

X T M S E R I E S

INFINERA HDEA

1.6 Terabit High-Density Ethernet Aggregator

The HDEA (TM-HDEA1600G) is part of the Infinera XTM Series, providing compact and high-density aggregation for 10 Gigabit Ethernet (GbE) services. The HDEA is an access-optimized packet-optical aggregator that seamlessly integrates wavelength-division multiplexing (WDM) transport capabilities and Layer 2 metro Ethernet functionality in a compact 1 rack unit (1RU) chassis. With high density and lower power consumption, the HDEA is ideal for fiber-deep applications, including distributed access architectures (DAAs) such as

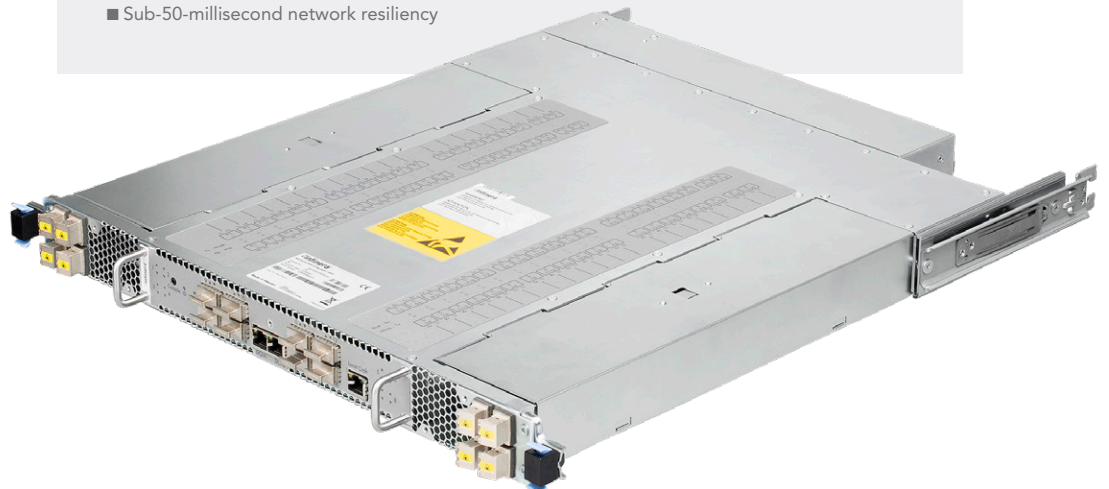
Remote PHY (R-PHY) or Remote MAC/PHY (R-MAC/PHY) in cable networks and 5G wireless networks.

10G Access for Remote PHY and 5G Architectures

The HDEA provides 80 x 10 GbE interfaces through the efficient use of enhanced small form-factor pluggable (SFP+) interfaces supporting dense wavelength-division multiplexing (DWDM), coarse wavelength-

Key benefits:

- Ultra-high-density aggregation: 80 x 10 GbE and 8 x 100 GbE local area network (LAN) services
- Industry-leading fiber management density and reliability via MPO connectors
- Zero-touch provisioning with customer premise equipment-independent Auto-Lambda pluggable optics
- Synchronous Ethernet and 1588v2 for superior mobile network synchronization
- SDN-based open programmable access network capability with OpenFlow
- Ultra-low latency and zero-jitter performance
- Ultra-low power consumption at less than 500 watts fully equipped
- Sub-50-millisecond network resiliency



division multiplexing (CWDM) and gray optics. In addition, the HDEA provides 8 x 100 GbE interfaces via quad small form-factor pluggable (QSFP28) interfaces.

Unique Fiber Management Approach

Access networks provide mass subscriber connectivity that is aggregated for efficient transport over metro and long-haul networks. As a consequence, mass fiber cabling at aggregation nodes can be extremely complex in space-constrained site locations.

The HDEA provides a unique approach to high-density fiber management by utilizing multi-fiber push-on (MPO) connectors to drastically reduce the amount of fiber cabling within the rack. The HDEA also provides secure access to internally mounted fiber connectors via an innovative slide-out case design that avoids accidental fiber damage.

