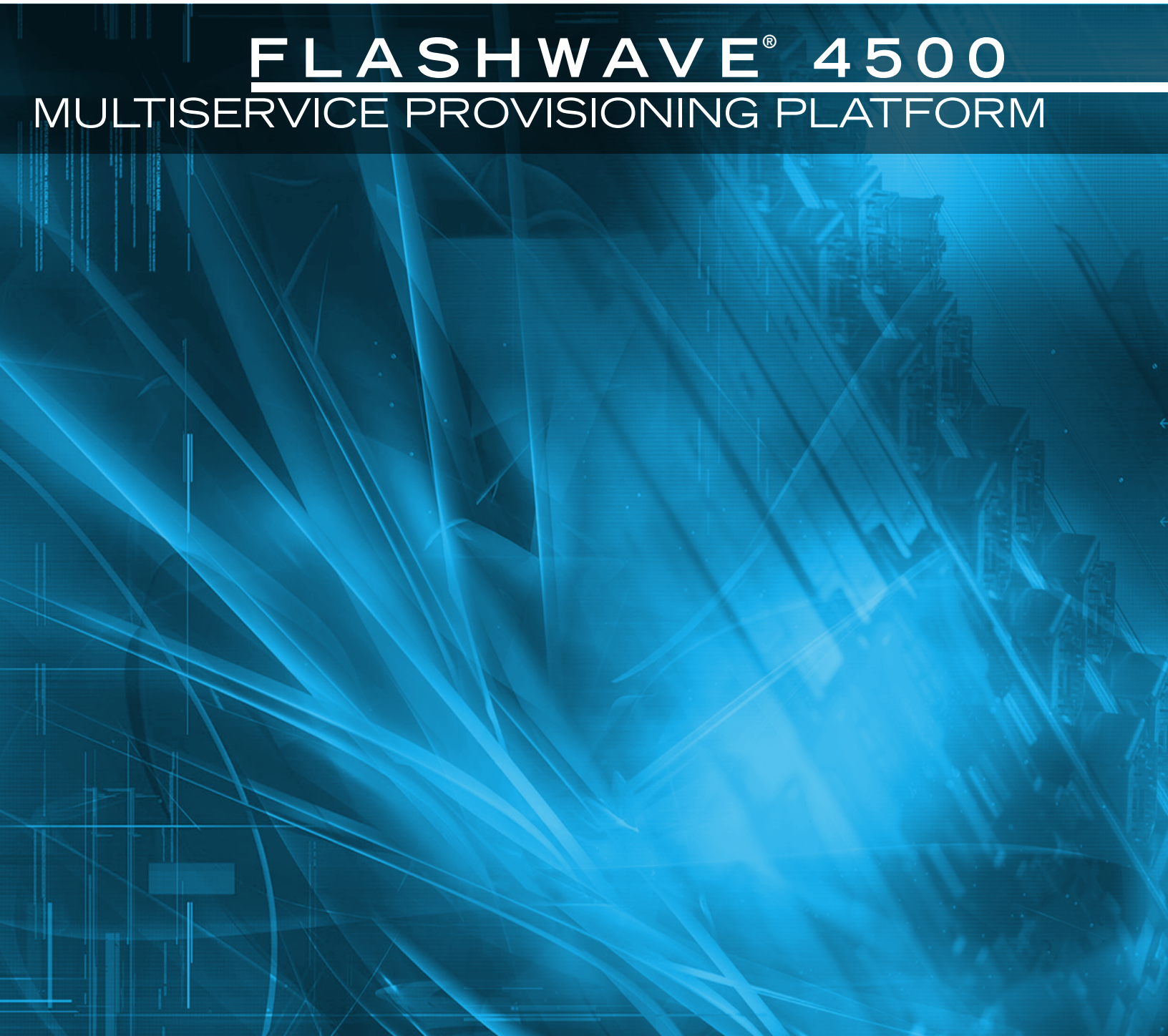


THE POSSIBILITIES ARE INFINITE

FLASHWAVE[®] 4500

MULTISERVICE PROVISIONING PLATFORM



MIGRATION TO ETHERNET

Today's optical transport networks are increasingly defined by the unpredictable convergence of voice, data and video technologies. They are shaped by accelerating service demands and shifting business models that aim to reduce overall operational expenditures. To succeed, national, local and multiservice providers need extremely flexible and scalable infrastructure equipment that will adapt to emerging bandwidth fluctuations.

