

So Innovative It Makes Legacy Equipment Last Longer

Evolving technology and end user voice and data needs are putting new demands on communications networks. This is true for traditional telecom companies, wireless carriers, MSOs, utilities and a variety of other service providers. Networks must support traditional Time Division Multiplexed (TDM) services, while incorporating an ever-expanding compliment of Ethernet-based applications. Providers must maintain high levels of service reliability yet control costs and extract maximum capacity from existing optical networks.

The Fujitsu FLASHWAVE® 4500 multiservice optical platform delivers the reliability Fujitsu is known for in a product that offers convergence between a variety of newer technologies and legacy asynchronous and SONET network segments. The FLASHWAVE 4500 platform allows providers to get the most out of their existing communications network without sacrificing service reliability or increasing capital outlays for expensive overlay networks.

The FLASHWAVE 4500 platform provides a variety of configurations and applications that improve efficient bandwidth use throughout the network. The Multiservice Provisioning Platform (MSPP) optimizes currently deployed DCS devices and easily migrates into a scalable Multiservice Switching Platform (MSSP) that can serve as a mini-DCS to meet future needs. In addition to tuning up a DCS by grooming out empty time slots, the FLASHWAVE 4500 platform continuously implements new technologies such as Resilient Packet Ring (RPR), Link Capacity Adjustment Scheme (LCAS) and enhanced Virtual Concatenation (VCAT) to optimize Ethernet services.

Service providers who implement the FLASHWAVE 4500 platform can:

- Reduce space and power requirements
- Save bandwidth and take pressure off the DCS through STS-1 and VT1.5 grooming
- Converge SONET, Ethernet over SONET (EoS), and IEEE 802.17 RPR technology
- Provide industry standard Quality of Service (QoS) levels to support guaranteed Ethernet service delivery
- Postpone CAPEX outlays and minimize business risks with a clear migration path from an MSPP to a three-shelf MSSP

Realize Savings and Benefits Now

The FLASHWAVE 4500 platform solves major business and network problems by reducing transport costs and power requirements, conserving valuable space and simplifying network management. The FLASHWAVE 4500 platform integrates multiple service, transport and grooming elements into a single Network Element (NE).

With up to 20 flexible service interface slots in the MSPP configuration and up to 60 service interface slots in the MSSP configuration, the FLASHWAVE 4500 platform supports dozens of terminal, linear and ring architectures simultaneously, while integrating Dense Wavelength Division Multiplexing (DWDM), broadband video and the Local Area Network (LAN) into the metropolitan transport network. Two switch fabrics are available to match grooming capacity with available space, power and budgetary requirements.

In the single-shelf configuration of the MSPP, the switch fabric provides non-blocking STS-1 grooming and cross-connect capability for up to 70G of service interfaces. While this switch fabric is sufficient to support the vast majority of optical transport applications, the FLASHWAVE 4500 platform provides a clear migration strategy so that carriers can scale the initial configuration up as future business needs dictate. An MSSP configuration is available that provides an increase of over four times the standard MSPP switching capacity. Both switch fabrics provide immediate CAPEX and OPEX savings without sacrificing reliability and performance.

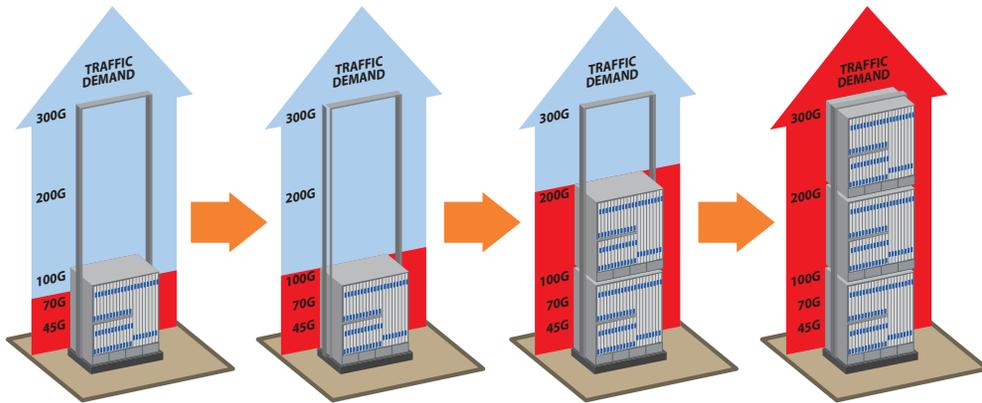
The FLASHWAVE 4500 platform offers a cost- and space-saving way to terminate up to 84 protected DS1 circuits directly from interface slots within the shelf. When additional DS1 drop capacity is required, a DS1 expansion shelf can be added to allow an additional 168 DS1 circuits to be added in just 2U of rack space. Multiple expansion shelves can be used when even more DS1 circuits are required.

