Network Automation with Nokia Transcend Software Suite

Enabling Network Transformation and Unleashing the Power of Open, Disaggregated Optical Transport Networks

Network operators face many challenges:

- The need for bandwidth continues to grow, but operators need to ensure that it results in healthy revenues and margins.
- Technology trends, including cloud computing, data center interconnect, 5G, and the Internet of Things, create new requirements and new types of services that push the boundaries of network functionality and flexibility. These services will also result in more dynamic traffic patterns that are harder to manage.
- End-customer experience expectations keep rising, and there is demand for faster service delivery and compliance to stricter SLAs.
- Services supported by dated, power-hungry equipment that is nearing end of life need to be migrated to new, more economical and modern solutions.

The transport layer is the foundation of networking, and a malleable transport layer, based on high-capacity advanced optical devices that are fully configurable, helps address the issues above. Operators need a transport network that is not only reliable, efficient, and scalable, but also highly programmable, ready for launching new services and opening up new revenue streams – and yet possible to operate in a simple manner.

Network operators are also favoring the adoption of open optical networks, where transponders are disaggregated from the line system, allowing multi-vendor environments that enable fast introduction of innovative solutions in the network, promote supplier diversity, and improve network economics overall. However, the open paradigm defies some of the established ways of operating a network, and a powerful automation platform is mandatory to make the most of it.

Network automation offers the means not just to achieve seamless operation of multi-vendor environments, but also to advance operations with agile and rapid network deployment and configuration (sometimes referred to as NetOps) and to pave the way toward NOC-less network operation.

Complementing Nokia's innovative, best-in-class portfolio of optical transport solutions, Nokia Transcend network automation software enables network transformation and unleashes the true potential of open optical networks. Transcend helps operators overcome their challenges by simplifying network operations, increasing service velocity, and optimizing network resource usage, leading to a superior experience for both operators and end users – even in open environments.

Benefits of Network Automation with Nokia Transcend

- Efficiently utilize network resources with operations based on real-time network information
- Roll out networks fast with process integration that facilitates zero-touch automation and services turn-up
- Speed service velocity by provisioning capacity in real time
- Enable simple and flexible automation architectures and multi-vendor-capable solutions
- Achieve operational simplicity by automating recurrent workflows
- Troubleshoot quickly and effectively with an end-to-end view of services, consolidated performance and fault monitoring, and fault correlation
- Increase network resiliency with support for dynamic, centralized service restoration
- Streamline networks to accommodate network scalability, ensure automated and repeatable service delivery, maximize network reliability, and reduce operational workload

Nokia Transcend Software Suite

The Nokia Transcend software portfolio encompasses a Network Automation Suite and an Open Optical Toolkit to enable operators to smoothly deploy, operate, and automate networks from Layer 0 to Layer 2.5.

- Transcend Network Suite is a set of solutions comprising network design and planning to optimize capital expenditures, as well as broad-scope network management and control to simplify network operation.
- Transcend Open Optical Toolkit is a set of applications developed to ease the deployment and operation of multi-vendor open networks, removing the barriers to open networking and addressing specific network operator pain points.

