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Infinera: network automation and orchestration

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RESEARCH

Company summary

Infinera is a networking solutions vendor with hardware and software products covering optical-line systems, packet optical transport systems, cloud networking solutions, network routers and network management and automation applications. It provides solutions to its primary vertical of communications service providers (CSPs) but also to other verticals such as internet content providers, enterprises, governments, research/education institutions and utilities. It is boosting its professional services capabilities related to network automation.

Infinera pioneered photonic integrated circuit (PIC) technology with throughputs of 500Gbit/s for use in fibre-optic networks. It plans to deliver 800Gbit/s ICE6 technology in 2020, including digital signal processors (DSPs) and PICs with 1.6Tbit/s coherent DWDM capacity.

Traditionally a hardware vendor, Infinera is moving further into the software and automation space. Before the second half of 2018, Infinera's automation software suite consisted of Xceed, an open-source-based multi-layer SDN platform for transport networks.

The acquisition of Coriant in October 2018 has enhanced Infinera's focus on software solutions. The Transcend software suite gained in the acquisition consists of a multi-domain orchestrator, an SDN controller, network management and operation automation tools and NFV management solutions. The functionality of Xceed was subsumed into the Transcend solution.

Figure 1: Infinera company facts

Founded	2000
Offices	Sunnyvale, USA – HQ and worldwide
Employees	3000+
Regional focus	Worldwide
Revenue	USD1.3 billion, 2019
Customers	Alibaba, Netflix, Orange, Telia Carrier, Telstra, Virgin Media
Selected key customers	NBN Co, Telefónica, Verizon
Partnerships	EdgeCore, Telecom Infra Project (TIP)

Company summary: financials

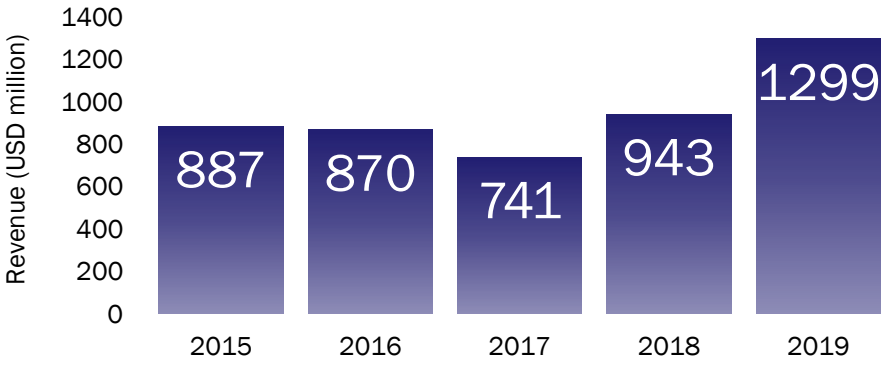
Infinera's revenue declined by 20% during 2015–2017. This decline is attributable to factors such as customer consolidation and changes in network spending patterns, particularly away from long-haul solutions, which are a significant part of Infinera's business. The acquisition of Coriant in October 2018 and organic growth combined to increase revenue by 27% year-on-year from 2017 to 2018. Infinera's revenue increased by 38% to USD1.3 billion in 2019.

Infinera's reported revenue in 2019 was evenly divided between the domestic and international markets. Before the acquisition of Coriant, Infinera's revenue was predominantly generated in the USA.

Products accounted for 78% of Infinera's revenue in 2019. Services account for the balance of revenue, a proportion of which is attributable to product-related services such as installation and lifecycle management.