Other advanced features of the FLASHWAVE 4500 platform include:

- Support for up to 76 Section Data Communications Channels (SDCCs) per shelf (228 per three shelf MSSP) to provision multiple subtending rings with full OAM&P
- A full complement of optics with standards-compliant short reach, intermediate reach, long reach and tunable narrowband units (up to 88 wavelengths)
- A complete suite of Performance Monitoring (PM) capabilities, including Intermediate Path Performance Monitoring (IPPM), Pointer Justification Counts (PJC), and Ethernet PM



- Optimized for Edge Access
- SONET and RPR Connectivity
- Data and Traditional Services
- Survivable Ethernet Services
- Economical Platform Options



Service Interface Capacities

Clear Migration Path to Network Optimization

DCS port optimization is one of the key applications for the FLASHWAVE 4500 MSPP/MSSP. With powerful, centralized 70G/300G STS-1 and 20G VT1.5 switch fabrics, integrated test access, and full PM capabilities, the FLASHWAVE 4500 platform pre-grooms traffic before it enters the DCS. The platform optimizes DCS port usage, frees up valuable ports for new customer traffic and allows carriers to extend the life of an existing DCS.

Optimizing port usage on the DCS can improve its efficiency and delay the purchase of a new DCS. However, with continued growth, a carrier will eventually need to add another high-capacity grooming device to the network. Fujitsu provides an elegant solution that allows grooming capacity to be added as needed, which delays CAPEX and minimizes risks.

Use a single-shelf FLASHWAVE 4500 MSPP configuration with a 70G STS switch fabric and 20 interface slots to meet the traffic demands in smaller offices. Later, when traffic demand grows, the 300G STS switch fabric can be added to allow configurations that can scale from a single shelf with 20 slots to a full three-shelf configuration that offers 300G of unrestricted STS connectivity with over 60 interface card slots. The three-shelf configuration fits in a single rack. Upgrades from a single-shelf to a multishelf configuration are non-service-affecting, providing this platform with the easiest multishelf architecture upgrade available.

A FLASHWAVE 4500 MSPP can be easily expanded to become an MSSP without losing any interface capacity, SONET/DWDM functionality or support for any interface type. A triple-stage MSSP system supports a three-fold increase in interface capacity with 300 Gbps of traffic grooming capacity, all managed with a single TID, which minimizes any impact on existing operating systems, procedures and staff.

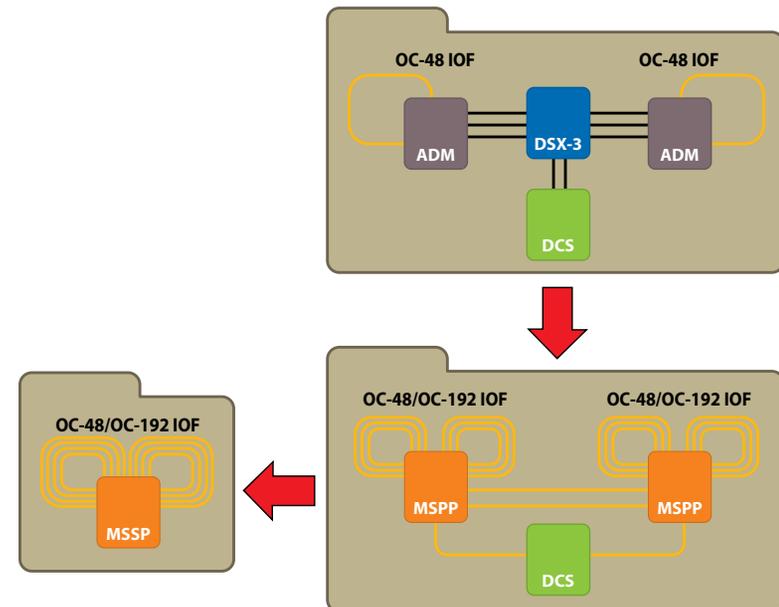
Advanced Service Aggregation

The FLASHWAVE 4500 platform delivers simultaneous transport and grooming through a centralized STS switching architecture. This switching complex permits any-port-to-any-port connectivity with unequalled flexibility in an optical networking platform. In addition, VT1.5 switching provides grooming within STS-1s to ensure maximum use of available bandwidth.

The wide variety of service interfaces available, combined with innovative switching fabrics capable of handling these services as standard or VCAT SONET entities, allows grooming and aggregation of disparate signal types such as broadband video, LAN, asynchronous, and SONET into the metropolitan transport network.