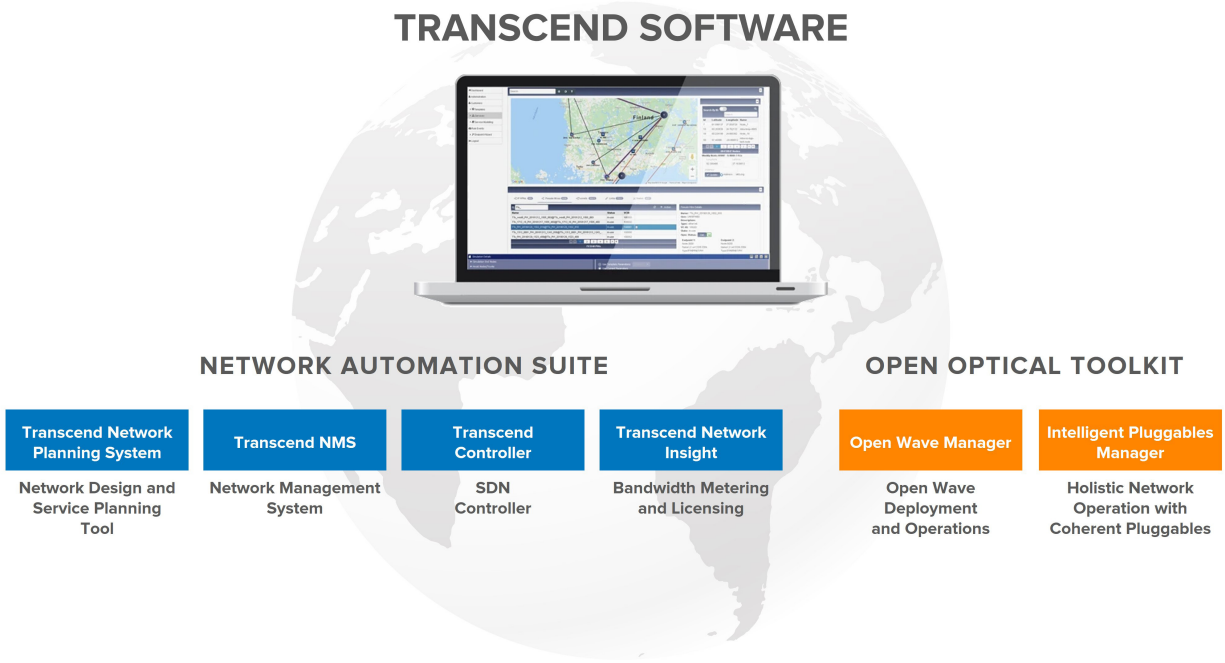

Figure 1: Nokia Transcend portfolio overview

The images shown are for illustration purposes only and may not be an exact representation of the product.

Transcend software is built on cloud-native technologies using microservices-based architectures and supporting container-based deployments for maximum flexibility and ease of deployment.

Transcend Network Suite comprises the following:

- **Transcend Network Planning System: Online Network Design, Capacity, and Wavelength Planning**
  Transcend Network Planning System (TNPS) is a software tool for network design, wavelength and capacity planning, and network optimization. TNPS can be used in the planning and deployment of greenfield optical transport networks, as well as in the upgrade or optimization of a network, link, or channel within an existing network, and for capacity add-ons.

  TNPS includes detailed equipment modeling that can be extended with equipment templates, including parametrization of equipment from third parties. TNPS includes an accurate default optical transmission model that can be replaced with other simulation algorithms (e.g., open-source implementations). TNPS performs multi-layer path computation and network optimization. It generates detailed site deployment packages, including visual equipment views for simplified deployment.

  TNPS is integrated with TNMS and Transcend Controller, enabling online planning functionalities and complementing automation with optical transmission information and capacity planning algorithms.

- **Transcend Network Management System: Network Management and Operations**
  Transcend Network Management System (TNMS) is a management system designed to support end-to-end network operations, including service activation and testing. In addition to discovering network inventory, links, and physical topology, TNMS provides performance monitoring with visualization capabilities such as network heat maps, as well as service and network element fault management, including alarms, event correlation, and root cause analysis. TNMS also automates common network management functions, including commissioning, software upgrades, configuration backup, and user and security management.

- **Transcend Controller: SDN Control**
  Transcend Controller is an SDN controller enabling machine-to-machine automation of optical transport networks and offering intent-based network programmability. Its open, standards-based APIs abstract the technology- and product-specific details of the network and support hierarchical controllers implementing high-performance applications, even for large-scale networks. The network automation APIs offered by Transcend Controller are typically used to perform compound actions in the network that require real-time knowledge of equipment and service status, such as bandwidth on demand, support for network virtualization and slicing, and service (re)routing and restoration.