Eight single-mode MPO connectors, with each connector supporting up to 10 bidirectional 10G optical interfaces, replace up to 160 intra-rack fibers. This allows for up to an 86 percent decrease in the number of required fiber patch cables compared to standard small form-factor fiber-optic connectors.

The HDEA's sliding mount design enables easy access to the 10G pluggable optics on each side of the unit and the rear pluggable fans, as shown in Figure 1. Not only does this deliver industry-leading 10G service density, but it also protects the 80 fiber pairs from being damaged in space-constrained cabinets.

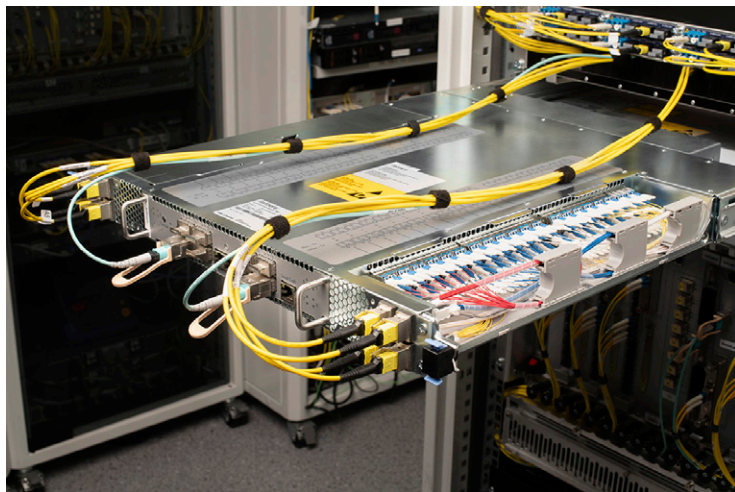


Figure 1: HDEA Slide-out Mounting in Action with Side Cover Removed to Give Access to the SFP+ Connectors.

Zero-touch Provisioning with Auto-Lambda

The HDEA supports Infinera's Auto-Lambda pluggable optics for fully automated remote wavelength tuning, enabling fast network deployment and simplified management and sparing. The remote Auto-Lambda pluggable optic is host-independent and will automatically tune to the corresponding service channel set on the HDEA. Host-independence enables support in any suitable third-party remote/access device. This significantly reduces operational costs and enables operators to rapidly mass-deploy high-speed access networks and services.

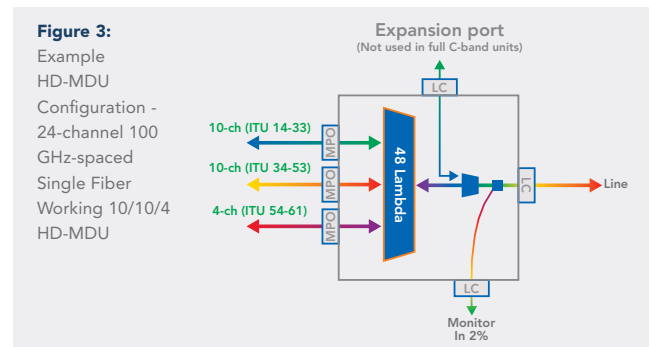
High-density Filters

The high-density capability of the HDEA is best complemented with MPO-based high-density filters to provide a large number of connections in an extremely small footprint. The High-Density Mux/Demux Unit (HD-MDU) uses MPO connections to the HDEA rather than many individual fiber pairs to minimize fiber handling. Up to eight HD-MDU modules can be mounted in a single 1RU chassis, providing very high-density mux/demux functionality.

A range of HD-MDU options and supporting single-/dual-ended MPO cables are available to support varying deployment scenarios in which incoming access fibers contain a mix of DAA/5G traffic destined for HDEA units and other wavelengths destined to third-party systems.



Figure 2: Eight High-Density DWDM Mux/Demux Units in 1RU Chassis.