Transition to Packet Services

The Fujitsu FLASHWAVE® 4500 Multiservice Provisioning Platform (MSPP) provides a unified platform for both packet and SONET-derived services. The FLASHWAVE 4500 MSPP solves major business and network problems by reducing transport costs and power requirements, conserving valuable space and simplifying network management. The system allows convergence of data, synchronous and asynchronous networks, increasing revenue without the expense of overlay networks.

Converged Ethernet Services

The MEF-certified FLASHWAVE 4500 platform supports a wide range of Ethernet interfaces and features. Utilized as a hybrid TDM/packet device, the inherent bandwidth granularity within a single system can realize further savings.

A Quantum Leap in Efficiency and Scalability

The FLASHWAVE 4500 MSPP provides a quantum leap in network efficiency. It delivers a flexible, multiservice optical transport solution for a comprehensive range of applications. This highly scalable system easily expands to become a Multiservice Switching Platform (MSSP), supporting ultra high-capacity grooming applications. Such scalable expansion previously required an expensive Digital Cross-connect System (DCS).

Optical Flexibility and Density

The FLASHWAVE 4500 system offers an extremely cost- and space-effective solution for traditional SONET Add/Drop Multiplexer (ADM) applications. Its architecture supports advanced functionality, such as high-density Ethernet transport, data aggregation, versatile multirate optical interfaces and optional integrated DS1/DS3 grooming.

The FLASHWAVE 4500 platform enables you to:

- ▶ **Migrate** TDM to packet with efficient Gigabit Ethernet (GbE) streams within the SONET layer.
- ▶ **Unify** service delivery and applications with a single, flexible multirate card (OC-3 to OC-48).

Trusted to Deliver with Proven Reliability

Fujitsu has deployed more than 400,000 Network Elements (NEs) throughout every sector of the communications market in North America. Our platforms have also been proven via rigorous independent assessment. One example is testing of the FLASHWAVE 4500 system by the U.S. Defense Information Systems Agency (DISA)-sanctioned Joint Interoperability Test Command (JITC) for use in the DISA Defense Information System Network (DISN).



OPTIMIZED FOR EFFICIENCY

Future-Proof Strategy, Scalability

The FLASHWAVE 4500 system's switch fabric units match system capacity to that of the network, helping to control capital outlay. The platform enables an elegant scalable solution, allowing grooming capacity to be added as needed. This architecture scales from MSPP (70 Gbps) to MSSP (300 Gbps) single-rack configurations, protecting initial capital investments. The system integrates multiple service, transport and grooming elements into a single NE. A centralized non-blocking STS-1 switching architecture, combined with an optional 20 Gbps VT1.5 switching fabric, provides flexible grooming within the STS-1 to ensure maximum use of available bandwidth.

Ethernet Flexibility, Aggregation

The FLASHWAVE 4500 system enables flexible management and cost-effective transport of Ethernet services. Packet transport efficiency is optimized by utilizing features such as VCAT, LCAS, & RPR. The platform's Trunking Port (TPORT) function can efficiently aggregate multiple VLAN and EoS WAN services onto a single GbE LAN facility. This capability is ideal for applications that require Ethernet aggregation, such as wireless backhaul. TPORT functionality also reduces routers/switch ports, external cabling and FLASHWAVE 4500 system interface ports. Optional redundant GbE hand-offs provide facility and module protection for mission-critical applications.

