Infinera Groove G30 Network Disaggregation Platform – Muxponder

Innovative Connectivity Solution

The Infinera Groove G30 Muxponder (MUX) is a configuration of the Groove G30 Network Disaggregation Platform. Delivering 4.8 terabits of capacity in a compact 1RU form factor, the Groove G30 MUX solution simplifies the provisioning of 10G, 40G, 100G, and 400G wide area network (WAN) cloud connectivity services for metro, regional, and long-haul DWDM transport applications. Designed to meet the scalability requirements of today's cloud and data center networks, the Groove G30 MUX features the industry's most compelling pay-as-you-grow approach that enables the lowest initial costs, reduced equipment sparing costs, and cost-effective scalability.

The Groove G30 MUX achieves its leading performance advantage by leveraging the latest innovations in high-speed optics, photonic/electrical integration, and silicon photonics. Modeled after proven data center operations practices, the user interfaces and management tools of the Groove G30 MUX feature simple task-based procedures and server-like ease of use. Purpose-built to cost-effectively power a better end-user cloud experience and manage growing data traffic volumes to and between data centers, the Groove G30 MUX sets new benchmarks in interconnectivity performance.

FEATURING MODULARITY AS A BUSINESS ENABLER

The Groove G30 MUX is based on the innovative three-tier modular architecture of the Groove G30 Network Disaggregation Platform, providing a number of competitive advantages to data center interconnect (DCI) and telecom network planners and architects. Four service slots in the Groove G30 1RU chassis support up to four single-slot sleds/modules or two double-slot sleds/modules that are field replaceable, individually configurable, and hot swappable. One 1.2 Tb/s sled and three 400G sleds (or field replaceable units [FRUs]) are currently available for MUX applications: two single slot and two dual slot. The single-slot 400G Coherent Module 1 (CHM1) and 400G Coherent Module 1G (CHM1G) can be equipped with up to two 200G line-side interfaces (CFP2-ACO pluggables) and up to four 100G client-side interfaces (QSFP28 pluggables).

Service Modules: 400G CHM1/CHM1G, 400G CHM2, 20 x 10G/2 x 100G Transponder/ Muxponder Module (XTM2), 1.2 Tb/s CHM2-T Module

BENEFITS OF THE INFINERA GROOVE MUXPONDER

- **Supports** 2.4 Tb/s client-side and 2.4 Tb/s line-side traffic in a compact, high-density 1RU platform, enabling cost-effective scaling of data center transport capacity up to 38.4 Tb/s per fiber and up to 201 Tb/s per 42RU rack

- **Offers** leading energy efficiency due to ultra-low power consumption of less than 0.16 W per 100G, including CFP2-ACO and client optics, by employing state-of-the-art dual-carrier 600G coherent DSP and recent advancements in photonic integration

- **Enables** the lowest first-in cost 10G, 40G, 100G, and 400G services with an innovative three-tier modular architecture for capacity growth that includes differentiated pay-as-you-grow service planning and rollout and supports the lowest cost for on-site passive and active sparing

- **Delivers** a truly open platform free of proprietary software and hardware components for rapid introduction and integration within any data center or telecom operating environment, along with seamless interoperability with any existing metro or long-haul line system, with the support of Open ROADM

- **Leverages** optical reach and spectrum programmability with line-side support for 600G 64QAM, 200G 16QAM, 200G 8QAM, 150G 8QAM, and 100G DP-QPSK

- **Provides** open APIs for rapid automation and integration within any IT operational environment to enable fast service roll-out and activation

Infinera Groove G30 Muxponder

The two-slot 400G Coherent Module 2 (CHM2) can be equipped with up to two 200G line-side interfaces (CFP2-ACO pluggables) and supports a mix of 10G, 40G, and 100G clients (QSFP28 and QSFP+ pluggables), while the two-slot 1.2 Tb/s Coherent Module 2-T (CHM2-T) can be equipped with up to two 600G line-side interfaces and supports a mix of 100 GbE/OTU4 (QSFP28 LR4, SR4, PSM4, CWDM4, AOC) and 400 GbE (QSFP-DD-56) client interfaces. The sleds/modules and pluggable interfaces can be purchased and deployed one at a time as required.

