



## COMPANY OVERVIEW

### LAMBDA OPTICALSYSTEMS – SWITCHING INTO THE OPTICAL FUTURE

The global telecommunications carrier industry is in the midst of disruptive change, transitioning its infrastructure to meet the demand for and facilitate the delivery of reliable, affordable, high-bandwidth multi-service applications. Government agencies and enterprises alike have ever-increasing requirements for fast, high-bandwidth application delivery, particularly in the realms of grid computing, remote visualization, and terabit file transfer. The trends toward global network simplification (enabled by IP proliferation), standards-based networks, the maturation of WSS (wavelength selective switch) technology, and the growing migration to Ethernet are driving advances in optical switching that are quickly gaining traction and making their way to market.

As a pioneer in all-optical switching, Lambda OpticalSystems has adopted a standards-based architecture that allows it to focus on the delivery of dynamic optical networking for next-generation networks. Based on the proven AdvancedTCA<sup>®</sup> standard, the platform architecture supports the integration of equipment from multiple suppliers, enabling rapid time-to-market and offering customers flexibility, reduced Capex/Opex, and investment protection.

The first company to deliver an all-optical switch — the LambdaNode<sup>™</sup> 2000 — Lambda OpticalSystems is ready to deliver on its vision of all-optical networks that eliminate the need for expensive OEO components and increase the efficiency and reliability of all-optical switching.

Lambda OpticalSystems offers a full set of all-optical networking products, including:

- The Lambda Node 2000, the industry's first all-optical switch,
- the LambdaNode 3000 all-optical cross connect,
- the LambdaNode 5000 optical services platform,
- the LambdaNode 200 optical switching system, and
- the LambdaCreate<sup>™</sup> software, the associated suite of distributed and dynamic control plane and integrated network management software tools.

The company empowers its customers to layer these next-generation technologies on top of their legacy systems to seamlessly upgrade their infrastructure while protecting installed investments. The Lambda Node 2000 supports both ring and mesh topologies, as well as migration of ring to mesh architectures, which are recognized for their survivability and ability to provide effective scaling for network growth.



The LambdaNode 3000 all-optical cross-connect adds intelligence to static DWDM transport networks. It adds protection and restoration capabilities while reducing the cost of high-speed 10G and 40G router interconnects. The LambdaNode 5000 integrates WSS technology with AdvancedTCA shelf to provide an industry-based modular approach to transport networks. The LambdaNode 200 enables dynamic fiber switching for enterprise and education networks. In addition, all of the LambdaNode optical switching platforms support GMPLS control plane, which automates installation, circuit provisioning, protection and fault isolation. Additional benefits of Lambda OpticalSystems' technology include:

- **Protocol Independence** – LambdaNode is protocol and bit-rate independent, carrying each signal on its own wavelength and enabling savings through the elimination of dedicated protocol conversion equipment.
- **Quality of Service** – LambdaNode ensures reliable and consistent network traffic. It eliminates the variable delays caused by signal processing at the nodes in traditional optical network topologies. Point-to-point delay is fixed, allowing the delivery of predictable and manageable real-time, high-speed services throughout the network.
- **Transparency** – As Lambda OpticalSystems' solutions are designed to operate in an overlay fashion across existing network configurations, network components provide genuine transparency without any disruption of existing signals – allowing simple migration to higher degree or meshed networks.
- **Flexibility** – The Lambda OpticalSystems solutions suite offers flexibility to support all technology protocols and applications – Ethernet, HDTV, etc. – including proprietary signals. In addition, network operators can efficiently deploy a Lambda OpticalSystems network regardless of network topology – including ring, mesh, and hybrid configurations
- **Simplicity and Scalability** – Lambda OpticalSystems' solutions suite empowers network managers to plan, build, and manage new networks easily from one remote interface. Operations costs are reduced through elimination of provisioning errors and speeding of service activation. For example, managers can rapidly provision new customers online and reconfigure services. The solutions' scalability enables organizations to expand capacity without large capital expenses, addressing the carrier market's requirement to increase bandwidth and availability at the lowest possible cost
- **Security** – Lambda OpticalSystems solutions provide security at both the physical and logical layers, enabling the creation of services such as optical virtual private networks (O-VPNs) and virtual DWDM paths. With the growth of sensitive information transportation over metro and regional networks, an all-optical approach is required to ensure a safe and secure network.



