business relationship-aware hierarchical data model to enable service provider tenants (e.g., internal business units, resellers, partners) at multiple levels to define and independently operate optical network services.

Service virtualization

At the physical network operator's discretion, the tenancy arrangement can be either single tiered with end customer tenants or multi-tiered with up to N levels of partner tenants (e.g., internal business units, resellers, partners) arranged in a hierarchical manner (see Figure 2).

Each partner tenant owns a securely partitioned virtual slice of optical connectivity sold to it as a service offering by the underlying tenant or network operator. Each partner tenant can sell services from its virtual network slice without continuous coordination with the underlying network operator.

Figure 2. Nokia WS-SE patented hierarchical service virtualization data model
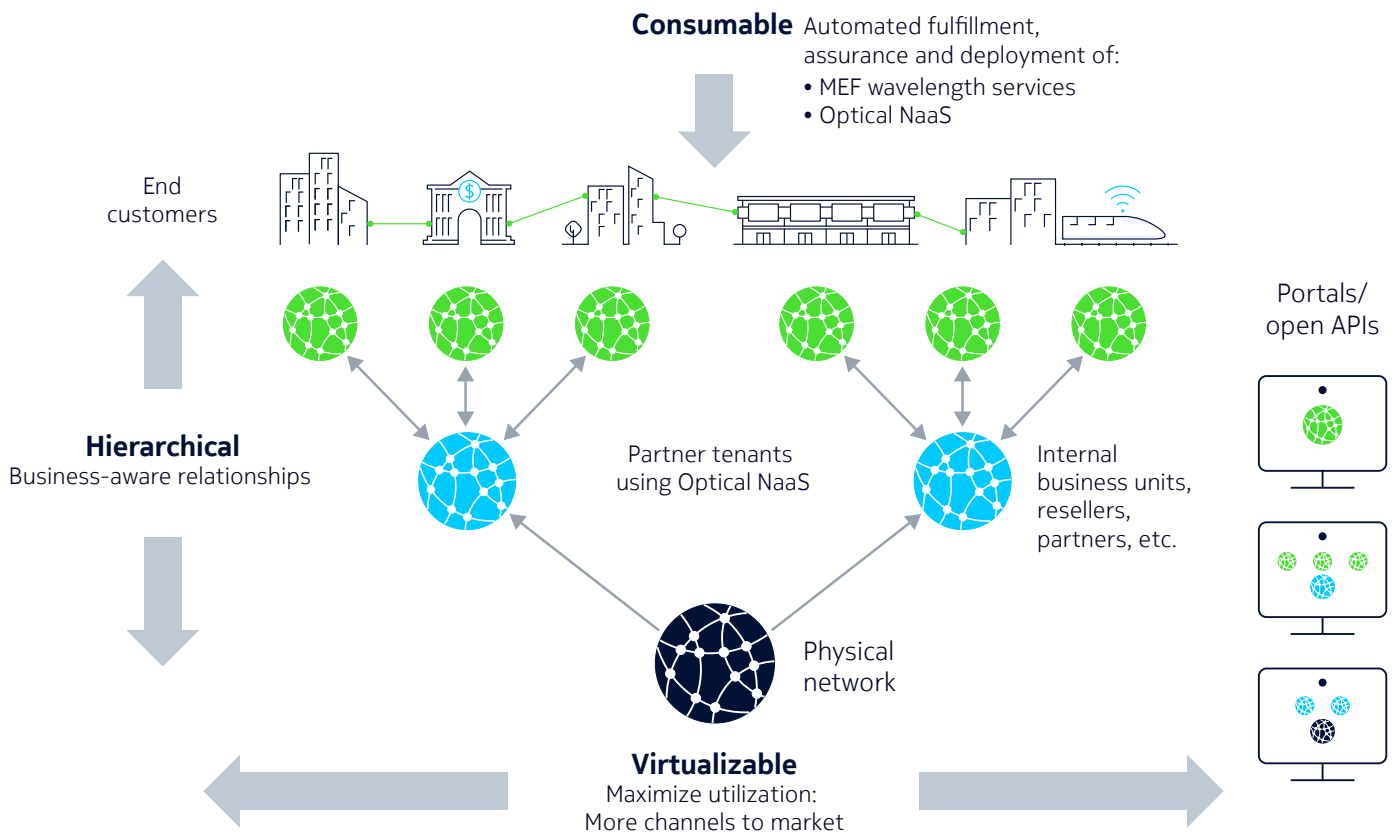
Service assurance

The WS-SE application provides comprehensive service reporting and dashboard functions that enable all network tenants to visualize services' connectivity and health as well as track performance.