Open, Programmable Access

The HDEA follows the OpenFlow specification supporting software-defined networking (SDN). When the HDEA is set to operate in SDN mode, it allows an external SDN controller to manage resources in the data plane for automated and dynamic service creation, such as in central office rearchitected as a datacenter (CORD) environments. Together with Infinera’s Xceed Software Suite multi-layer SDN platform and its range of Xceed Applications, or a third-party controller, the HDEA provides an open, programmable access network.

CE 2.0-compliant

The HDEA is Metro Ethernet Forum (MEF) Carrier Ethernet (CE) 2.0-compliant and offers all CE 2.0 services, including E-Line, E-LAN, E-Tree and E-Access. Accordingly, the HDEA is ideal for high-density business Ethernet applications, either in a dedicated network infrastructure or as an additional service capability over existing cable or mobile networks, as shown in Figure 2.

Superior Synchronization and Low Latency

The HDEA has leading-edge synchronization and latency performance by means of Synchronous Ethernet (SyncE) for frequency synchroni-

zation and IEEE 1588v2 Precision Time Protocol (PTP) for phase and time-of-day synchronization. The HDEA’s SyncE capabilities support clock selection logic and on-board holdover. Synchronization signaling is used to provide traceability of the synchronization source and to provide automatic synchronization source selection for high network synchronization reliability. The 1588v2 Boundary Clock functionality provides flexibility and scalability for the growing number of time-sensitive applications.

The HDEA is designed for the lowest possible latency and jitter for all packet sizes, regardless of traffic load and configuration. Accordingly, the HDEA is ideal for demanding Ethernet applications in which synchronization, latency and jitter are important, such as Remote PHY aggregation, Long Term Evolution (LTE) and 5G backhaul, services for financial institutions and video distribution.

Unified Management

The HDEA is fully supported by and integrated into the Infinera Digital Network Administrator (DNA) multi-layer network management suite. DNA provides a full set of tools to plan, deploy and operate transport networks in a cost-effective and simple manner. DNA management provides a single system for multi-layer metro networks, template-based service provisioning and powerful troubleshooting capabilities.

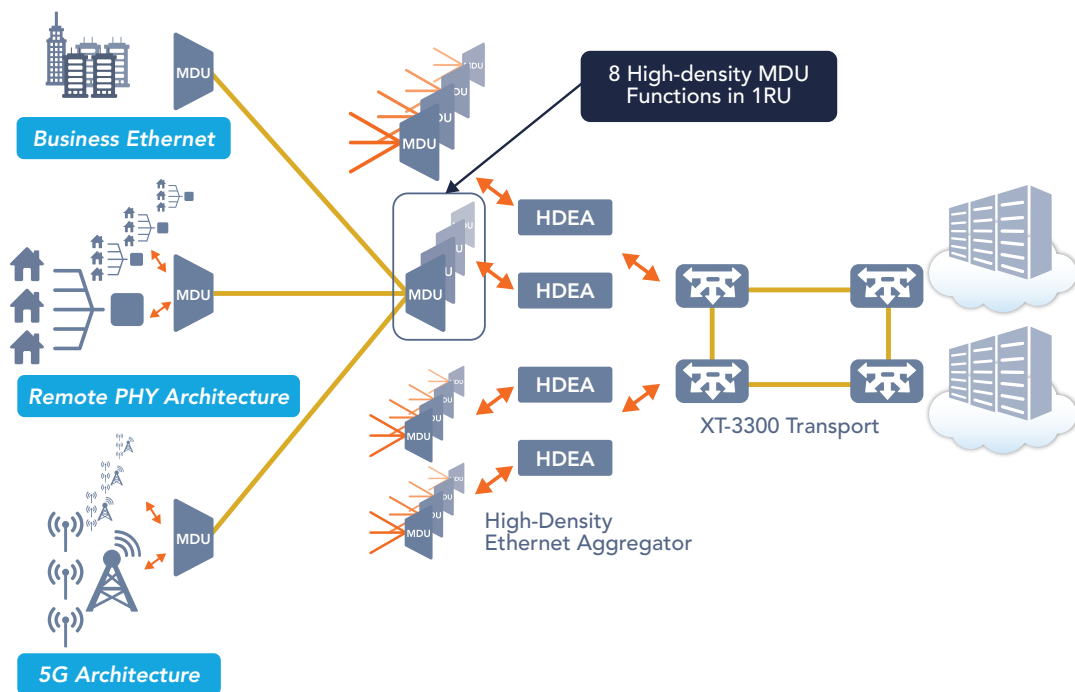


Figure 4 : HDEA Networking Example with High-density MDU Filters Connecting to the HDEA and Further Transport over the XT-3300 Transport Platform.