Based in Reston, Virginia, with additional facilities in Holmdel (New Jersey), Tokyo, Seoul, and Milan, Lambda OpticalSystems boasts a world-class management team and a research and development organization focused on bringing to market innovative solutions that exceed customer requirements and transform the telecommunications landscape.

Lambda OpticalSystems brings you the all-optical future – today.



## **EXECUTIVE BIOS**

### **Irfan Ali President and Chief Executive Officer**

Irfan Ali is president and chief executive officer of Lambda OpticalSystems, an advanced optical network solutions provider. Ali leads the company, applying his extensive experience in the telecommunications industry to manage Lambda OpticalSystems' continued growth as a provider of all optical switches and sophisticated optical network management tools to telecommunications carriers, government agencies, and research institutions.

Prior to joining Lambda OpticalSystems, Ali served as president of CommWorks Corporation, a wholly-owned subsidiary of 3Com. Prior to this position, Ali was vice president of marketing for 3Com's carrier networks business unit, where he led development of the company's global business, with particular focus on Asia Pacific and Latin America.

Previously, Ali worked for Newbridge Networks, Inc. (acquired by Alcatel in May 2000), where he first served as assistant vice president, building the ATM and frame relay businesses for the company. Subsequently, he served as vice president of marketing for Newbridge Networks, Inc. Prior to that, Ali worked for Nortel, both as part of the scientific staff and in market development. He was also founder of the ATM Forum. Ali holds a master's degree in business administration and a Master of Science degree in electrical engineering from the Southern Methodist University.

### **Dr. Abdella Battou Founder, Chief Technology Officer, and Vice President of Software Development**

Dr. Abdella Battou is founder, chief technology officer, and vice president of software development for Lambda OpticalSystems, where he is responsible for overseeing the company's software development teams.

Previously, Battou served as co-founder and vice president of software at Firstwave Secure Intelligent Optical Networks. Additionally, he served as senior research scientist for the Naval Research Laboratory's high speed networking group, Center for Computational Sciences.

Dr. Battou holds a Doctor of Philosophy degree, a Master of Science degree in electrical engineering, and a Master of Science degree in mathematics from the Catholic University of America.



**Makoto (Mark) Suzuki**  
**President, Asia**

Mark Suzuki is president of Lambda OpticalSystems, Asia, where he leads the company's business and market development. Suzuki comes to Lambda OpticalSystems with more than 20 years experience from Hitachi, where he was tasked with developing international and domestic sales strategies as executive officer to the sales and management division. Suzuki also served as board director for the international division of Hitachi, managing company sales for wireless communications, broadcast systems, and electronic device production systems.

Suzuki served as president of Hitachi Telecom (USA). He also worked for Hitachi, Ltd. and Hitachi Europe, where he oversaw sales and marketing, as well as research and development for products including SONET, SDH, and ATM.

Suzuki earned Bachelor of Science and Master of Science degrees in electrical engineering from Sophia University in Tokyo.

**Lenny Chin**  
**Director of Product Management and Marketing**

Lenny Chin is director of product management and marketing of Lambda OpticalSystems, where he is responsible for managing and developing the company's product portfolio and executing marketing strategies. Utilizing his extensive knowledge in cross-connect technology, packet switching, and optical platform technology, Chin brings more than 19 years of telecommunications and data communications industry experience to the company.

Prior to Lambda OpticalSystems, Chin served as director and senior manager of transport switching and OSS integration at Tellabs, which designs and deploys technology for telecommunications service providers. Prior to this, Chin served as director of product management for Ocular Networks, a telecommunications start-up later acquired by Tellabs.

Previously, Chin held various product marketing and management positions for companies including Network Access Solutions, Ciena Corporation, Newbridge Networks (now Alcatel), Acterna, and Raytheon Corporation. Chin obtained his Master of Business Administration degree from Carnegie Mellon University and a Bachelor of Science degree in electrical engineering from Syracuse University.



**Steven Field**  
**Corporate Controller and Treasurer**

Steven Field is corporate controller and treasurer of Lambda OpticalSystems, where he oversees financial management of the company, employing his vast experience in capital raising, treasury management, financial forecasting, human resources, and MIS functions.

Prior to joining Lambda OpticalSystems, Field served as corporate controller and treasurer of Etenna Corporation, which makes embedded antennas for portable communications equipment.

Previously, Field served as director of planning and analysis for OTG Software, where he was responsible for financial forecasting and budgeting operating activities, including initial public offering planning for the storage software company. Additionally, Field served as controller for Picture Network International, a subsidiary of Eastman Kodak, where he led the company's daily accounting operations, financial forecasting, and administrative functions. Field received a Bachelor of Science degree in accounting from the University of Maryland and is a certified public accountant.