Service dashboards (see Figure 3 and Figure 4) provide an at-a-glance summary view of services from within a service portal. Service reporting provides tenants with a historical summary of service performance compared to service level agreement (SLA) target metrics in the service specification.

To facilitate integration with operations support systems/business support systems (OSS/BSS), a secure partitioned view of service reporting data and dashboard status is also available through a northbound REST API.

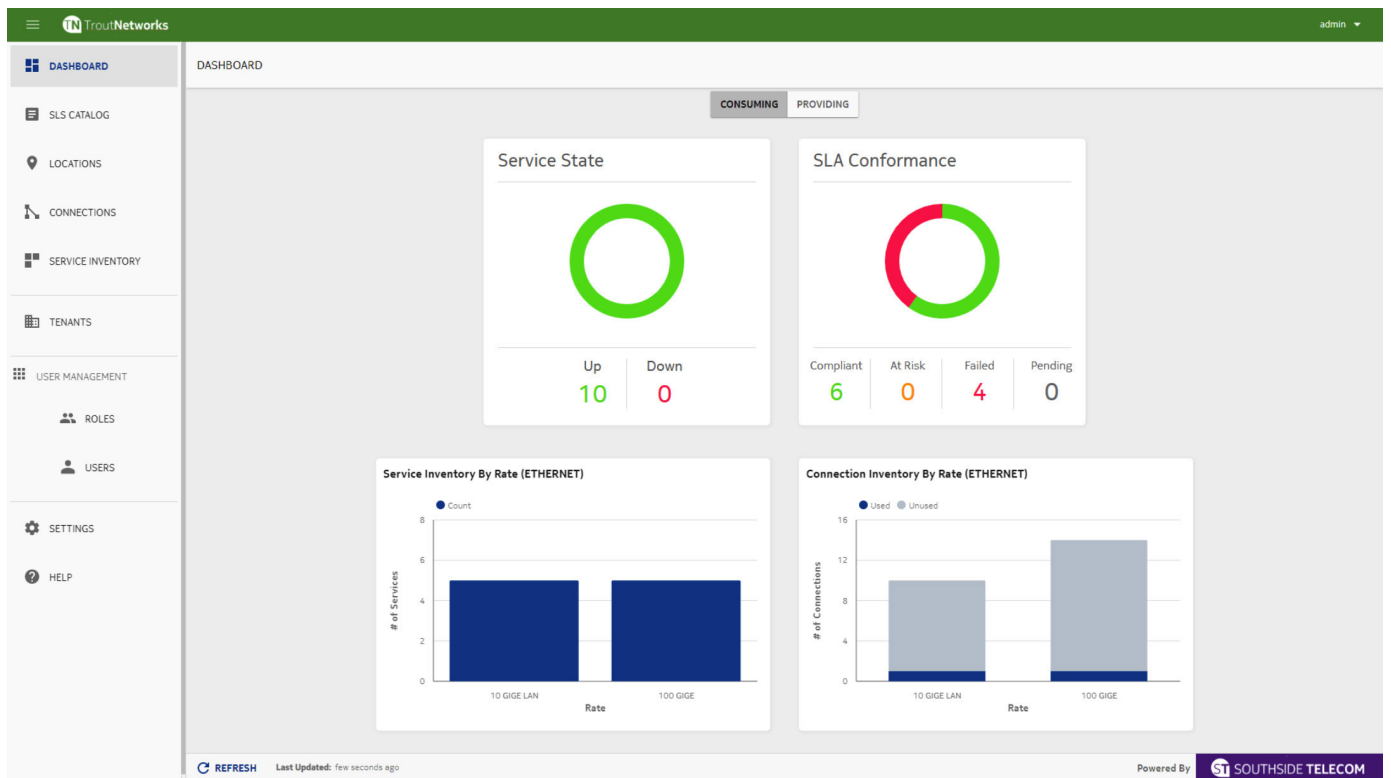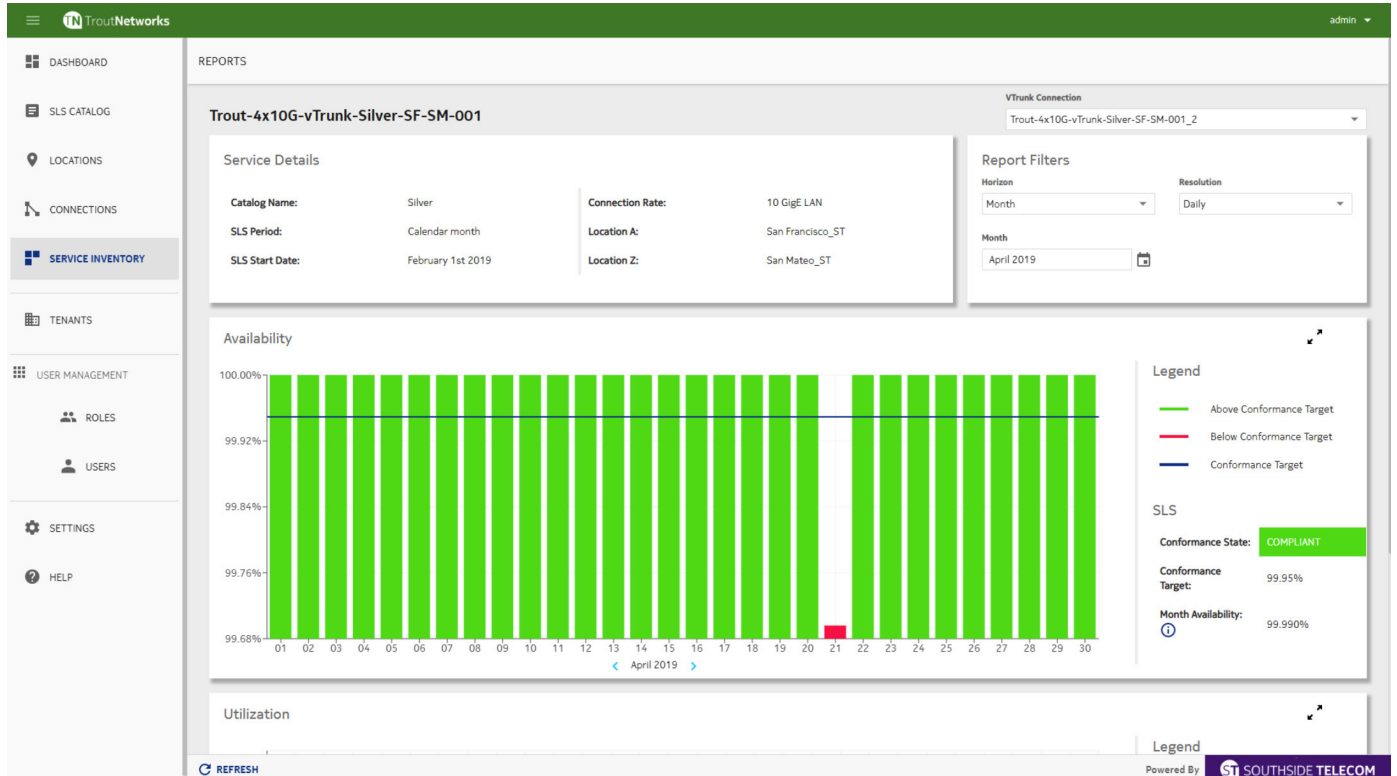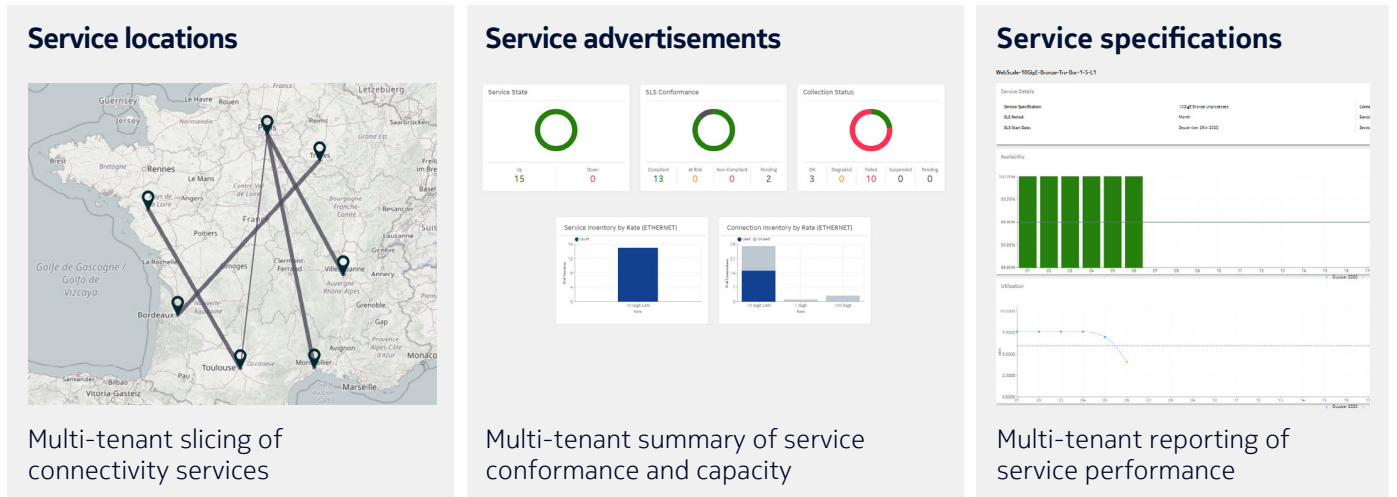Figure 3. Nokia WS-SE assurance dashboard for a partner tenant