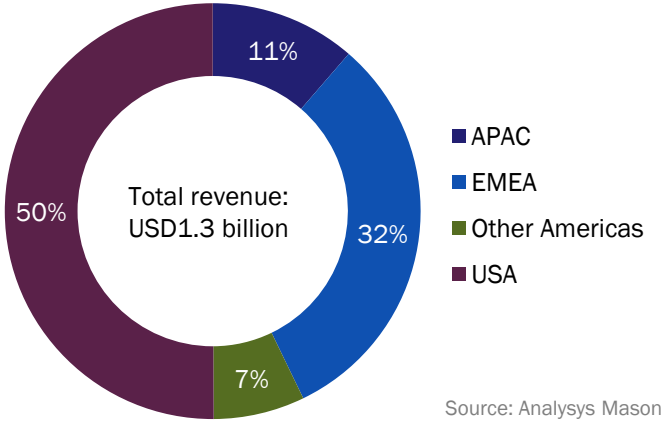
Software accounts for a small share of Infinera's revenue, which Analysys Mason estimates to be around 5% in 2019. Infinera is a product-driven vendor and invested 22% of revenue in R&D in 2019, an increase of 18% compared with the previous year.

Figure 2: Infinera's revenue, worldwide, 2015-2019



Source: Analysys Mason

Figure 3: Infinera's revenue by region, worldwide, 2019



Source: Analysys Mason

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Strategic direction

Infinera's historical differentiation is in optoelectronics but it is increasing its presence in the network software and automation market. Its Xceed software platform was integrated with Coriant's Transcend automation software suite in 2018. The suite enhances Infinera's SDN offering, adding multi-layer control, multi-domain orchestration and MANO for VNFs as well as a growing series of automation applications.

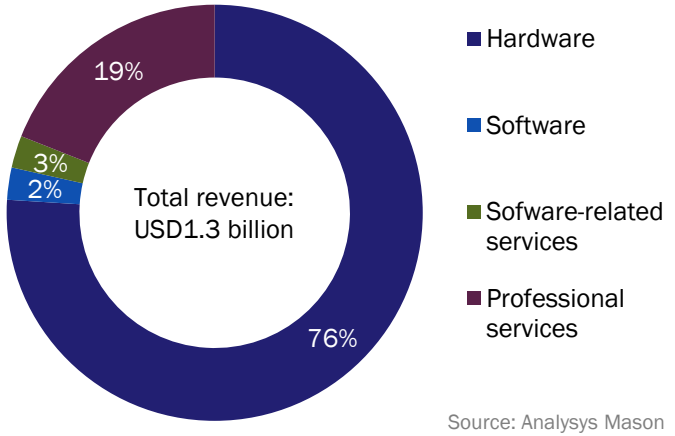
Many of its software deployments include additional services to onboard or to ensure a particular outcome for the deployment. Infinera takes an application-centric approach to automation and advocates for step-wise automation implementation to enable swift progress and return on investment.

It has a growing number of active orchestrator and controller solution engagements, mainly in Europe and North America. The Coriant acquisition increased Infinera's engagements with Tier 1 carriers and is reframing how it positions its products. It announced 10 new Tier 1 customer wins in 2019.

Infinera has moved to a more modular, cloud-native, microservice-based approach to selling its software to enable 'use-what-you-need', easy-to-integrate deployments. Its software is built on an open architecture, which enables a high degree of flexibility to operate in a multi-vendor environment. Solutions can be purchased in an opex (software-as-a-service) model or capex (upfront investment) model, which increases flexibility for customers.

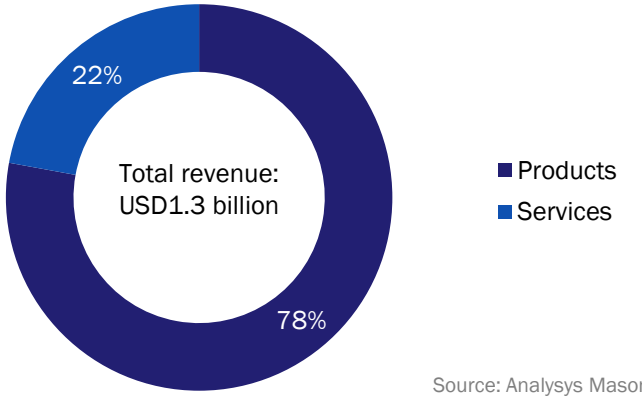
[1] Analysys Mason estimates.