Key Technical Advantages

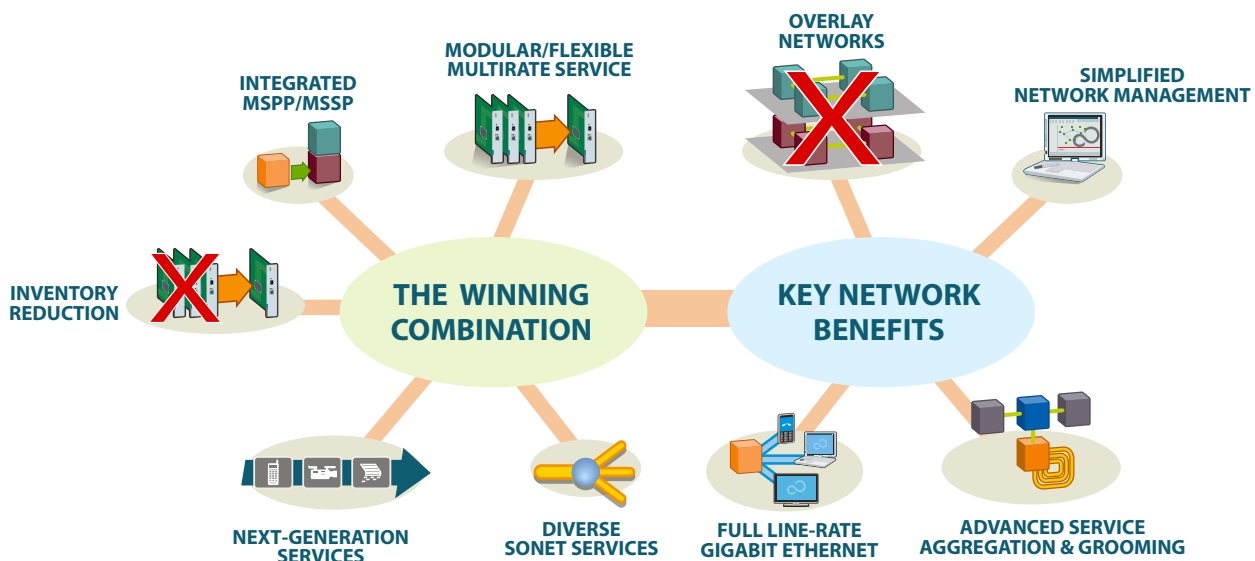
The FLASHWAVE 4500 platform supports a wide range of services, while improving the bottom line:

- ▶ **Integrated** MSPP and high-density MSSP on a single platform
- ▶ **Modular** and flexible multirate service interface to conserve shelf real estate
- ▶ **Tunable** optics for reduced sparing inventories
- ▶ **Next-Generation** data, video and voice services, plus operational continuity with existing networks
- ▶ **Diverse** MEF-9 and MEF-14 certified E-Line and E-LAN services over a reliable SONET platform

Key Network Benefits

The FLASHWAVE 4500 platform delivers a full range of services and architectures utilizing SONET and Ethernet technologies:

- ▶ **Full Line-Rate** Gigabit Ethernet provisioning over all SONET/DWDM backbones
- ▶ **Advanced** service aggregation and grooming (DS1, DS3, STS-1, optical and Ethernet)
- ▶ **Simplified** network management and visibility (performance monitoring data)
- ▶ **Converged** data, synchronous and asynchronous networks without expensive overlay networks



CRITICAL NETWORK APPLICATIONS

Wireless Backhaul

For wireless-carrier backhaul services, the FLASHWAVE 4500 is the transport platform of choice, delivering Ethernet aggregation and TDM grooming. The platform enables a smooth migration in supporting an increasing amount of data over the wireless infrastructure at optimized cost.

Core and Dedicated Rings

Optical flexibility and density, dependability and cost efficiency make the FLASHWAVE 4500 platform ideal for incumbent national carriers deploying core, dedicated ring and path-protected mesh topologies.

Multiservice Transport

With a single multirate card, the FLASHWAVE 4500 platform provides the ultimate in optical flexibility, easy sparing and low maintenance costs.