KEY ADVANTAGES OF THE INFINERA GROOVE G30 MUX MODULAR ARCHITECTURE

- The lowest first-in cost for any single service (10G, 40G, 100G, 400G, or a combination) compared to the competition

- The most economical pay-as-you-grow concept, enabling incremental in-service service capacity growth from 10 Gb/s up to 2.4 Tb/s in 1RU

- Among the lowest power consumption in the industry at ~0.16 W/G

- The only commercially available compact disaggregated platform to support mix-and-match client/line AND photonic sleds in a compact 1RU platform

- Longest transmission of a 600G wavelength in a live Tier 1 network at 250 km

- Flexibility to mix and match 10G, 40G, 100G, and 400G clients according to network demand

- Power-as-you-grow with no phantom power drain for unused capacity

- Significant increase in network availability compared to non-modular solutions that require a complete chassis replacement

- The simplest and lowest-cost sparing concept of all products on the market

- The lowest sparing cost per site of all competitive products (one SKU per sled for the entire C-band)

- Rapid adoption and deployment of future technologies with new sleds without the need to replace and discard the entire chassis, thus preserving hardware investment

LEVERAGING PROGRAMMABLE MODULATION FORMATS

Powered by Infinera CloudWave T Optics, the Groove G30 MUX supports programmable DWDM line interface bandwidth and performance to optimize high-capacity transmission from 100G to 600G in metro, regional, and long-haul applications. The Groove G30 MUX features five different user-programmable line rate/modulation formats to further cost-optimize each network design for optimal transparent reach and fiber spectrum utilization. Each of the eight Groove G30 MUX line-side ports can be independently configured as 100G DP-QPSK, 150G 8QAM, 200G 8QAM (CHM1G only), 200G 16QAM, or 600G 64QAM.

Pairing the Groove G30 MUX with the Groove G30 OLS, which features pluggable form factor amplifiers, variable optical attenuators, power monitoring, combiners, splitters, WSS, and all other optical layer functions, is the simplest, most flexible, and most efficient DWDM transport solution currently available.

Infinera Groove G30 Open Line System
Purpose-built as a disaggregated and compact open line system to manage surging data traffic volumes, the Infinera Groove G30 Open Line System (OLS) solution is a configuration of the Groove G30 Network Disaggregation Platform and leverages innovative Infinera Pluggable Optical Layer devices. Through the Groove OLS configuration, network operators and cloud and data center operators can build their own customized, scalable optical line solution with best-in-class functions, all enabled through open APIs.

Key benefits of the modular solution include:

- **Open line system** – prevents vendor lock-in by disaggregating the optical layer from the transmission layer and enables the Groove OLS to be paired with Groove or third-party transmission/transponder layer solutions. It also supports the Open ROADM Multi-Source Agreement (MSA) for seamless interoperability with third-party optical vendors in various optical configurations.

- I**ndustry-leading optical layer density** – supports up to 96 channels in 1RU with full WDM terminal functionality, including passive and active optical layer functions, delivering three times the density of comparable solutions and enabling significant OpEx savings via minimized footprint and power-efficiency.

- **Unmatched configuration flexibility** – enables "build your own optical layer" based on plug-and-play configurable technology for coherent or direct detect (PAM4) applications, including a diverse range of optical layer functions in compact modular pluggable formats such as multiplexing/demultiplexing, preamplifier, booster amplifier, local add/drop amplifier, optical channel monitoring, optical protection, OSC, OTDR, and tunable DCM functions.

- **Open management** – shares common YANG model-based NETCONF and RESTCONF, and other northbound management and control interfaces of the Groove G30 for fast deployment and ease of integration into any OSS environment.