Figure 4: Infinera's estimated revenue by service, worldwide, 2019[1]



Source: Analysys Mason

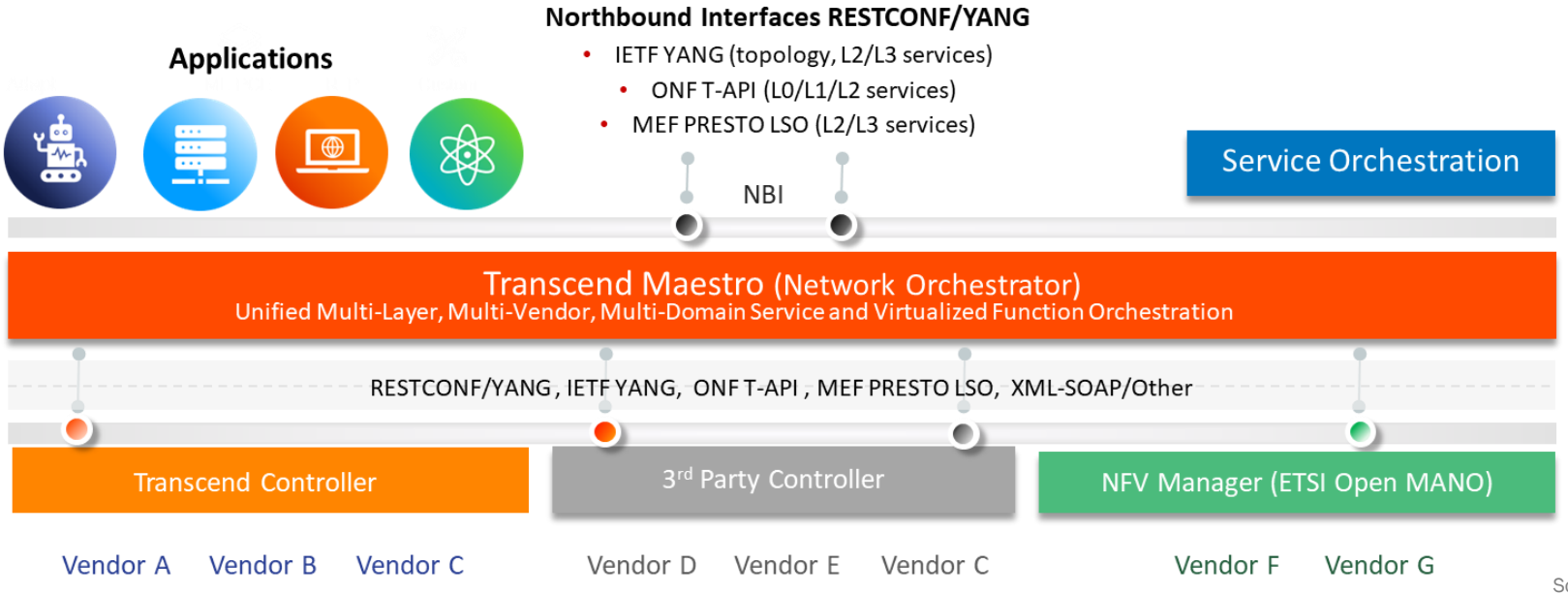
Figure 5: Infinera's revenue by type, worldwide, 2019