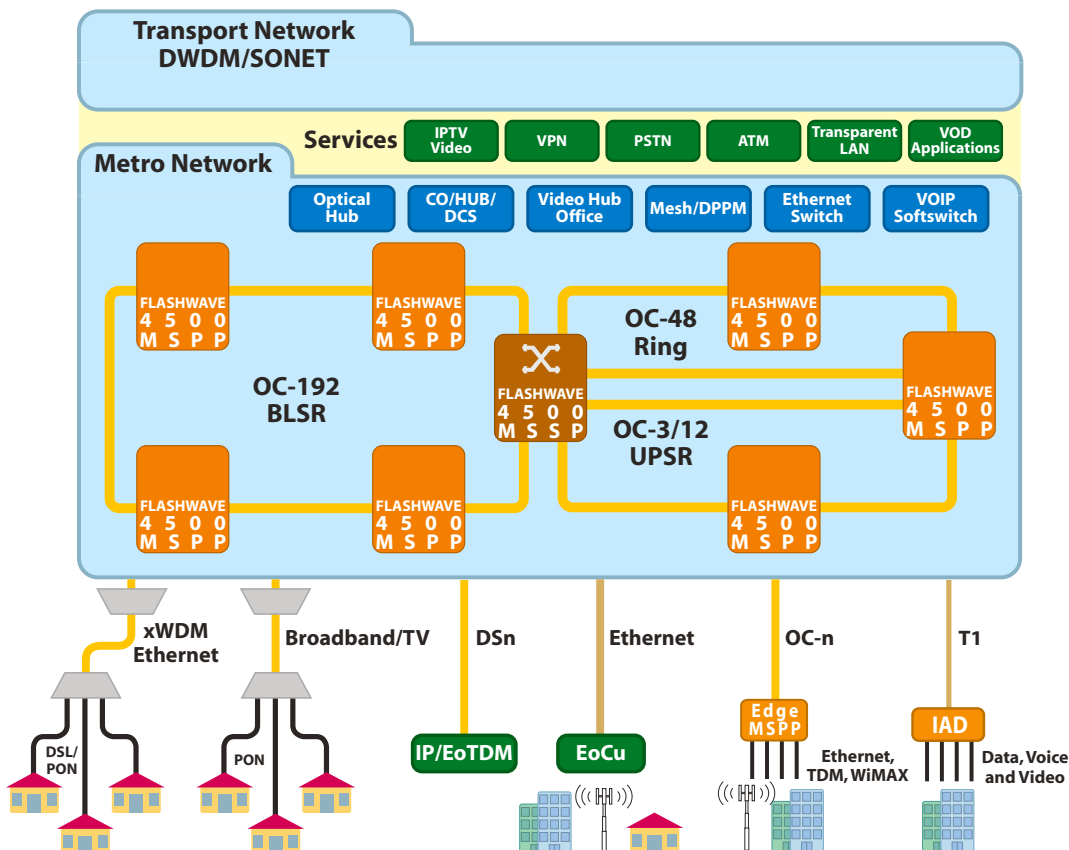
Transition to Broadband

The FLASHWAVE 4500 system is the ideal migration platform to assure a smooth transition to a more packet-centric network. The platform simultaneously maintains important revenue-bearing OC-n/TDM services.

DCS and Optical Hubbing

The FLASHWAVE 4500 system supports optical hubbing of OC-3/12/48/192 rings. This enables traffic aggregation and grooming across multiple networks when utilized with the inherent DCS functionality.

Scalable, Dependable, Cost-Effective



NETWORK LIFE CYCLE SERVICES

Fujitsu offers a broad selection of professional services to assist at every stage in a network's evolution and operation. From planning through deployment and ongoing maintenance to future enhancements, Fujitsu Network Life Cycle Services are available whenever needed. Our comprehensive range of services includes network and system design, training, customized deployment, craft interface software, migration planning and more. Your Fujitsu sales representative can guide you in selecting the right service options for your business.

Popular planning and deployment services for the FLASHWAVE 4500 platform include:

- ▶ **NETSMART® 1500 Element Management System** – Simplify Operations, Administration, Maintenance and Provisioning (OAM&P) through a secure point-and-click interface.
- ▶ **Advance Hardware Replacement** – Ensure uninterrupted operation with spares supplied within four hours or by the next business day.
- ▶ **Remote Technical Assistance** – Our Technical Assistance Center is your central point of contact for resolving network issues in collaboration with highly trained Fujitsu engineers—24 x 7 x 365.



Service Support Packages for Ongoing Maintenance

If you're looking for a complete professional maintenance solution, Fujitsu service support packages have the right combination of flexibility and comprehensive assurance. Choose the level and types of service you need to supplement your own resources. Our service support packages help keep your network running smoothly, provide critical care and protect the longevity of your investment.