Modulation Scheme	Application	Rate	Fiber Capacity	Reach	Forward Error Correction
DP-QPSK	Long-haul/ Submarine	100 Gb/s	9.6 Tb/s	Up to 5,000 km/11,000 km	Up to 25% SD-FEC
8QAM	Regional	150 Gb/s	19.2 Tb/s	Up to 2,000 km	Up to 25% SD-FEC
8QAM	Metro, Regional	200 Gb/s	25.6 Tb/s	Up to 2,000 km	Up to 15% SD-FEC
16QAM	Metro, Metro Edge	200 Gb/s	25.6 Tb/s	Up to 1,200 km	Up to 25% SD-FEC
64QAM	Metro	600 Gb/s	38.4 Tb/s	Up to 250 km	Up to 27% SD-FEC

SUPPORTING PROGRAMMABLE WAVELENGTHS

Each of the eight Groove G30 MUX line-side port wavelengths can be independently tuned over the entire C-band to support either a 96- or 128-channel plan. In addition, the Groove G30 MUX supports multi-carrier super-channels for increased spectral utilization and seamless interworking with all of Infinera's flexible grid-capable line systems, including the Groove G30 OLS, Infinera 7100 Nano Packet Optical Transport Platform for metro WAN interconnectivity applications, and Infinera 7300 Series Multi-Haul Transport Platform for long-haul WAN interconnectivity applications, as well as any third-party line system that supports either fixed-grid or flexible spectrum provisioning. The wavelength tuning and optical interface parameters are configurable via command line interface (CLI), WebGUI, SNMP, and NETCONF. Optional management and control are available through Infinera Transcend Software Suite, including the Infinera Transcend Network Management System (NMS) for Transport and Infinera Transcend Software-defined Networking (SDN) solution.

SIMPLIFYING INTEGRATION AND OPERATION IN CLOUD AND DATA CENTER ENVIRONMENTS

The Groove G30 MUX provides standards-based interfaces that simplify integration and operation within cloud and data center environments, including support for open northbound interfaces (NBIs) and APIs. The supported interfaces include CLI, WebGUI, SNMP fault and performance management, Syslog, zero-touch provisioning (ZTP), NETCONF, RESTCONF, and gRPC machine-to-machine APIs. The Groove G30 MUX provides a set of native YANG models that can map into any industry-standard or proprietary YANG model. These interfaces enable the rapid integration of the Groove G30 MUX into traditional telecommunications environments and data center SDN environments. The Groove G30 MUX is fully integrated with Infinera planning, management, and control solutions, including the Infinera Transcend Software Suite and Transcend NMS.
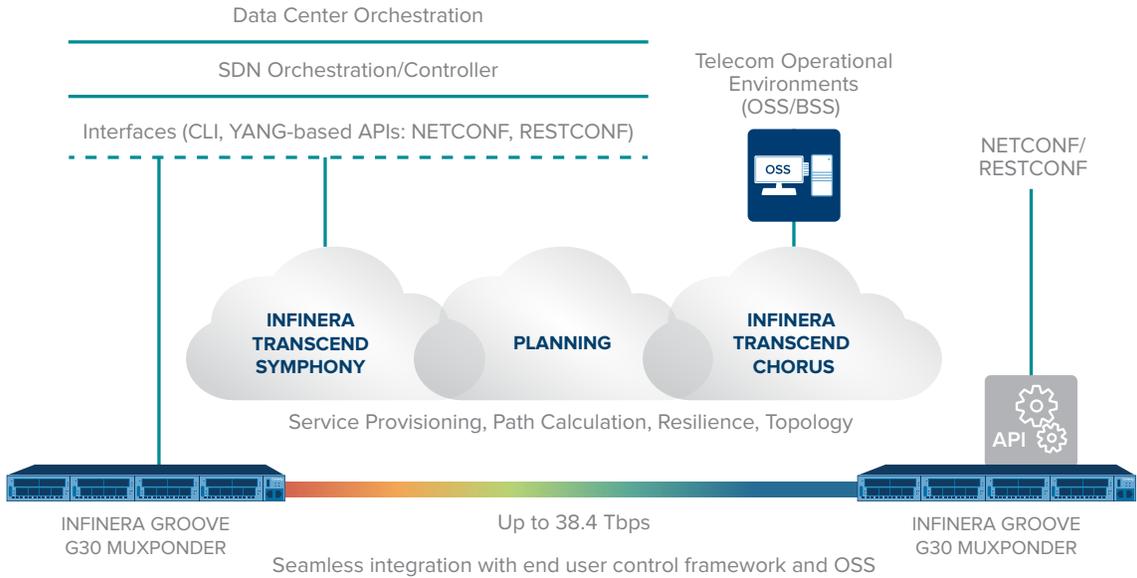