Source: Analysys Mason

Solution overview: Transcend Suite

Figure 6: Infinera's intelligent automation portfolio

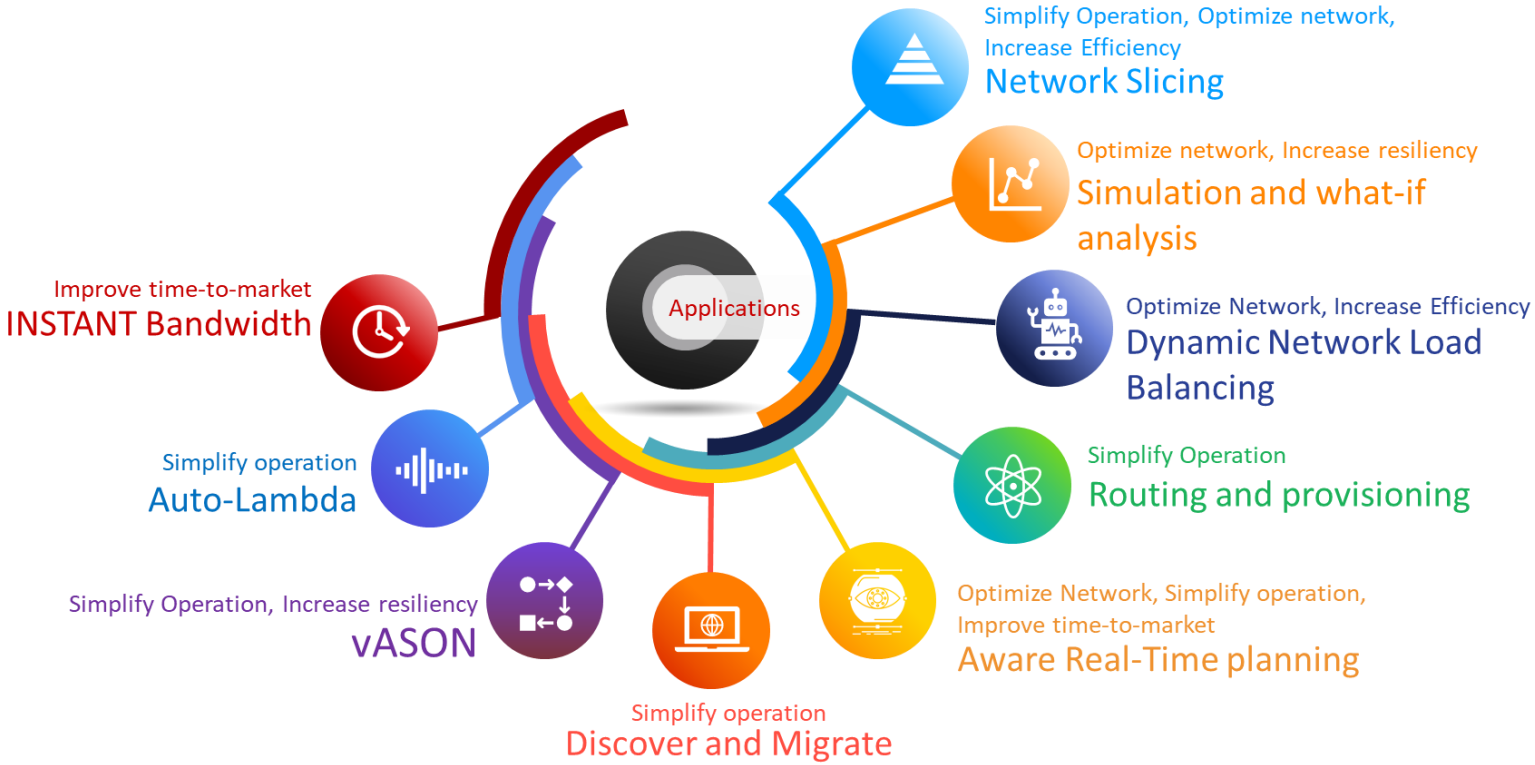


Source: Infinera

Transcend Maestro is a cross-domain network (or service) orchestrator that connects northbound and southbound using open networking interfaces. It can function as a hierarchical SDN controller or a full network orchestrator. Maestro enables network visualisation, monitoring, network configuration and analytics, and it is in conducting customer trials as an NFVO. Infinera has conducted third-party controller integration via open interfaces and has collaborated with third-party NFV managers. The Transcend Controller's features include extendable APIs for integrations and programmable networks; layer 0–3 path computation engine (PCE), which finds network paths based on SLA parameters and specified constraints; a service provisioning engine; a vASON restoration engine; the ADAPT programmable rules engine for customised adaptable networking; analytics and simulation; and logical network partitioning. The controller is also increasingly subsuming NMS functions and Transcend NMS is being integrated into the controller.