Figure 4. Nokia WS-SE assurance service reporting for a partner tenant

As shown in Figure 5, the foundational model for WaveSuite service virtualization consists of three concepts:

- **Service locations:** Model where services are offered. Locations are typically data centers or points of presence where connectivity services originate and terminate.

- **Service specifications:** Model the type of service offered. This is expressed using a set of service attributes and performance characteristics, including SLA objectives such as service availability and service latency along with service routing parameters such as service diversity, restoration and protection.

- **Service advertisements:** Determine who has visibility of which service specifications at which service locations. Advertisement workflows enable the network operator and its partner tenants to easily control which service types can be ordered by which end customer tenant.

Figure 5. Service virtualization concepts

Service locations	Service advertisements	Service specifications
Multi-tenant slicing of connectivity services	Multi-tenant summary of service conformance and capacity	Multi-tenant reporting of service performance

Bandwidth on demand: Burstable billing

The Nokia WS-SE burstable billing capability unlocks new pay-per-use billing models for optical connectivity services (e.g., wavelength services):

- Service utilization reporting provides tracking of tenant bandwidth consumption over a billing period.

- Utilization thresholding detects "burst" events to drive pay-per-use billing and alert the service provider to upsell opportunities.

- In-service updating of the billable service rate specifications enables upsell to higher service rates without reconfiguring the underlying optical connectivity.

This concept is illustrated in Table 4.

Table 4. Burstable billing capabilities

			Actual monthly usage (95th percentile			
Service level	Usage plan	Price per month (USD)	January	February	March	April
1	<10G	$ 1,500	8.0G			
2	10G to 20G	$ 2,000		11.2G		17.0G
3	20G to 40G	$ 3,000			22.0G	
4	40G to 60G	$ 4,000				

The burstable billing capability is enabled through a combination of the Service Utilization Reporting feature and the WS-SE northbound interface. An example of a service utilization report is shown in Figure 6.