**Darrell Sager**  
**Director of Manufacturing Operations**

Darrell Sager is Director of Manufacturing Operations at Lambda OpticalSystems where he oversees operations, manufacturing, supply chain and vendor management.

Prior to joining Lambda Optical Systems, he was a manager at Lucent Technologies Optical Networking Group, where he was responsible for managing component commodities and developing strategies including the Wavestar 400G DWDM System. Mr. Sager was also at AT&T Sub-Marine Systems on optical amplifiers and AT&T Network Systems on SONET and WDM long haul transmission equipment.

Mr. Sager has a B.S. Computer Science, Monmouth University.



**Dr. Fernanda Mendez**  
**Director of Sales and Business Development - CALA;**  
**Director of Customer Support and Engineering**

Dr. Fernanda Mendez is Director of Sales and Business Development for Caribbean and Latin America (CALA) and Director of Customer Support and Engineering for Lambda OpticalSystems.

Previously, Dr. Mendez was Senior Director of Market Development and Customer Support at Photuris, Inc. where she was responsible for tier 1 carriers such as AT&T, MCI, Verizon, TELMEX, and Telefonica. She was also Senior Director of Customer Support and Network Analysis at Celight, Inc. Additionally, Dr. Mendez held several positions at Lucent Technologies including Optical Network Analysis Group, Optical Networking Group and Optical Technology Group for SONET and DWDM systems.

Dr. Mendez holds a Ph.D, MSEE and BSEE from City College of New York.



## LAMBDA OPTICALSYSTEMS SOLUTIONS

### LAMBDA NODE™ 2000

#### All-Optical Switching

The LambdaNode 2000 is the industry's only integrated all-optical switch. Unlike other "optical" switches that have to convert optical signals into electrical signals and then back to optical format for transport, the LambdaNode 2000 executes all switching in native optical format. This "all-optical" approach eliminates the requirement for organizations to maintain expensive OEO conversion equipment on their networks. What does this mean for carrier and enterprise customers? Lower signal delays, reduced cost, higher performance, improved reliability, and enhanced manageability. The LambdaNode 2000 utilizes 3-D MEMS (micro-electro-mechanical systems) for reliable, rapid switch time and low signal loss for effective optical switching. 3-D MEMS have met the rigorous Telcordia GR-63 design standard that protects systems against extreme temperature, humidity, vibration, etc., and have shock tested to over 2,000 Gs (G for gravitation unit of measure).

#### Integrated DWDM

Built for ring, mesh, and ring/mesh metro and regional networks, the LambdaNode 2000 fully integrates Dense Wavelength Division Multiplexing (DWDM) technology, which multiplies fiber capacity and allows diverse packet formats (SONET/SDH, IP, ATM, etc.) to travel together at the same time on one optical fiber. This integrated functionality eliminates the need for expensive transponders to convert signals back to 1310nm wavelengths and the associated optical switch ports, which are typically deployed in metro and regional networks.

#### Express Traffic

The LambdaNode 2000 supports optical circuits of up to 1,000 kilometers without electronic regeneration. More than 50 percent of network traffic does not need to stop at each node in the network, however traditional switches require all signals to stop in order to route them to their next location. Because it is all-optical and does not require signal conversion, the LambdaNode 2000 bands wavelengths, allowing network traffic to take the "express" route – traveling at the speed of light to its final destination.

#### GMPLS Advantages

Protocol agnostic, the LambdaNode 2000 is compatible with GMPLS (Generalized Multi-Protocol Label Switching), a standard that enables a broad suite of new communications applications. GMPLS provides enhancements to the Multi-Protocol Label Switching (MPLS) standard, supporting optical networks for time, wavelength, and space/packet switching. GMPLS adoption improves switching and photonic networking device performance, providing service providers with a scalable, cost-effective means to automate network management and facilitate the deployment of new services.



## Multiple Degrees of Flexibility

In a typical metro network, DWDM terminals reside where the fiber ends and are interconnected by a manual fiber patch panel or an OEO junction switch. While most OEO switches enable traffic flow through two locations, the LambdaNode 2000 enables network traffic to flow through seven interfaces – maximizing network efficiency. Because the LambdaNode 2000 integrates an all-optical switch with DWDM, it allows network operators to interconnect up to three metro rings without the need to deploy an OEO switch at the junction of each DWDM terminal. It also readily supports a migration path to mesh topology. This minimizes redundancy inherent in traditional OEO networks – eliminating the need for excess equipment, reducing cost, and maximizing network performance.