Solution overview: Automation applications

Figure 7: Infinera's automation applications



Source: Infinera

Infinera has a practical, application-centric approach to software automation. Its automation applications address specific needs of the customer and can be applied incrementally. The requirements of the application dictate the specific software deployments, for example vASON, a fault monitoring and path computation application, is facilitated by the Transcend Controller. In contrast, applications such as Auto-Lambda can be deployed standalone, although they do benefit from the visibility and monitoring that Transcend provides.

Example case studies [1]:

Modernising Verizon's network

Problem

Verizon's network has legacy equipment with millions of complex TDM circuits across thousands of digital cross-connect systems (DCSs). The network is costly to operate and maintain.

Solution

Infinera's Discover and Migrate SDN-based application was employed. Infinera's tools and professional services team collected data from a wide variety of sources, including textual information to help Verizon to visualise connections and services in its multi-vendor network, then plan and implement the network transformation. The solution uses standardised scripting languages for ease of customisation and it scales to support 100 000 network elements and millions of services.

Results

Verizon is collaborating with Infinera professional services on a multi-regional project to modernise its network and migrate it to Ethernet-based connectivity. To date, benefits include the identification of resources that were idle and could be turned off or removed from service.

Restoring service for NBN Co

Problem

NBN Co has a 60 000km optical network across Australia. It needed to mitigate the risk of simultaneous failures across the network without investing in additional hardware resources.

Solution

Infinera's vASON SDN-based application and the Transcend Controller Path Computation Engine are being certified for use across NBN Co's network. vASON is a centralised control plane for layer 0–3 restoration and increased network resiliency. NBN Co was initially hesitant to use an SDN-based solution, but its fears were allayed when Infinera demonstrated that the solution's capabilities could expose several restoration options from which NBN Co could choose the best.

Results

NBN Co has been able to compute optimal traffic paths in multiple-network-failure scenarios and to improve network quality without new hardware investments. The tool enables NBN Co to customise service-rerouting criteria and constraints to its specifications.

Example case studies [2]:

Tier 1 service provider: end-to-end control

Problem

This Tier 1 service provider needed to gain end-to-end control of its multi-domain, multi-layer (optical and IP) and multi-vendor network, starting with one of its OpCos.

