The carrier-class FLASHWAVE CDS Micro Packet Optical Networking Platform (Packet ONP) can operate either standalone or as an extension of the FLASHWAVE 9500 Packet ONP. This cost-effective, reliable access system provides Carrier Ethernet and OTN switching/multiplexing with no single point of failure. The platform is hardened for outside-plant applications.
Agility for Changing Networks

In a changing communications industry, networks are being enhanced to support new packet-based and OTN services. As Ethernet becomes more prevalent, the networks must evolve to deliver it efficiently, cost-effectively, and with 99.999% service availability. Fujitsu has developed the next generation of Packet Optical Networking Platforms (Packet ONPs) specifically to meet these emerging challenges and smooth the transition to an OTN and/or Carrier Ethernet network.

A Whole New Class of Optical Edge System
The FLASHWAVE CDS system consists of a two-slot chassis and a range of interface units to meet a variety of business applications, traffic capacity requirements, and price points. Service providers can exploit its modular architecture to enhance their business services and optimize their access network.

Packet-Based Services
The FLASHWAVE CDS platform incorporates advanced rate shaping, traffic management, and aggregation supporting revenue-bearing services with guaranteed Ethernet service delivery. The platform provides a number of innovative features including:

• Optimized throughput and fiber assets with reuse of underutilized bandwidth
• Guaranteed bandwidth with dynamic buffer allocation enabled by advanced traffic management
• Sub-50 ms network resiliency using G.8031 VLAN-based Ethernet Virtual Connection protection
• Low first-cost Nx GbE network ports provide investment protection and flexible scaling to 10 GbE transport
• Line rate throughput (10 Gbps) with 64-byte frame size

OTN-Based Services
A transition is occurring from using OTN purely as a digital wrapper for enhanced DWDM performance to a switching mechanism for the next generation of service grooming and aggregation. OTN provides a fully transparent, global transport capability for various service protocols such as Ethernet, SONET, and Storage Area Networks, to name a few. The OTN switching and multiplexing capabilities of the FLASHWAVE CDS system provide a transparent transport interface between these highly critical services and the OTN network.

The FLASHWAVE CDS system incorporates a non-blocking OTN switch with multirate I/O, offering very high-density OTN switching and multiplexing. The system interoperates seamlessly with the Fujitsu FLASHWAVE 9500 and 7500 platforms.

Provisioning is as simple as M.E.F.
The FLASHWAVE CDS Micro Packet ONP is designed for three primary applications:

- Mobile backhaul
- Enterprise service delivery
- Access infrastructure

**Mobile Backhaul**

The FLASHWAVE CDS Micro Packet ONP is optimized for mobile backhaul applications. The platform makes optimal use of underutilized bandwidth which, in turn, maximizes throughput and use of fiber assets. Enhanced traffic management makes it possible to attain consistently superior performance in complex, high-traffic networks during peak traffic times. Carriers can define individual bandwidth profiles, on a per-VLAN basis, for guaranteed minimum and peak maximum traffic rates. Optional sub-50 ms network resiliency offers selective path protection. The FLASHWAVE CDS platform is the premier high-performance cell tower access solution, providing “five nines” carrier-class reliability for mobile backhaul services.

Mobile backhaul is experiencing an explosion in traffic demand. Wireless operators are moving from leased lines to dark fiber as part of their solution and must use wavelengths as efficiently as possible to secure their investment for future expansion at minimal additional cost. The ideal solution to their backhaul needs includes the FLASHWAVE CDS and FLASHWAVE 9500 platforms as shown in the diagram below, delivering redundancy at all critical points:

- Wavelength-based scalability
- Even/odd traffic replication (green/orange)
- Ring-based service aggregation with redundant E-Line EVCs per cell site
- RFC2544 turn-up and testing
- Y.1731 performance monitoring
- End-to-end service protection

**Consistently superior performance in mobile backhaul networks**
Enterprise Service Delivery

The FLASHWAVE CDS system is the ideal access and aggregation solution for delivering Ethernet business services. High-density Ethernet service interface cards allow large numbers of data customers to be supported in a single system. Integrated traffic management, data aggregation, and Ethernet transport technologies provide carrier-class data services with guaranteed SLAs.

Some businesses require relatively small Ethernet services (10 to 100 Mbps), which are optimally supported with a switched Ethernet access architecture for economical transport. Larger enterprises often require full-rate 1 GbE services and need fully transparent transport. This type of application is best served with an OTN-based network with GbE services mapped into an ODU0 format. Both of these options, Ethernet and OTN, are supported by the FLASHWAVE CDS platform, while the FLASHWAVE 9500 Packet ONP provides an additional layer of aggregation across all service types (Ethernet, OTN and SONET).