Network Operations Center

With a full range of vendor-independent network fault and performance monitoring features, the Fujitsu Network Operations Center (NOC) offers guaranteed, round-the-clock system protection. Our reliable NOC facility is available as a primary or supplemental operations resource. This service not only helps you control costs and maintain high levels of customer satisfaction, it also provides trustworthy and reliable after-hours and emergency coverage.

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
- ▶ OC-3/STM-1 SC for dual unit; LC for quad unit, MPO connector for 8-port unit
1310 nm wideband
- ▶ OC-12/STM-4 LC, FC, SC or ST for single unit; LC for quad unit; MPO connector for 8-port 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 (8 λ @ 50 GHz)
- ▶ OC-192/STM-64 LC, FC, SC or ST connectors
1310 nm wideband; 1550 nm wideband
1550 nm tunable narrowband (4 λ @ 100 GHz)
1550 nm full band tunable to 88 λ (@ 50 GHz spacing) G.709 compliant
- ▶ Ethernet (EoS) RJ-45 connectors for 10/100Base-T Ethernet; LC or SC connectors for Gigabit Ethernet
- ▶ Ethernet Aggregation (trunking port, RPR) LC connectors for dual port unit
850 nm wideband; 1310 nm wideband
High/Low Order Aggregation

Switching

Maximum Switching Capacity				
Specification	Single MSPP	Main Shelf MSPP/MSPP	Double Shelf MSSP	Triple Shelf MSSP
Switch Capacity	70 Gbps	140 Gbps	220 Gbps	300 Gbps
STS-1 Cross-Connects	1344 x 1344	2688 x 2688* 5760 x 5760**	5760 x 5760	5760 x 5760
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)

* Requires 140 Gbps switch fabric
** Requires 300 Gbps switch fabric

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; Port Link Aggregation or Unit Link Aggregation
- ▶ 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



FLASHWAVE 4500 Single-Shelf Configuration

FEATURES AND SPECIFICATIONS

Type	Maximum Number of Unprotected (Protected) Service Interfaces			
	Ports/ Card	Single Shelf MSPP/MSSP	Double Shelf MSSP	Triple Shelf MSSP
DS1 (Integrated)	28	84 (84)	168 (168)	252 (252)
DS1 (High-Density)	168	6720	13,440	20,160
DS3/EC1	8	96 (96)	192 (192)	288 (288)
DS3 Transmux	12	144	288	432
OC-3/3c/STM-1	8	160 (80)	320 (160)	480 (240)
OC-12/12c/STM-4	8	160 (80)	320 (160)	480 (240)
OC-48/48c/STM-16	2	40 (20)	80 (40)	120 (60)
OC-192/192c/STM-64	1	10 (5)	20 (10)	30 (15)
10/100Base-T Ethernet	4 (8)	80	160	240
Gigabit Ethernet	2	40	80	120

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 Management 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
- ▶ DS1, DS3, OC-3 and OC-12 digital test access
- ▶ PM Threshold Provisioning on a per facility basis
- ▶ G.709 compliant digital wrapper for narrowband OC-192 optical channel adaptation
- ▶ Automatic equipment protection group creation
- ▶ Interoperable with all Fujitsu transmission products
- ▶ Full suite of in-service hardware and software upgrades
- ▶ NEBS Level 3 compliant
- ▶ Telcordia OSMINE compliant

Power Consumption/Heat Dissipation

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

Operating Environment

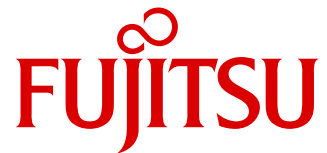
- ▶ Temperature 0 to 50 °C (32 to 122 °F)
- ▶ Humidity 5 to 95% (non-condensing)

Physical Characteristics

- ▶ Dimensions (H x W x D) 22.75 x 21.5 x 12" (578 x 546 x 305 mm)
- ▶ Weight (fully loaded) 137 lb (62 kg)



FLASHWAVE 4500 Multishelf Configuration



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Configuration requirements for certain uses are described in the product documentation.
Features and specifications subject to change without notice.