Features

Interfaces	80 x 10 GbE LAN interfaces (SFP+): <ul style="list-style-type: none"> • Uncolored multi-mode and single-mode • CWDM up to 16 channels and HD-CWDM up to 36 channels • DWDM up to 96 channels • Single and dual fiber pair solutions supported Eight QSFP28 100G LAN or four 10G Supported optics formats: <ul style="list-style-type: none"> • 100G QSFP LR4/SR4/DAC/AOC
Resilience	Link Aggregation with LACP. Normal LAG, N+1 and N+N protection LAG, Multi-chassis LAG ITU-T G.8032 Ethernet Ring Protection v1 and v2 Supports Ethernet Ring over LAG and in-service adding/removing links MPLS-TP Linear Protection with Protection State Coordination (PSC) RFC6378
Ethernet Services	E-Line (EPL and EVPL), E-LAN (EP-LAN and EVP-LAN), E-Tree (EP-Tree), E-Access CE 2.0-compliant, MEF 9+14
Synchronous Ethernet and Timing	ITU-T G.8262 Synchronous Ethernet Equipment Clocks (EEC) ITU-T G.8264 Ethernet Synchronization Messaging Channel (ESMC) ITU-T G.781 Synchronization Status Messages (SSM) IEEE 1588v2 Transparent Clock IEEE 1588v2 Boundary Clock
Performance Monitoring/ Operations, Administration and Management	IEEE 802.1ag Continuity Check and Loopback Port Mirroring RFC5586 MPLS Generic Associated Channel for OAM RFC5884 Bidirectional Forward Direction (BFD) for MPLS Label Switched Paths (LSPs) Management VLAN for in-band management Port isolation using private VLAN technique Link Layer Discovery Protocol (LLDP)
Source-specific Multicast	RFC4607 Source-specific Multicast for IP RFC4541 IGMP Snooping
L2 Switching	Selectable learning enabled per VLAN, 4,094 VLAN IDs, 128K MAC addresses Storm control IEEE 802.1ad Q-in-Q SVLAN Flexible VLAN tag handling: push, pop, swap, pop-swap super jumbo frames up to 10,248 bytes Full wire-speed switching

Specifications

Physical Specifications	1RU, 19" standard rack mount Height: 44 mm (1.73 in) Depth: 500 mm (19.68 in) excl. mounting brackets Width: 442 mm (17.40 in) excl. mounting brackets Weight: 7.9 kg (17.4 lb) excl. mounting brackets
Temperature Range	Extended temperature range support: 0 to +50° C/+32 to +122° F
Power	Maximum power consumption: 500 W Dual DC inlets. Redundant, DC (40V - 57,0V) Five redundant in-service replaceable fans IEC 60950-1/UL 60950-1/CSA C.22.2 No 60950-1 FCC Part 15 Class A, ICES-003 CE Marking and RoHS Compliant, WEEE Compliant
Regulatory and Certification	IEC 60950-1/UL 60950-1/CSA C.22.2 No 60950-1 FCC Part 15 Class A, ICES-003 CE Marking and RoHS Compliant, WEEE Compliant

HD-MDU Specifications

Wavelength Support	Extended C-band (ITU channels 14 to 61)
Temperature Range	-25 to +70° C
C-band Insertion Loss	Maximum 5.8 dB, typical 5.1 dB
Upgrade Port Insertion loss	Maximum 2 dB
Adjacent Isolation	25 dB
Non-adjacent Isolation	33 dB

Specifications and Features Are Subject to Change—Please Refer to XTM Series Roadmap for Availability Dates of Specific Features

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