Figure 6. Service utilization report example
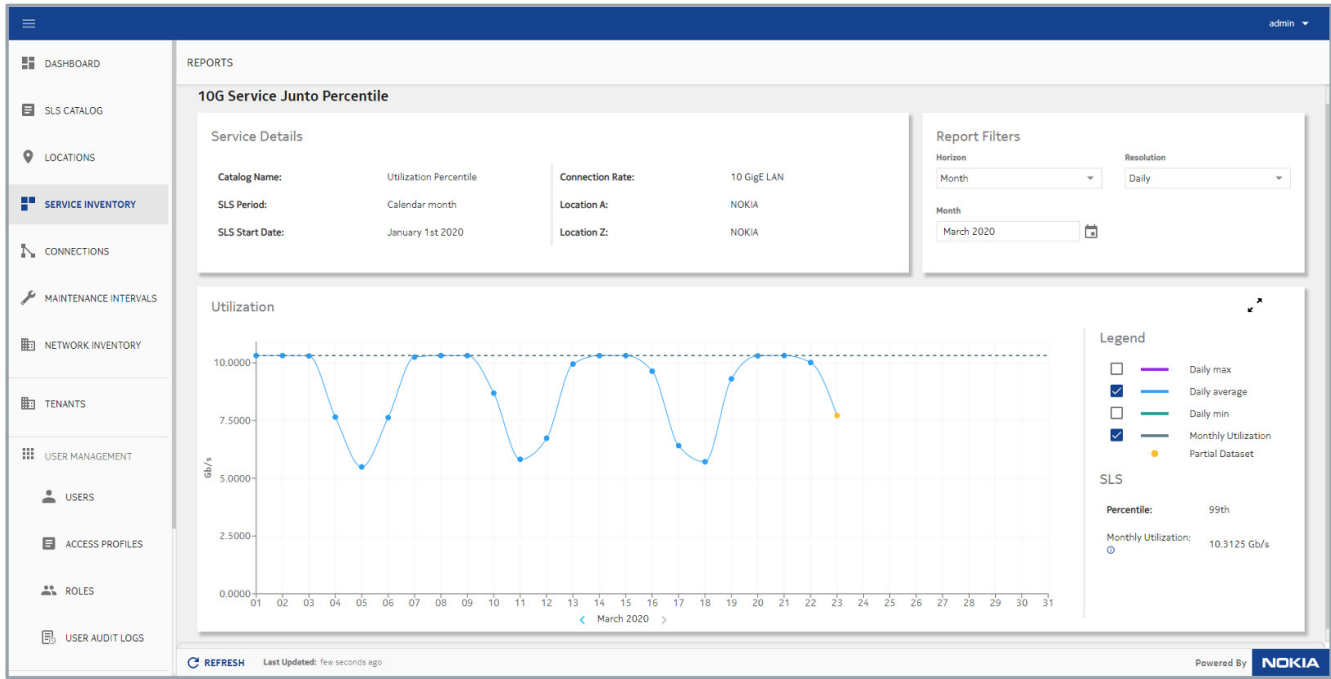
Bandwidth on demand: Automated service fulfillment

The service fulfillment capability provides an automated on-demand service delivery experience for subscriber tenants.

The Nokia WS-SE application enables an on-demand and highly automated user experience for ordering and fulfillment of optical network services through a tenant service portal.

When combined with underlying software-defined networking (SDN) service automation capabilities, network operators move toward realizing transformational reductions of service delivery times—from weeks to minutes.

Available service offerings and their locations are "advertised" through the service portal to network tenants, with full specification of the service offered, including bandwidth rate, client protocol and service performance targets. Service specifications also model constraints that

determine the type and route of the network connection used to transport the service.

Specifications model SLA-related attributes offered to subscribers such as degree of protection, restoration policy and route diversity constraints.

Tenant service order requests can be made using simple point-and-click operations on a web-based service portal or can be automated using the WS-SE northbound API. The tenant simply specifies endpoint locations and desired service specification, and then submits a service order to their service provider. Optionally, the service order can be scheduled to be fulfilled at a future date/time—with WaveSuite reserving virtualized network resources for the order until the scheduled fulfilment time.

An automated fulfillment workflow creates and provisions the service, activates the underlying network connection, and assigns the newly fulfilled service to the tenant's inventory. Automation of provisioning and activation of the underlying network connection are accomplished through coordinated orchestration between WaveSuite and the underlying SDN controller.

Through a combination of WaveSuite and SDN controller functions, a variety of types of optical network services can be developed. Path computation algorithms are used to automatically compute service routes between service locations based on available network resources. Routing constraints such as diversity and shared risk are applied during path computation based on service definitions specified by the service provider.

The WS-SE application computes a nominal route for the tenant service and automates provisioning of network connection and resource assignments through the underlying SDN controller. Port assignments that match the tenant's request and the operator's service specification are automatically determined within the workflow.