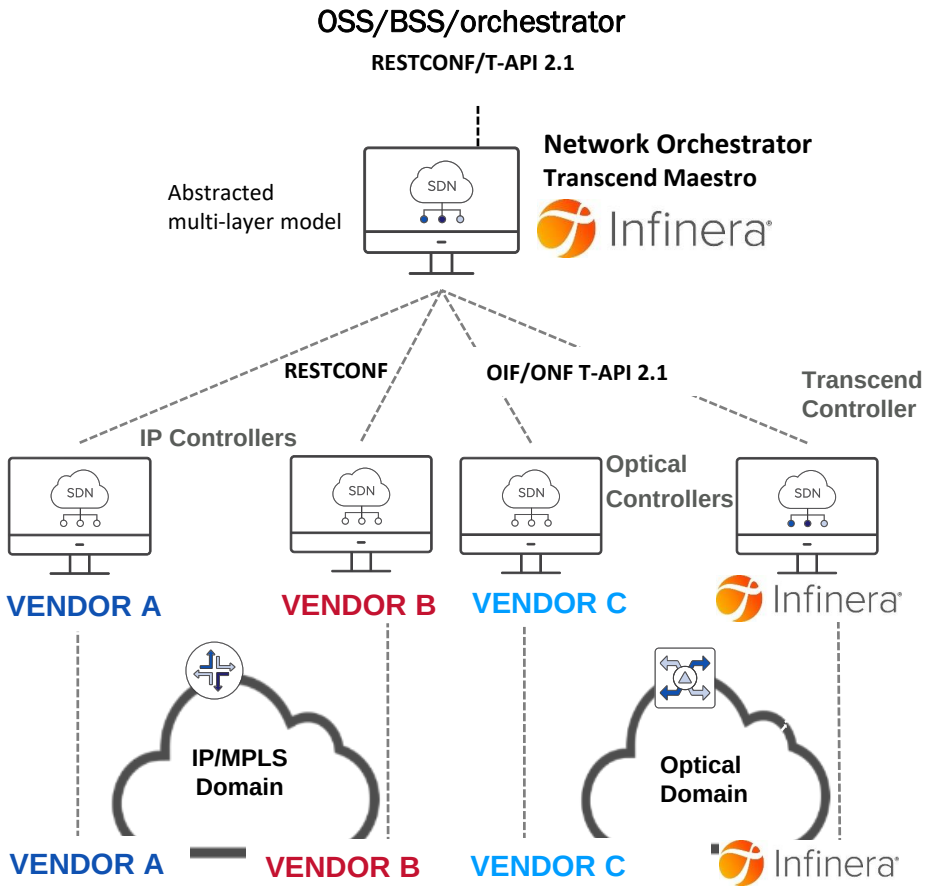
Solution

Infinera supplied its Transcend solution consisting of the Maestro Network Orchestrator and Transcend Controller. The Network Orchestrator is integrated with the Transcend Controller as well as third-party IP controllers and optical controllers via RESTCONF and OIF/ONF T-API 2.1 APIs.

Results

The service provider gained unified network control, enabling the first two of many use cases: automatic end-to-end provisioning of services and complete topology discovery in layer 0–3. Additional use cases are intended to follow including: inventory management, performance management and traffic engineering optimisation.

Figure 8: Transcend's integration into the service provider's architecture



Source: Infinera

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Key acquisitions and mergers

Figure 9: Infinera's key acquisitions and mergers, 2015–2018

Date	Company	Description
August 2015	Transmode	Infinera acquired Transmode, a Sweden-based networking equipment provider specialising in metro packet-optical networking. The transaction was valued at USD350 million and enabled Infinera to offer an end-to-end metro aggregation solution.
October 2018	Coriant	Infinera finalised the acquisition of Coriant for USD230 million. The acquisition brought an extensive line of packet-optical open networking infrastructure solutions, the Transcend software suite and a base of reportedly more than 600 customers to Infinera. The acquisition has had a positive effect on Infinera's revenue and opportunities in international markets.

Product summary

Figure 10a: Infinera's network automation and orchestration products

Product	Analysys Mason segment	Description
Transcend Maestro	WAN SDN Multi-layer control/ cross-domain orchestrator	Transcend Maestro is a multi-layer, multi-vendor control and orchestration platform that enables automation in layer 0–3. It covers multiple domains such as metro, regional and long haul. It supports the integration of third-party SDN controllers. Infinera has reported some VNF manager integration and the ability to do cross-domain SDN and NFV domain orchestration, but to our knowledge the company does not yet have any commercial NFV orchestration deals. It can act as a hierarchical SDN controller or as a full network orchestrator depending on the customer needs and hierarchy. Most active and ongoing implementations are abstracting and automating the physical network.
Transcend Controller	WAN SDN Multi-layer control	Transcend Controller is Infinera's SDN controller for its packet-optical infrastructure products. It enables end-to-end service management. It is supported by Infinera's Aware Technology for optical path computation and Infinera vASON for virtualised multi-layer protection and restoration.
Transcend NMS	NMS/EMS	Transcend NMS is a network and operations management automation tool for Infinera packet optical infrastructure products. Its capabilities include service activation testing, network discovery and service and element fault management. It is increasingly being subsumed into the Transcend Controller, which is taking on more NMS functions.

Figure 10b: Infinera's related software products

Product	Analysys Mason segment	Description
Infinera CNOS	Digital infrastructure Networking software (for white boxes)	Infinera CNOS is a network operating system designed to be disaggregated from routing hardware and run on white boxes. It can be deployed in a number of environments including carrier fibre networks (such as for mobile network cell site backhaul), cloud and enterprise networks. It can be sold independently of Infinera disaggregated hardware solutions such as the DRX series white boxes that were designed in collaboration with its partner EdgeCore.