## Mesh Networking

Data networks can run logical mesh topology overlays on transport ring architectures, but burgeoning traffic demands on IP routers over-run threaded multi-ring transport networks. As such, survivability is a growing challenge. Mesh networks can rapidly scale to meet the demands of these networks and offer the necessary survivability. The LambdaNode 2000 is designed to support physical mesh topology to meet the growing transport needs of high-speed packet networks and offer the robust survivability required on these converged networks.

The LambdaNode family is also fully integrated with the LambdaCreate network management software suite.

## LAMBDA NODE<sup>™</sup> 5000 OPTICAL SERVICES PLATFORM

### Pioneering AdvancedTCA<sup>®</sup> in the Optical Network Layer

The LambdaNode 5000 Optical Services Platform leads the way in the rapid provisioning of optical services for access, metro, and regional applications, offering customers flexibility and investment protection. Based on the Advanced Telecom Computing Architecture (AdvancedTCA<sup>®</sup>), the LambdaNode 5000 platform takes a lead role in the rapid provisioning of optical services for access and metro applications. The AdvancedTCA shelf supports standardization of optical transport systems and provides increased flexibility via a competitive blade (circuit pack) environment.



## Increased flexibility, lower cost, and investment protection

Incorporating leading edge technology, the LambdaNode 5000 platform provides unprecedented switching capability that extends from two-degree ring topologies to multi-degree mesh topologies. Among the benefits offered by the LambdaNode 5000 platform:

- Reduce CapEx costs through standardization of integrated optical systems such as Wavelength Selectable Switching (WSS) and ROADMs (reconfigurable add/drop multiplexers) on AdvancedTCA
- Reduce OpEx costs through GMPLS control-plane with auto discovery, automated inventory, provisioning, and fault management
- Improve optical network flexibility with a path from rings to mesh topology and dynamic reconfigurability
- Rapidly customize specific applications just by changing circuit packs.
- Simplify management through common control and management software

## Complementing the LambdaNode 2000 and LambdaCreate<sup>TM</sup> software

The LambdaNode 5000 platform complements the features of the LambdaNode 2000, the industry's first integrated, all-optical switch, while continuing to offer:

- simplified network engineering and operation
- dynamic, flexible network configuration
- high-availability service protection
- differentiated transport services
- elimination of costly O-E-O conversions
- scalability to 40 Gbps
- carrier-class fault and performance management
- protocol and bit-rate independence.

Based on these attributes, the LambdaNode 5000 platform is the ideal choice to support legacy ATM and Sonet/SDH networks as well as converged IP, IPTV, Internet-based video, interactive gaming, storage area networking, Ethernet, Lambda Grid, WSS, and ROADM applications.



## LAMBDA<sup>™</sup>NODE 3000

### Intelligent Optical Cross-Connect Dramatically Reduces CAPEX and OPEX

Lambda OpticalSystems' intelligent optical cross-connect incorporates an all-optical fabric with dynamic GMPLS control plane for metro, and long-haul locations. The all-optical cross-connect and software will:

- Provide bit-rate independent and transparent switching to any protocols.
- Enables carriers to provide unique all-optical services such as optical virtual private networks (O-VPNs).
- Rapidly switch fiber to increase network resiliency.
- Add dynamic fiber and wavelength support to static WDM transport networks.
- Reduce CAPEX and OPEX by using lower-power all-optical technology and dynamic control plane.

### Intelligent All-Optical Cross Connect

The LambdaNode 3000 is a new intelligent, all-optical cross-connect with integrated GMPLS control plane. Designed for metro, long-haul carrier locations, it offers the ability to switch traffic in native format without converting to electrical format which saves on space and power. The GMPLS software has been tested for interoperability with leading router and multi-service provisioning platforms (MSPPs).

### Creates Dynamic and Survivable Optical Networks

Adding the LambdaNode 3000 to an existing WDM network creates the ability to provide intelligent path routing, mesh network protection that make networks more dynamic and survivable. The system is designed to upgrade an existing static single or multi-wavelength optical transport network into a dynamic application-driven optical network. Optional protection mechanisms include: 1+1, 1:1 and 1:N.