Transport of:
- Transparent GbE Services
- Legacy SONET Services
- Switched Carrier Ethernet Services
Traffic Consolidation and Aggregation

The FLASHWAVE CDS Micro Packet ONP is an excellent solution for:

- Wholesale services
- Small wire centers
- Outside-Plant (OSP) cabinets and Controlled Environmental Vaults (CEVs)

**Access Infrastructure**
The FLASHWAVE CDS can act as an intermediate aggregator for networks that require multiple stages of traffic consolidation in their infrastructure. Instead of putting a very expensive piece of equipment in small wire centers that may not justify such a device, the FLASHWAVE CDS system can provide this infrastructure with significantly lower cost and simpler operations for the network operator.

Since either Ethernet or OTN fabrics can be used on the CDS, this intermediate aggregation can consist of either or both technologies within the same small wire center. This can result in significant operational and capital savings.

**Point-of-Presence Handoff**
With its slim 2RU footprint and the remote management capabilities, the FLASHWAVE CDS platform can also serve as a cost-effective Point-of-Presence (PoP) handoff to a third-party carrier. This configuration can be implemented simply and quickly, and offers an easy solution for situations that require something small and with low power consumption, such as a CLEC cage. The FLASHWAVE CDS has all the necessary loopbacks and OAM capabilities to act in this capacity, providing full visibility into the network, all the way to the PoP handoff client ports.

**Outside-Plant Installation**
The FLASHWAVE CDS Micro Packet ONP is environmentally hardened, allowing the device to be put into OSP cabinets. The platform has its own thermal management capabilities with a self-contained fan tray, so it can be installed in very tight spaces, without requiring additional external fans or baffles. Its small size is also ideal for CEVs or Huts or just about any place where space is minimal, but carrier-class functionality and resiliency are still needed.
The FLASHWAVE CDS platform is an ideal solution during and beyond this shift to packet optical networking, addressing the three technology groups that are making the transition possible: optical, OTN and packet.

**Optical Capabilities**
Explosive bandwidth demand is easily accommodated with the integrated 50 Ghz spaced 88-channel DWDM functionality. The FLASHWAVE CDS platform offers 10 Gbps of bandwidth on any of the 88 channels, utilizing the full-band tunable optics. It also supports fixed DWDM XFP, CWDM XFP/SFP, traditional wideband, and single-strand bidirectional optics for both network and client interfaces. Providers taking advantage of these features enjoy several key benefits: fiber plant conservation, operations practice consistency, and increased margins resulting from cost and performance optimization. Optical power and performance statistics are provided for all interface rates.

**Packet-Based Capabilities**
E-Line and E-Access services, as defined by the Metro Ethernet Forum (MEF), are all supported by the FLASHWAVE CDS platform. Standards-based interfaces at the UNI, VUNI (Virtual UNI) and INNI/ENNI enable the platform to deliver either retail or wholesale services. The E-LAN technology of the FLASHWAVE 9500 Packet ONP can interoperate with the FLASHWAVE CDS to allow the operator to extend E-LAN services over existing access infrastructure. Retail E-Line or wholesale E-Access services may be offered with guarantees or best effort quality as required. For example; mobile backhaul, a linear path which does not need switching but which will, with the advent of LTE, require QoS guarantees. Fujitsu Carrier Ethernet technology may be used to support this type of E-Line service.

The FLASHWAVE CDS platform supports IEEE 802.1ag CFM and ITU-T Y.1731 capabilities. These include the use of MEPs and MIPs, continuity check, loopback, traceroute, RDI, AIS, CSF, APS, Frame Delay and Frame Loss measurements. These capabilities make the behavior of the Ethernet paths fully visible. This applies to all of the MEF-defined services offered. At the customer interface, full traffic management, including access control/classification, policing and prioritization of traffic, is available. LAG and G.8031 protection is supported at both the customer interface and the network boundaries.

**OTN Based Capabilities**
The FLASHWAVE CDS platform supports OTN multiplexing and switching functionality. These capabilities serve applications where total transparency of traffic is a necessity, or when transport of legacy-based OC-3/OC-12/OC-48 services is required.

The OTN functionality enables transport of transparent GbE and Private Line services. The HD32 card provides a built-in full non-blocking OTN switch, which allows any to any port connectivity, including client-to-client hairpinning within a single card or across two cards. The FLASHWAVE CDS system also offers comprehensive protection capabilities so that with the use of two cards, the system can support both equipment protection and facility protection, in conjunction with the Y-cable module.