This superior ability to alleviate wasted bandwidth while aggregating services into an OC-n compatible with any existing SONET network is accompanied by a sophisticated compliment of innovative features, including:

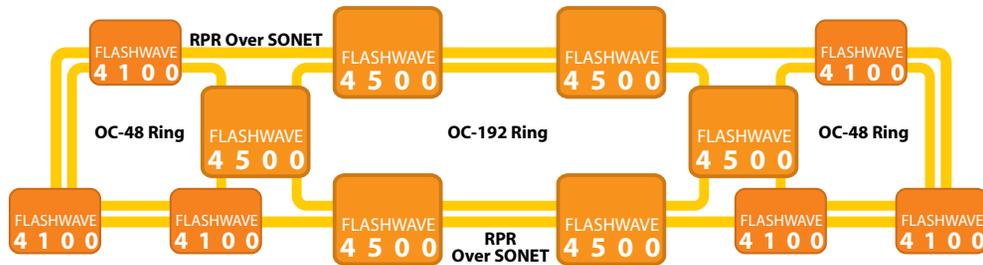
- Electrical DS1, DS3, EC1 and Ethernet service interfaces, and an additional full complement of standards-based OC-n optics
- Direct DS1 to OC-192 traffic grooming
- DVB-ASI broadcast video service interfaces for direct digital video transport over SONET
- Non-blocking VT1.5 and STS grooming plus PM of all transport signals from any port
- Expansive M13 Transmux capabilities
- Multiple architecture support with complete subtending ring, hairpinning and loopback capabilities



Carrier-Class Ethernet with QoS Functionality

Like other members of the FLASHWAVE 4000 series, the FLASHWAVE 4500 platform allows carriers to leverage their existing SONET investments and still offer advanced, carrier-class, Metro Ethernet Forum (MEF) certified Ethernet transport services. To allow full convergence in a single NE, the FLASHWAVE 4500 platform uses the inherent granularity of SONET formatting. Selected bandwidth within the OC-n is optimized for packet traffic using features such as LCAS and VCAT. Ethernet PM and alarm management are provided using SONET's robust overhead. Sub-50 ms ring protection is maintained using UPSR/ BLSR for SONET and steering protection for RPR per IEEE 802.17.

FLASHWAVE 4500 RPR-based Ethernet services offer low-cost scalability and fast service activations. The RPR User Network Interfaces (UNIs) allow service bandwidth to be expanded in increments as small as 1 Mbps without a truck-roll. Automatic topology discovery capabilities broadcast changes in the RPR network to all nodes without manual technical intervention. This automation saves OPEX and expedites service activation.



Single RPR Functionality Over Subtended SONET Rings

RPR is applied during traffic ingress and stripped at egress. While RPR protection operates independently of SONET protection, switching is implemented whenever the network is affected by a fiber cut or equipment failure. RPR uses a dual counter-rotating ring topology (ringlets) and sub-50 ms steering protection to maintain services in the event of a fiber cut or unit failure. RPR statistical multiplexing with QoS provides additional bandwidth for sudden fluctuations in demand. This allows service providers to set price points for various levels of packet-based service quality: guaranteed, partially guaranteed, and best effort. Demand from higher priority customers is met by borrowing bandwidth from lower priority users.

Future-Proof Your Network with an Established Solution

Fujitsu continues to provide the most widely deployed optical transport equipment in the metro market with more than 320,000 NEs installed across North America. As a trusted supplier with extensive deployment experience and superior customer service, Fujitsu helps telecom, MSO, wireless network operators and utility providers to converge their voice, video and data networks with the FLASHWAVE 4500 platform. The FLASHWAVE 4500 system plays a key role in core, IOF, metro and business access deployments, while providing an economical link between CATV hub sites, cell towers and long-haul transport networks.

Complemented by the NETSMART[®] 500 craft user interface and NETSMART 1500 Element Management System (EMS) software with full Telcordia[™] OSMINE compliance and support for OAM&P, the FLASHWAVE 4500 platform gives you everything you need to build next-generation optical networks.

Switching Capacity				
Specification	MSPP	Single Stage MSSP	Double Stage MSSP	Triple Stage MSSP
Interface Capacity	70 Gbps	100 Gbps	200 Gbps	300 Gbps
STS-1 Cross-Connects	1344 x 1344 (70 Gbps)	5760 x 5760 (300 Gbps)	5760 x 5760 (300 Gbps)	5760 x 5760 (300 Gbps)
VT1.5 Cross-Connects	5376 x 5376 (10 Gbps)	10,752 x 10,752 (20 Gbps)	10,752 x 10,752 (20 Gbps)	10,752 x 10,752 (20 Gbps)