Figure 1: Infinera Groove G30 MUX Management and Control

Deploying over Third-party Line Systems

The Groove G30 MUX is based on open protocols and industry standards, including Open ROADM, to interwork with almost every third-party metro and long-haul line system currently deployed. This architecture enables the advanced transmission capabilities and benefits of the Groove G30 MUX to be added to existing deployments. As a purpose-built WAN transmission system, the Groove G30 MUX disaggregates the transponder and muxponder functions of the traditional telecom transport network element that also includes ROADM and optical amplification to enable rapid deployment in any existing network.

Physical Dimensions
• 440 x 43.7 x 510 mm/17.32 x 1.72 x 20.08 in (W x H x D)
• Supports 600 mm depth with cabling
• Rack installation into two- or four-post standard 19-inch, 21-inch, and 23-inch racks
• Height: 1RU
• Weight: 6.4 kg/14 lb for 3.2 Tb/s configuration without pluggables

System Capacity and Scalability
• Maximum line-side capacity: 2.4 Tb/s
• Maximum client-side capacity: 2.4 Tb/s
• Maximum capacity per fiber: 38.4 Tb/s
• Maximum capacity per rack: 201.6 Tb/s

System Configuration and Modularity
• Four individually configurable and hot-swappable single-slot FRUs (400G sleds CHM1/CHM1G)
• Three individually configurable and hot-swappable dual-slot FRUs (1.2T CHM2-T, 400G sled CHM2, or 20 x 10G muxponder unit XTM2)
• Single-slot FRUs (400G sleds) and dual-slot FRUs (400G or 1.2T sleds) can be mixed within the same system
• Up to eight CFP2-ACO pluggables (100G/150G/200G)
• Up to 24 x QSFP28 pluggables (100G)
• Up to 20 x QSFP+ pluggables (4 x 10G/40G)

Service Modules/Sleds
• Single-slot 400G Coherent Module 1 (CHM1/CHM1G) FRU
  • Two 200G line-side CFP2-ACO pluggable interfaces
  • Four 100G client-side QSFP28 pluggable interfaces
• Dual-slot 400G Coherent Module 2 (CHM2) FRU
  • Two 200G line-side CFP2-ACO pluggable interfaces
  • 10 x QSFP28/QSFP+ client pluggable interfaces with a total capacity of 200G supporting a mix of 10G, 40G, and 100G client interfaces
  • 20 x 10G clients are supported via the use of a 4 x 10G breakout cable per 40G client interface

• Dual-slot 1.2T Coherent Module 2-T (CHM2-T) FRU
  • Two 600G line-side interfaces
  • 12 x QSFP28 (LR4, SR4, PSM4, CWDM4, AOC) or three QSFP-DD-56 client pluggable interfaces, with a total capacity of 1200G supporting 100 GbE/OTU4 and 400GbE client interfaces
• Dual-slot 20 x 10G/2 x 100G Coherent Transponder/Muxponder (XTM2) FRU
  • Two 100G QSFP28 pluggable interfaces
  • 20 x 10G SFP+ client interfaces
  • Can be used as 10 x 10G transponder or regenerator

Electrical Power
• Less than 0.20 W per 100G
• AC PSU input voltage range 100 to 240V AC 50/60 Hz, 1:1 FRU redundancy
• DC PSU input voltage range -40 to -72V DC, 1:1 FRU redundancy
• HV DC PSU, 1:1 FRU redundancy

Cooling and Fans
• Front to back straight through air flow
• 4:1 FRU fans, indefinite operation with a single fan failure
• Filler cards required in unused slots

Management and Console Ports
• Two RJ45 front access
• Two RJ45 rear access
• One USB front access
• Field-replaceable SD memory card

In-band General Communication Channel (GCC) Support
• Support for GCC0 online port OTUk (CHM1/CHM1G/CHM2)
• Two GCC channels per module (CHM1/CHM1G/CHM2)