- **Transcend Network Insight: Instant Bandwidth Support**
  Transcend Network Insight implements automated license management functionalities and bandwidth metering. Network Insight license management enables automated bandwidth license assignment upon service activation. Network Insight bandwidth metering monitors network usage and supports periodic reconciliation of used capacity against entitlements. Together, these functionalities take Nokia Instant Bandwidth application to the next level, supporting software-defined capacity add-ons, automating optical capacity activation, reducing truck rolls to install additional hardware, and speeding up service delivery.

Transcend Open Optical Toolkit currently comprises the following applications, focused on simplifying the deployment and operation of open, multi-vendor networks:

- **Transcend Open Wave Manager: Management of Disaggregated Xponders over Any Optical Line System**
  Transcend Open Wave Manager (OWM) is a software application that makes it operationally simple to deploy, operate, and troubleshoot open wavelengths in disaggregated networks, i.e., Xponders or pluggable optics equipped over a third-party optical line system, including legacy platforms.

  OWM gathers details on the line system nodes and physical topology, as well as any preexisting optical circuits deployed over the line system. It reconciles that line system information with the Xponders, supporting unified visualization and monitoring of all involved network elements, connections, and services – including performance data, resource status, and alarms.

  OWM offers optical connectivity verification between Xponders and line system, as well as end-to-end wavelength and digital service creation, including automated Xponder power setting. Additionally, OWM supports automated fault correlation for troubleshooting open waves.

- **Transcend Intelligent Pluggables Manager:Management of Intelligent Coherent Optical Pluggables in Any Host**
  Transcend Intelligent Pluggables Manager (IPM) is a software application that introduces a new approach to the management of coherent pluggable optics, leveraging the framework defined by the Open XR Optics Forum.

  IPM supports seamless and consistent deployment and operation of coherent optical engines that are not hosted in traditional transport platforms, but in network platforms such as routers, switches, compute platforms, and 5G radio units, in the form of optical pluggables. IPM ensures that intelligent coherent optical pluggables, regardless of their host platform, maintain the operational capabilities that operators are used to when deploying DWDM transponders.

Both IPM and OWM can be deployed as lightweight, purpose-built, standalone software applications. They can also be combined with each other when managing coherent pluggable optics installed in routers, switches, and servers connected by any line system, leveraging the power of coherent optical technology in any platform, across any optical infrastructure.

IPM and OWM can also be deployed as add-ons to TNMS and Transcend Controller, extending their functionality to third-party line systems and/or to environments where intelligent coherent pluggable optics are equipped.

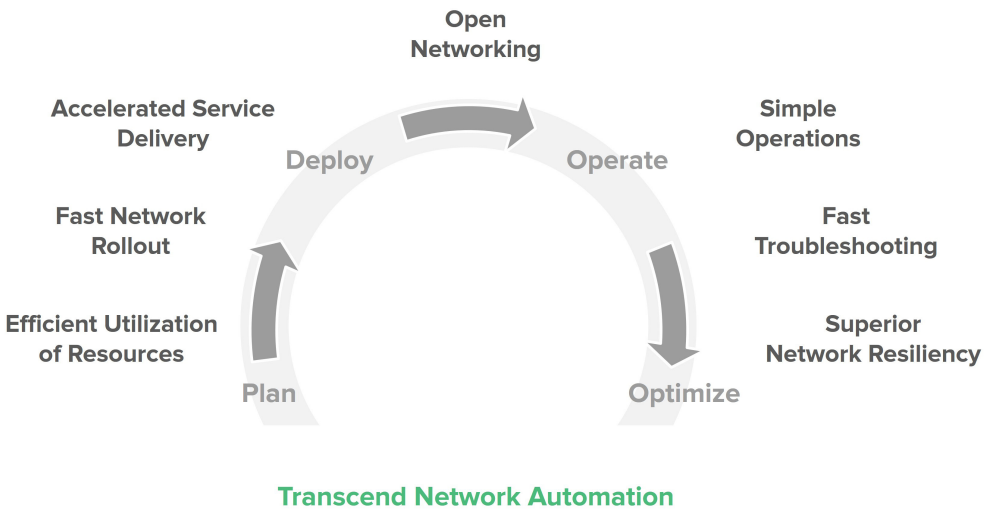

Figure 2: Benefits of Transcend network automation solutions and applications

The Open Optical Toolkit is expected to be extended over time, as Nokia, in close cooperation with network operators, identifies and implements new software applications that remove potential customer pain points of open optical networking.