Maximum Number of Unprotected (Protected) Service Interfaces					
Type	Ports/ Card	MSPP	Single Stage MSSP	Double Stage MSSP	Triple Stage MSSP
DS1 (Integrated)	28	84 (84)	84 (84)	168 (168)	252 (252)
DS1 (High-Density)	168	6720	6720	13,440	20,160
DS3/EC1	8	96 (96)	96 (96)	192 (192)	288 (288)
DS3 Transmux	12	144	144	288	432
OC-3/3c/STM-1	4	80 (40)	80 (40)	160 (80)	240 (120)
OC-12/12c/STM-4	4	80 (40)	80 (40)	160 (80)	240 (120)
OC-48/48c/STM-16	2	40 (20)	40 (20)	80 (40)	120 (60)
OC-192/192c/STM-64	1	4 (2)	10 (5)	20 (10)	30 (15)
10/100Base-T Ethernet	8	80	80	160	240
Gigabit Ethernet	2	40	40	80	120
DVB-ASI	8	40	40	80	120

Features and Specifications

Architectures

- Terminal
- Linear ADM (1+1)
- Unidirectional Path Switched Ring (UPSR)
- Two Fiber-Bidirectional Line Switched Ring (2F-BLSR)
- Four Fiber-Bidirectional Line Switched Ring (4F-BLSR)
- Dedicated Path Protected Mesh (DPPM)
- Resilient Packet Ring (RPR)

Interfaces

- DS1 64-pin AMP® CHAMP connectors
- DS3/EC1 BNC connectors
- DS3 Transmux BNC connectors
- OC-3/STM-1 SC for dual unit; LC for quad unit
1310 nm wideband
- OC-12/STM-4 LC, FC, SC or ST for single unit;
LC for quad unit
1310 nm wideband
1550 nm wideband (single unit only)
- OC-48/STM-16 LC, FC, SC or ST connectors
1310 nm wideband
1550 nm tunable narrowband
(4λ @ 50 GHz)
- OC-192/STM-64 LC, FC, SC or ST connectors
1310 nm wideband
1550 nm wideband
1550 nm tunable narrowband
(4λ @ 100 GHz)
- Ethernet/RPR RJ-45 connectors for
10/100Base-T Ethernet;
LC or SC connectors for Gigabit
Ethernet
- DVB-ASI BNC connectors

Switching

STS Grooming

- MSPP 1344 x 1344 STS-1
- MSSP 5760 x 5760 STS-1

VT1.5 Grooming

- MSPP 5376 x 5376 VT1.5 (optional)
- MSSP 10,752 x 10,752 VT1.5 (optional)

Protection

- DS1 1+1 or unprotected
- DS3/EC1 1:n (n=1 to 6) or unprotected
- DS3 Transmux 1+1 or 1:n (n=1 to 6)
- OC-3/STM-1 1+1, UPSR, DPPM or unprotected
- OC-12/STM-4 1+1, UPSR, DPPM or unprotected
- OC-48/STM-16 1+1, UPSR, 2F-BLSR, DPPM
or unprotected
- OC-192/STM-64 1+1, UPSR, 2F-BLSR, 4F-BLSR, DPPM
or unprotected
- Ethernet RPR or unprotected
- DVB-ASI Unprotected
- Switch matrices 1+1
- Synchronization 1+1

Synchronization

- Internal Stratum 3 timing source
- Synchronization Status Messaging (SSM)
- DS1 Building Integrated Timing Supply (BITS) primary
and secondary clock output/input
- Line timing

Operations

- In-service expansion from MSPP to MSSP with common operations benefits
- Standard RPR embedded management plane
- TL1 protocol over X.25, OSI/LCN or IP/LCN
- Simple Network Mentoring Protocol (SNMP)
- TCP/IP and X.25 gateway functionality
- Software download and remote memory backup/restore
- Managed via NETSMART 500 craft user interface and NETSMART 1500 EMS
- Interoperable with all Fujitsu transmission products
- Telcordia OSMINE compliant
- DS1, DS3, OC-3 and OC-12 test access
- G.709 compliant digital wrapper for narrowband OC-192 optical channel adaptation
- Automatic equipment protection group creation
- PM Threshold Provisioning on a per facility basis
- Full suite of in-service hardware and software upgrades
- NEBS Level 3 compliant

Power Consumption/Heat Dissipation

- Per shelf (typical) 400 W (1364 BTU/hr)
- Power Input -48 V DC (A and B)

Operating Environment

- Temperature 0 to 50° C (32 to 122° F)
- Humidity 5 to 95% (non-condensing)

Physical Characteristics

- Dimensions (H x W x D) 22.8 x 21.5 x 12"
(578 x 546 x 305 mm)
- Weight (fully loaded) 134 lb (61 kg)

Contact your Fujitsu sales representative for more information on how to order this product.

Fujitsu Network Communications Inc.

2801 Telecom Parkway, Richardson, TX 75082

Tel: 800.777.FAST (3278) Fax: 972.479.6900

us.fujitsu.com/telecom

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