Client-side Interfaces 400G
• QSFP-DD-56 for 400 GbE

Client-side Interfaces 100G
• QSFP28 SR4 (100 m) 100 GbE
• QSFP28 LR4 (10 km) 100 GbE
• QSFP28 LR4 (10 km) Dual Rate (100 GbE and OTU4)
• QSFP28 CWDM4 (2 km) 100 GbE

• QSFP28 PSM4 (500 m) 100 GbE
• QSFP28 ER4 (30 km) 100 GbE
• QSFP28 4 x 8G/16G Fibre Channel (SMF) (10 km)
• QSFP28 Active Optical Cable (3 m and 10 m) 100 GbE

Client-side Interfaces 10G/40G
• QSFP+ SR4 (100 m) 40 GbE and 4 x 10 GbE
• QSFP+ LR4 (10 km) 40 GbE
• QSFP+ LR4 (10 km) 40 GbE and OTU3, and 4 x 10G with support of OTU2 and OC-192
• QSFP+ IR4 (2 km) 40 GbE
• QSFP+ LR4 (10 km) 4 x 10 GbE for 40 GbE <-> 10 GbE with breakout fiber (without cable), OTU2/2e, and OC-192/STM-64
• QSFP+ eSR4 (300 m) for 40 GbE <-> 10 GbE with breakout fiber (without cable)
• QSFP+ ER4 (40 km) 40 GbE and 4 x 10 GbE (10 GbE, OC-192, OTU2/2e)
• QSFP+ 8G/16G Fibre Channel (reach 190 m/125 m)
• SFP+ 10 GbE/8G/10G Fibre Channel (LR 10 km and SR 300 m)
• SFP+ 1310 nm multi-rate SR1, 1310nm (reach 450 m)

Line-side Interfaces
• Tunable C-band coherent optical transceiver (100G QPSK, 200G QPSK, 200G 8QAM, 200G 16QAM, 400G 32QAM, 600G 64QAM)
• Tunable C-band CFP2-ACO coherent bidirectional optical transceiver
• Tunable C-band CFP2-ACO coherent optical transceiver (100G DP-QPSK, 150G 8QAM, 200G 8QAM on CHM1G, 200G 16QAM)
• Tuneable C-band 10G SFP+ for XTM2 20 x 10G transponder application
• Transparent reach: up to 4,000 km terrestrial, up to 11,000 km subsea
• Chromatic dispersion tolerance
  • DP-QPSK 280 ns/nm
  • 8QAM/16QAM 45 ns/nm
• PMD Tolerance: 40 ps mean DGD

Data Encryption
• Integrated wire-speed AES-256 OTN payload encryption (10G, 40G, 100G) on CHM1G and CHM2
• Integrated Layer 1 wire-speed AES-256 OTN encryption on CHM2-T
• Diffie-Hellman dynamic key exchange
• Secure key transmission via local OTUk GCC0 communications channel

Regulatory and Compliance
• RoHS-6 compliant and lead-free per Directive 2002/95/EC
• GR-3160-Core Generic Requirements for Telecommunications Data Center Equipment and Spaces
• Emissions: FCC Part 15 Class A, EN55022/CISPR Class A Compliant, CE Laser Safety: ANSI Class 1M, IEC Class 1M, EN 60825-1/2, 21 CFR 1040 US FDA CDR, Class 1
• Electrical Safety: UL 60950, CSA22.2 60950 and IEC 60950

Environmental
• Operating temperature: 0° C to 40° C / 32° F to 104° F
• Transport and storage: -40° C to +70° C/-40° F to 158° F/40° C + 93% RH
• Humidity: 5% to 90% non-condensing

Performance Monitoring
• Ethernet PMs: 24 hour, 15 minute, 1 week, 1 month
• OTN PMs: Tx/Rx, FEC

Management Options
• Management and control platforms
  • Infinera Transcend Network Management System for Transport
  • Infinera Transcend SDN Solution
• NETCONF and RESTCONF YANG model-based machine-to-machine APIs
• Command line interface (CLI)
• Zero-touch provisioning (ZTP)
• SNMP fault management
• GUI-based Craft Terminal
• Open ROADM MSA

Infinera®