Fulfillment workflows are easily controlled using policy settings to accommodate a variety of operational paradigms, ranging from fully automated flows for resource provisioning to semi-automated flows that provide additional assignment control for the network operator.

Automated service provisioning supports optical NaaS service types, including:

- **Unprotected services:** Are commonly offered for optical connectivity in scenarios where network protection is provided at a higher-layer service outside the optical domain—typically Layer 3 IP/MPLS or Layer 2 Carrier Ethernet layer protection.

- **Network protected services:** Provide protection through either Layer 1 Subnetwork Connection Protection (SNCP) for switched optical transport network (OTN)-based services or Layer 0 photonic layer protection using an optical protection switch for transponder-based services.

- **Diverse services:** Provide a high degree of survivability by ensuring that an associated pair of services are routed diversely from each other. Diversity algorithms in the WS-SE path computation element (PCE) ensure both fiber diversity and equipment diversity between the associated service pair. Fiber diversity is

computed based on shared risk link groups (SRLG) discovered from the network management system (NMS). Equipment diversity is computed based on equipment traversed along each service path such that segments in each path do not have overlapping equipment.

- **Lowest-latency services:** The WS-SE PCE optionally routes service paths based on the lowest latency. This enables ultra-low latency services to be offered to tenants.

- **Diverse protected services:** Enable premium-class services with ultra-high availability by combining network protection with service diversity.

When combined with WaveSuite's patented hierarchical service virtualization solution, new business models for wholesale and resale partners can be used to expand addressable markets for optical network services.

These business models include B2B models between the network operator and partners and also B2X models between partners and end customers (see Figure 7).

Figure 7. Nokia WS-SE advertisement and fulfilment
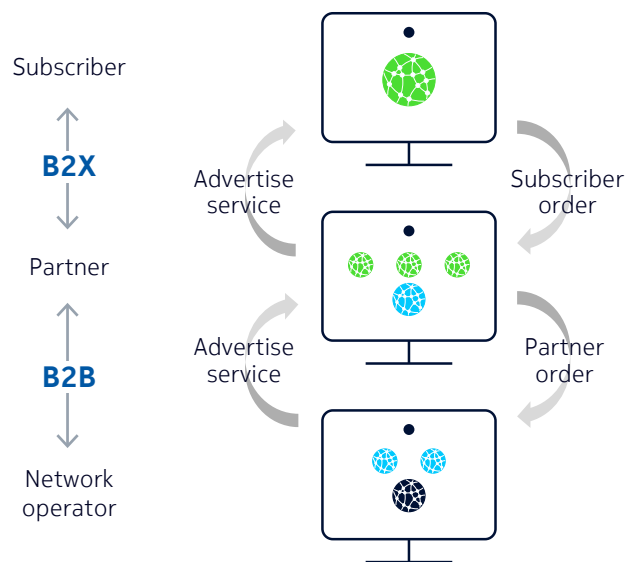
WaveSuite provides direct tenant advertisement of optical network services and locations, automated service-aware path computation, automated connection provisioning, and automated service activation and assurance. This high degree of automation enables unprecedented optical network service delivery velocity and lower network TCO.

Latency-as-a-Service: Differentiate optical network services

The Nokia WS-SE application enables operators to differentiate their optical network services based on ultra-low latency. Latency-related features include:

- Customizable service specifications that model latency SLA objectives.

- Latency-aware path computation engine that automatically determines lowest latency service paths in the network. Depending on policies set by the operator, subscribers can be offered the lowest latency path in the network or a maximum permitted latency can be specified in the subscriber order.

- Service visualization of primary and protection service connectivity assures that the lowest latency service paths are assigned.

- Service latency measurement and service latency performance reporting provide assurance that latency objectives for the service are being met on an ongoing basis. Service latency is measured using Nokia1830 Photonic Service Switch (PSS) optical transport network (OTN) delay measurement and then aggregated into monthly reports. Service latency is measured for both primary and protection paths for a service—enabling operators and their subscribers to assure lowest latency even during network fault conditions.

Rapid integration

A key strength of the Nokia WS-SE application is its ease of deployment and integration into the service provider's environment. Service automation and orchestration solutions often require complex service templates and system integration activities to operationalize the solution for the service provider's service use case. WS-SE provides several capabilities that make rapid and simple deployment possible.