The OTN switch has all the basics built-in, such as OAM, loopbacks, and timing recovery. The HD32 card is fully standards based but also has functionality that goes beyond the standard to enhance its applicability.

The HD32 supports path protection, which means any network topology can be used, such as ring, mesh, or point-to-point. The HD32 also supports a full-band tunable XFP, which can interface directly with a ROADM, bypassing the transponder and thus saving costs.
Features and Specifications

System overview
- Carrier-class
- No single point of failure
- 2-slot, 2RU, modular chassis
- Client and network rings
- Point-to-point topologies
- Cross card protection
- 50 ms switch time
- SFP and XFP
- Multiple options based on network needs
- CWDM XFP and SFP Optics supported

Available interfaces

| LDP1 standard GbE data unit | • 12 x Gigabit Ethernet (SFP) or mixed with 10/100/1000Base-T (RJ45) |
| LDP3 SONET unit | • 2 x OC-48 WAN
• 2 x Gigabit Ethernet/OC-3/OC-12 |
| HD1 standard 10 GbE data unit | • 2 x 10 Gigabit Ethernet (XFP)
• 12 x Gigabit Ethernet (SFP)
• 12 x 10/100/1000Base-T (RJ45) |
| HD12 Ethernet data unit with enhanced traffic management and ring support | • 2 x 10 Gigabit Ethernet (XFP)
• 12 x Gigabit Ethernet (SFP)
• 12 x 100/1000Base-T (RJ45)
• Software-configured for 1 GbE or 10 GbE network ports or client ports |
| HD32 OTN switch/multiplexer unit | • 2 x 10G (OTU2) (XFP)
• 16 x subrate port
• OC-3/OC-12/OC-48 (SFP)
• Gigabit Ethernet (SFP) |

Ethernet functions
- Ethernet Private Line and Ethernet Virtual Private Line services
- Hub and spoke topologies
- Ring and mesh topologies
- VLAN push, pop, translation
- Connection admission control
- IEEE 802.3ad Ethernet link aggregation (1:1 or 0:n)
- Jumbo frame support
- Advanced traffic classification
- Port
- VLAN
- Ethernet priority bit (802.1p)
- IP DSCP
- Strict priority 8 per-EVC queuing
- Hierarchical shaping with logical ports
- IEEE 802.3ah link EFM OAM
- In-band VLAN management
- Large buffering for high burst tolerance
- G.8031 support
- Enhanced traffic management
- 2,000 flows

Ethernet functions (continued)
- Sync E
- Hardware-based 512 x 3.3 ms, 10 ms, 100 ms, or 1 s CCMs
- Line rate throughput at all frame sizes
  (10 Gbps @ 64-byte frame)
- SOAM – B02.1AG CFM, Y.1731
- ACL support
- MAC translation
- MAC swap loopback
- Port mirroring
- Enhanced security
- DS1 circuit emulation with special SFP

SONET functions
- STS cross connects
- TDM multiplexing
- Ethernet over SONET
- GFP-F encapsulation
- HD VCAT
- SDCC support for remote access

OTN Functions
- Full-band tunable optics
- 80G non-blocking OTN switch fabric per two card system, 40G per single card system
- Cross-card switching capabilities
- Protection utilizing SNC-N/S
- Y-cable protection on client

Operating environment
Operating temperature range: –40 to +65 °C (–40 to +149 °F)
Humidity range: 5 to 95%

Maximum power consumption (heat dissipation)
- Maximum power per system: 415 W (1416 BTU/hr)
- Power input: –48 VDC
- 110 VAC (via 1RU rectifier)

Physical characteristics
- Dimensions: 3.5 x 17.4 x 12” (89 x 442 x 305 mm)
- (15” (381 mm) deep with cabling)
- 2RU high, 19/23” rack-mountable
- Weight: 10.2 lb/4.6 kg
- Note: No external fans or baffles required

Operations
- TL1 protocol over OSI/Ethernet
- NETSMART 500 Element Manager
- NETSMART 1500 Management System
- Software download and remote memory backup/restore
- Interoperable with FLASHWAVE 7500 ROADM and FLASHWAVE 9500 Packet ONPs
- Telcordia™ OSMINE compliant
- RADIUS support

Regulatory & standards compliance
- UL-certified
- NEBS Level 3 compliant
- Certified compliant to MEF 9 and MEF 14