Significant customers [1]

Figure 11a: Infinera's named network automation and orchestration and related customers

Customer	Country	Date	Scope
Verizon	USA	May 2019	Infinera supplied US CSP Verizon with the Transcend Discover and Migrate automation application. The software-based automation tools and professional services enable Verizon's efficient migration from a time-division multiplexing and SONET optical network to a simpler Ethernet-based optical network. In a parallel project, Infinera is integrating its "open API- and YANG-driven date modelling software capabilities" into Verizon's Base Network Controller (BNC, a network telemetry data collection point) to allow operations lifecycle automation of its programmable optical infrastructure based on open networking principles.
Telefónica	Germany	September 2019	Infinera provided Telefónica Deutschland with its DRX series white box platform and CNOS software for a disaggregated routing solution. The solution will help Telefónica to transition to an open network and upgrade its transport network in preparation for rolling out 5G.
NBN Co	Australia	September 2019	Infinera announced that NBN Co would deploy its Transcend Controller solution with vASON across its 60 000km fibre network to increase service availability to customers in remote locations and increased network resiliency for customers migrating to the new network.
GtD	Chile	October 2019	GtD deployed Infinera's Transcend Controller to act in the L0–L1 domains along with various optical transport solutions to increase capacity in its terrestrial and subsea networks. Work is ongoing and the priority use cases are yet to be determined.

Significant customers [2]

Figure 11b: Infinera's undisclosed network automation and orchestration and related customers

Customer	Region	Scope
Undisclosed CSP	NA	Real-time planning, automated management and service provisioning with Transcend Controller
Undisclosed CSP	NA	Automated management and service provisioning with Transcend Controller
Undisclosed CSP	EMEA	Multi-vendor management and service provisioning with Transcend Controller
Undisclosed CSP	EMEA	Closed-loop automation with Transcend Controller
Undisclosed CSP	EMEA	Multi-vendor management and service provisioning with Transcend Controller
Undisclosed CSP	LATAM	Multi-vendor management and service provisioning with Transcend Controller
Undisclosed CSP	LATAM	Layer 0 restoration with Transcend Controller
Undisclosed CSP	LATAM	Automated management and service provisioning with Transcend Controller
Undisclosed CSP	APAC	Layer 0 restoration with Transcend Controller
Undisclosed CSP	APAC	Automated management with Transcend Controller
Undisclosed CSP	APAC	Layer 2 restoration with Transcend Controller
Various CSPs	Various	More than 10 ongoing trials spanning Infinera use-cases including multi-vendor, multi-layer management and service provisioning with Transcend Maestro and/or SDN control and service restoration with Transcend Controller.

Analysis: strengths, weaknesses, opportunities and threats

STRENGTHS

- The acquisition of Coriant brought Infinera a large, established customer base to add to its existing base and build upon.
- Infinera's SDN solutions are based on open architecture and open-source software. They are programmable and modular, making them easy to integrate with third-party software and hardware, and extend Infinera's market reach to operators beyond its packet-optical infrastructure footprint.
- Infinera is taking a pragmatic and what it calls "light and thin" approach to network automation that lets its customers evolve to an SDN-based approach one step at a time.

OPPORTUNITIES

- Infinera's incremental, application-based approach to SDN and network automation aligns with most CSPs' dislike of 'big bang' transformations.
- Some automation applications, notably Auto-Lambda, which is pluggable-optics based, do not require Transcend, but do enable Infinera to upsell Transcend's broader functionality and more applications over time.
- Analysys Mason expects vendor revenue in the non-NMS part of the network automation and orchestration market to increase at 42% CAGR during 2018–2023.[1] Infinera has an opportunity to establish itself in this market.
- Infinera's Telefónica CNOS win gives it the opportunity to use its mobile backhaul expertise and challenge the established router market.