Ready-to-go portals

WS-SE provides productized subscriber portals that enable service providers to give web portal-based service visibility to partner tenants and their customers. These portals ship with the product and require no customization or system integration services to deploy.

Service order workflow customization

WS-SE provides workflow policy settings within the product that enable simple workflow customization. Options such as degree of fulfillment automation, PCE routing policies and order approval options can be controlled with the push of a button by the administrator. No complex service template or workflow development is needed.

Open interfaces

WS-SE provides a fully featured REST API for network operators and tenant partners who want to develop their own service portal solution based on the WS-SE multi-tenant service framework. The WS-SE northbound interface can also be used to facilitate integration with higher level OSS/BSS such as billing systems, customer relationship management (CRM) systems or multi-domain service orchestration systems.

The REST API covers all major service portal use cases exposed through the reference portals, including service virtualization (multi-tenancy, service inventory), service assurance (dashboards, service reporting) and service fulfillment (advertisement, order fulfillment, provisioning). Reference service portals provided with the solution are based on the API.

Options for smart quotes and contracts

WS-SE can be optionally integrated with WaveHub ecosystem partners for smart service quotation and digital contracts.

WavePrime use cases

Optional WavePrime integration services are available to further automate service specification modeling and service location population based on the operator's specific use case.

Technical specifications

Network and services support

Services

- MEF 63 Subscriber Layer 1 Connectivity Services
- Ethernet private line services: GE, 10GE and 100GE
- Synchronous Digital Hierarchy (SDH) services

Equipment

- Nokia 1830 Photonic Service Switch: PSS-8/16/16II/32 R12.05, 13.04, 13.1, 14.0
- Nokia 1830 PSS-24x/8x/12x R12.05, 13.04, 13.1, 14.0
- Nokia 1830 Photonic Service Demarcation (PSD) R3.0, 4.0 (10GE client with 10G OTN uplink)
- Nokia WaveLite R1.1, 1.3
- Nokia 1830 Photonic Service Interconnect – Modular (PSI-M) R5.1, 6.0

Nokia Network Services Platform (NSP) releases

- Nokia Network Functions Manager for Transport (NFM-T) R20.11, 21.4, 21.12
- Nokia Network Resource Controller for Transport (NRC-T) R20.11, 21.4, 21.12

Order codes

Order codes for the Nokia WS-SE are structured using an annual software subscription. Subscription levels are based on a bundled set of features and the service quantity. Subscription levels consist of a Standard subscription, which covers service virtualization and assurance features, and an optional add-on subscription for Level 1 Service Automation, which provides automated service fulfillment.

To simplify ordering, a normalized service equivalent unit (SEU) measure is used to track service quantity. The SEU definition is normalized based on 100G service rate with conversion factors applied for other service rates.

Description	Frequency	Subscription service quantity						
		SEU 25	SEU 100	SEU 250	SEU 500	SEU 1000	SEU 2500	SEU unlimited
WS-SE Standard	Annual	3KC79754AAAA	3KC79755AAAA	3KC79756AAAA	3KC79757AAAA	3KC79758AAAA	3KC79766AAAA	3KC79759AAAA
WS-SE L1 Service Automation	Annual	3KC79760AAAA	3KC79761AAAA	3KC79762AAAA	3KC79763AAAA	3KC79764AAAA	3KC79767AAAA	3KC79765AAAA

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System requirements

- Web portal client: Supported browsers are Chrome, Firefox and Microsoft Edge

- WaveSuite Server – Single Host Deployment:

  - Host OS: Red Hat Linux (RHEL) 7.9

  - CPU: 12 vCPU

  - Memory: 64G RAM

  - Disk: 500G

- WaveSuite Server – Redundant Host Deployment

  - Primary and secondary hosts, each with the same requirements as preceding Single Host Deployment

Related standards

- MEF 63 Layer 1 Subscriber Service

Related materials

- Nokia 1830 PSD

- Nokia 1830 PSI-M

- Nokia 1830 PSS

- Nokia NSP NFM-T/NRC-T

- Nokia WaveLite

Learn more

To learn more about how Nokia WaveSuite Service Enablement applications can help you get new value from optical networks, visit our Optical Networks web page

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