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Interoperability of B100G Capabilities Enabled by OpenROADM MSA to be Demonstrated at OFC 21 in San Francisco, CA, on June 7-11, 2021

At this year's Optical Networking and Communication (OFC) Virtual Conference and Exhibition, a group of OpenROADM MSA (Multi-Source Agreement) members is proudly demonstrating optical network equipment elements from multiple suppliers that seamlessly interoperate at data rates up to 400G by means of the public OpenROADM MSA standards defined for both the optical data plane and control plane. Participants include AT&T, Ciena, Cisco, Fujitsu, Infinera, Juniper, Nokia, Orange, and Ribbon together with the researchers at the OpNeAR laboratory at the University of Texas at Dallas.

This collaborative effort showcases a fully automated and fully federated edge computing infrastructure that takes advantage of the latest functionalities defined by the OpenROADM MSA. These new functionalities are utilized in the optical network equipment provided by six suppliers. The demonstration features interoperable ROADM nodes (from three of the six suppliers), collectively hosting a combination of 100G flexponders, OTN (Optical Transport Network) switches, 100G transponders, and 400G transponders/muxponders.

Based on the first version of OpenROADM 400G W specifications released at the end of 2020, OEM suppliers have now delivered their 400G OpenROADM compliant products that are showcased for the first time in this demonstration. This is a major step towards the development of open transport for B100G. Flex-grid capabilities are also supported by OpenROADM and applied to demonstrate end-to-end 400G wavelength connectivity. Along with B100G services, this demonstration also showcases full interoperability of other services – such as 1G, 10G (OTN), and 100G (WDM) using OpenROADM models – which combined offer a rich set of options to be leveraged in the federated edge computing use case. While moving towards higher bit rates (and baud rates) continues to pose significant challenges to open standards, this demonstration is the first concrete step towards this important goal.

The implemented optical data plane specifications are available on the OpenROADM.org download page along with the YANG data models that define the control plane interoperability APIs (Application Programming Interfaces). Combined, these features enable easy plug-and-play of different supplier's hardware.

The MSA forum brought together experts from different operators and suppliers to collaborate on a common goal. The multi-vendor environment creates an opportunity to work with the best minds in the optical transport network industry to define specifications, build innovative solutions and products that can interoperate and provide choices to network operators.

“AT&T has started deployment of OpenROADM MSA compliant (<http://OpenROADM.org>) optical network equipment in metro areas with 400G capable nodes that utilize 100G client and 400G client signals to follow soon. This is a significant milestone and industry game changer considering that historically fiber optic networks have been predominantly based on proprietary single-supplier solutions in geographical areas,” says Janet Peng, Director, Network Core Infrastructure Services at AT&T.

MSA members are working to push beyond the initial 100G multi-vendor interoperable network. MSA has to address challenges to balance between the need for more robust specifications by operators and the extent of inter-op requirements that inherits the constraints and limits of each design/implementation within the inter-op group.

“As a founding member and key contributor to OpenROADM MSA, Ciena is committed to supporting our customers on their digital journey, enabling open, scalable, and automated networks that can easily evolve to 400G, 800G, and beyond,” says Brodie Gage, Ciena’s Vice President of Product Line Management.

“The most important proof point for any industry initiative is vendor adoption,” says Ronald Johnson, Cisco’s Senior Director of Optical Product Line Management. “As a member of OpenROADM, Cisco believes simplification and open networking are essential to deploying open, scalable and programmable networks.”

“Open ecosystems are pillars of network transformation,” says Rod Naphan, Chief Technology Officer at Fujitsu Network Communications. “With Fujitsu’s leadership in multivendor interoperability and 400G connectivity, the Open ROADM MSA continues to drive toward faster pace innovation and competition.”

“OpenROADM continues to advance open and disaggregated networking, enabling operators and vendors to accelerate technology introduction into ever more demanding network environments,” says Zeljko Bulut, Senior Director, Product Line Management at Infinera. “The standardized and well-defined interoperability requirements being showcased at OFC 21 will significantly reduce operational efforts for network operators to ease new technology integration and vendor interoperability. With a commitment to open networking, we are pleased to drive these requirements with our OpenROADM membership and welcome the opportunity to showcase our market leading technology.”

“As a leader in Optical Networking and a founding member in the Open ROADM MSA, Nokia drives and supports the development of standardized open interfaces and agnostic protocols like those defined by the OpenROADM MSA community,” says Giovanni Manto, Vice President,

Nokia Optical Networking. “In this demo, Nokia has showcased the 1830 PSS-8x Open OTN solution based on a 1.6Tb nonblocking switch fabric operating within a multi-vendor OpenROADM line system environment to deliver high-capacity wave services. Operators may now cost-effectively meet the growing demand for wave services while improving service provisioning times.”

“Optical networking is evolving to meet the needs of a diverse community. Being part of the OpenROADM movement aligns with our goal to offer customers various levels of flexibility in the design, planning and management of their optical networks,” says Rafi Leiman, Vice President of Product Management for Ribbon. “OpenROADM is particularly important because it supports not only an open control plane, but also interoperability in the data plane.”

“OpenROADM standards help service providers meet the challenges of building scalable and future proof optical infrastructures. Operators can leverage openness and interoperability to speed up development and share the associated effort, and disaggregation to cope with the different pace of innovation in optical technologies,” says Gilles Bourdon, Vice President, Wireline Networks and Infrastructure at Orange. “TransportPCE, the optical domain SDN (Software Defined Networking) controller used in this demonstration, is also an example of how open source contributes to accelerating innovation.”

Introduced in OpenDaylight Fluorine, it provides in the Silicon release network automation for both the WDM and OTN layers, and offers a reference implementation for OpenROADM based optical networks.

Through its northbound RESTCONF interface, the TransportPCE controller communicates with the UT Dallas PRONet (Programmable Optical Network) SDN orchestrator, providing a single point of control and coordination of resources across the OpenROADM optical layer and the client layer – which is comprised of Ethernet switches and datacenter/edge compute nodes.

“In this demonstration, the PRONet orchestrator automatically and sequentially initiates actions that are required to operate a federated edge computing system. Compute resources at multiple edge sites are dynamically aggregated together to form distributed super-cloudlets to best respond to varying application-driven loads. In its simplest form, a super-cloudlet consists of compute resources available at two edge computing sites, or cloudlets, that are interconnected by dedicated optical circuits deployed to enable low-latency and high data rate exchanges. The PRONet orchestrator offers three key functionalities of the demonstrated super-cloudlet architecture, i.e., service placement, auto-scaling, and offloading,” says Behzad Mirkhanzadeh, Ph.D. Candidate and Research Assistant at the University of Texas at Dallas.

The super-cloudlet architecture is experimentally demonstrated over the largest public OpenROADM optical network testbed to date, jointly leveraging a number of repurposed TACC Stampede servers connected to Ethernet switches through custom designed cables from Approved Networks that provide 40G connectivity to each server.