WEAKNESSES

- Automation software is a very small part of Infinera's business. It still needs to truly establish itself within the network automation and orchestration market.
- Infinera has focused on SDN-based automation, which is directly linked to its packet-optical WAN infrastructure strength. It is not clear how it can differentiate itself as it expands its focus to NFV applications.
- Infinera's nascent network automation-related professional services capabilities are a well-kept secret. It needs to be more effective in marketing these capabilities and expanding industry perception of it as a packet-optical infrastructure specialist.

THREATS

- Infinera is smaller than many of its key packet-optical rivals such as Cisco, Ciena, Huawei and Nokia, all of which are also expanding from packet-optical networking into network automation applications.
- In the disaggregated NOS market, Infinera faces competition from Cisco and Juniper as well as a varied set of players such as Adva, Big Switch, Cumulus Networks, IP Infusion (OcNOS) and Pica 8 as well as open source solutions such as OpenSwitch (OPX NOS) and operator in-house developments.

[1] See Analysys Mason's *Network automation and orchestration: worldwide forecast 2019–2023*. Available at www.analysysmason.com/nao-forecast-rma07.

About the authors

Dana Cooperson (Research Director) is the research director for Analysys Mason's six software and networks technology research programmes. Her team's mission is to help customers to progress toward and benefit from a more automated, autonomous, cloudified future, rather than be threatened by this market shift. Her areas of expertise are intelligent fixed and mobile network infrastructure, automation and operations. Dana's research and consulting focuses on the communications software/network market and technology best practices required for digital business transformation and enabled by the integration of NFV, SDN and other IT technologies for virtualisation, cloudification and automation.

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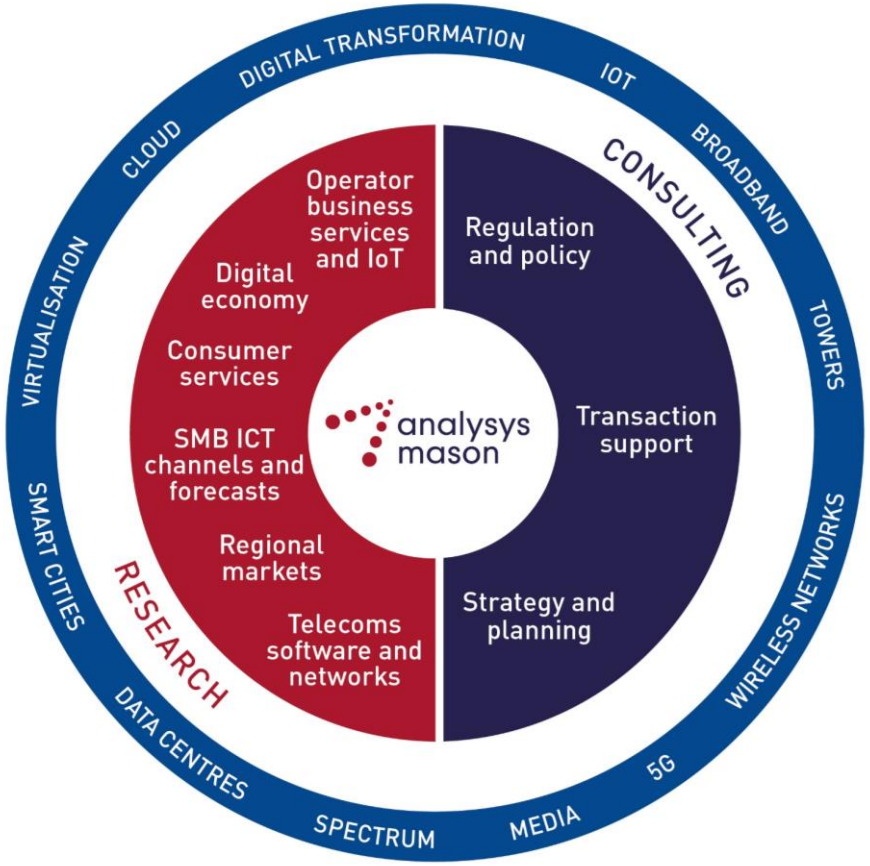

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