The Value of Transcend Network Automation

Transcend network automation solutions and applications bring to life a variety of benefits that span the full network equipment lifecycle, from network planning to deployment, operation, optimization, and maintenance:

Efficient Utilization of Network Resources

Transcend software and its engines, such as its path computation engine, can operate based on real-time network information, finding even less-obvious available capacity, and automatically optimizing network resource usage and maximizing the return on infrastructure investment.

Fast Network Rollout

The interworking between the TNPS planning tool and Transcend network management and control systems allows for smooth, software-supported workflows from the network design and link engineering phase to network element commissioning and service provisioning. The integration of these processes facilitates zero-touch network and services turn-up, minimizing the need for human intervention and translating to fewer errors and accelerated network rollout.

Since the planning tool has access to live network status and can retrieve information such as available resources and span loss measurement, it is able to re-optimize the network design. This triggers the generation of new optimized configurations that can be conveyed to the network elements in a simple manner via the management system.

Service Velocity

Transcend software enables the provisioning of new capacity in real time, with visibility over the live network and its optical impairments. A new service, including wavelengths, can be routed on the fly by selecting its endpoints and specifying its characteristics and applicable routing constraints. Together with Instant Bandwidth, Nokia's unique software-activated incremental bandwidth delivery solution, this ensures expedited service delivery and shortened time to revenue.

Automation of Open Optical Networks

The adoption of open, standard data models and interfaces at the network elements together with the use of open, standard models and interfaces at the northbound side of management and control systems enable simple and flexible automation architectures and multi-vendor-capable solutions.

Transcend solutions implement vendor-agnostic APIs at their southbound side, including OpenConfig and Open ROADM, enabling multi-vendor support for the optical transport domain (when complemented by Transcend Open Wave Manager functionality). They also expose the abstracted optical domain network and its functions toward OSS, BSS, or orchestrators via standard northbound interfaces such as ONF TAPI and MEF LSO.

Operational Simplicity

Transcend supports the automation of recurrent workflows by means of simple scripting languages or template-like structures, resulting in a reduction of the effort required to operate the network, as well as in a reduction of the human errors associated with frequently performed tasks.

Fast, Effective Troubleshooting

Transcend's ability to offer an end-to-end view of services, consolidate performance and fault monitoring, and perform fault correlation speeds up troubleshooting in case of transmission deterioration or failures and supports proactive maintenance. The multiple customizable visualization options offered in the TNMS GUI, such as the Micro-topology view, where a service is mapped graphically to all server layers that support it, and the Digital Link Viewer, showing all internal and external ports and cards crossed by a service, are powerful tools to analyze and pin down the root cause of a problem.

Increased Network Resiliency

Transcend's support for dynamic, centralized service restoration, alone or in a hybrid approach that combines centralized and distributed restoration techniques, ensures high network resilience and SLA compliance, while reducing CapEx compared to traditional protection schemes.

Nokia Software Consulting Services

Complementing Transcend automation software, Nokia Software Consulting Services help operators get the most out of the Transcend software and further their operations, administration, and management automation initiatives. These include:

- NMS and SDN design services to ensure seamless and future-proof system integration
- Integration support services for northbound integration of Transcend solutions and applications into OSS/BSS/orchestrators or southbound integration of third-party systems
- Workflow services to evolve business processes to software-supported, highly automated workflows, e.g., by using the results of network analytics to trigger an activity
- Network analytics services to assist operators in collecting, analyzing, and visualizing network data, thus enabling them to focus on the relevant events and patterns

Transcend network automation offers the means to simplify optical network operations for reduced operational costs and fast service delivery. Through optimized resource usage, it enables CapEx savings while ensuring maximum service availability. Complemented by Nokia Software Consulting Services, Transcend addresses all the network automation needs of operators and integrates smoothly into any operational software environment.

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