### Carrier Grade Design

- Fully redundant system control and switch fabric for high-availability operations.
- Supports 1+1 path protection.
- Optical ports are scalable to any speed from 50Mbps to 40Gbs. No need to upgrade fabric for higher port speeds.
- Optical ports can handle single or multiple lambdas.
- High density of 128x128 full duplex ports for medium and large switch applications.
- Scalable to 256x256 port fabric within the same system bay.

### Transparency Simplifies Operation

- No need to encapsulate traffic into a common protocol.
- Optical signals remain in native format and switch in an all-optical manner to decrease latency and provide a deterministic path which are required for grid networks and eScience applications.
- Can support any protocol: Ethernet, ATM, IP, Fibre Channel, FICON, Video.

### Intelligent Service Delivery

- Single management plane with point-and-click LambdaCreate Services Delivery System.
- Fast single person end-to-end remote provisioning/rearrangement and rapid automatic restoration for the entire network.
- Single LambdaCreate Optical Control Plane across all LambdaNode optical switch products.



## LAMBDA<sup>™</sup>NODE 200

### Intelligent Optical Switching System

Lambda OpticalSystems' intelligent optical switching system incorporates an all-optical fabric with dynamic GMPLS control plane for metro, access and campus locations. The all-optical switching system and software will:

- Provide transparent switching to any protocols
- Switch bands or groups of lambdas on each switch port
- Add dynamic fiber and wavelength support to static WDM transport networks
- Enable education and government labs to research optical networks
- Add all-optical switch function to OEO-based OXC junctions

### Intelligent All-Optical Switching System

The LambdaNode 200 is a leading intelligent all-optical switching system with integrated GMPLS control plane. Designed for metro, access and campus locations, it offers the ability to switch traffic in native format without converting to electrical format which saves on space and power. The GMPLS software has been tested for interoperability with leading router and multi-service provisioning platforms (MSPPs).

### Creates Dynamic and Survivable Optical Networks

Adding the LambdaNode 200 to an existing WDM network creates the ability to provide intelligent path routing, mesh network protection that make networks more dynamic and survivable. The system is designed to upgrade an existing static single or multi-wavelength optical transport network into a dynamic application-driven optical network. Optional protection mechanisms include: 1+1, 1:1 and 1:N.

### Transparency Simplifies Operation

- No need to encapsulate traffic into a common protocol.
- Optical signals can remain in native format and switched in all-optical manner to decrease latency and provide a deterministic path which are required for grid networks and eScience applications
- Can support any protocol: Ethernet, ATM, IP, Fibre Channel, FICON, Video



### Optimal Design

- Optical ports are scalable to any speed from 50Mbps to 40Gbps. No need to upgrade fabric for higher port speeds.
- Optical ports can handle single or multiple lambdas.
- High density of 64 x 64 full duplex ports for small and medium switch applications
- Saves space and power. Only 5.25 inches tall (3 telco rack units), the **LambdaNode 200** can easily fit into a small telecom closet with a rated 640Gbps capacity if 10Gbps SONET or 10Gbps Ethernet protocols are used.

### Intelligent Service Delivery

- Single management plane with point-and-click LambdaCreate Services Delivery System
- Fast single person end-to-end remote provisioning/rearrangement and rapid automatic restoration for the entire network.
- Single LambdaCreate Optical Control Plane across all LambdaNode 200s and 2000s.

## LAMBDACREATE<sup>™</sup>

### Single Point of Control

The LambdaCreate network management software suite enables remote, real-time, end-to-end control of all Lambda Node 2000 switches in the metro/regional network. The Lambda Optical Control Plane (OCP), the operating system running on the Lambda Node, fully integrates the Lambda Node switching family with the LambdaCreate software suite.

### Comprehensive, Robust Functionality

Fully FCAPS (Fault-Management, Configuration, Accounting, Performance, and Security) compatible, the LambdaCreate software suite provides a robust functionality in all management disciplines, including:

- **Topology and Connection Management** – Addresses all the steps necessary to discover, manage, and improve the reliability of the network. More specifically, the topology manager allows network operators to auto-discover the physical topology of the network, including Lambda Node 2000's connectivity. The connection manager utilizes the topology data to create bandpaths, bundle bandpaths into logical links, and provision end-to-end optical circuits with different service levels (1+1, auto-restore, 1:1, and 1:N)



- **Fault Management** – Provides real-time fault detection, isolation, identification and correlation, as well as historical alarm and client information. This functionality enables remote troubleshooting services that allow network operators to identify and correct current and potential network problems, minimizing network downtime and making the network more reliable
- **Configuration Management** – Allows network operators to configure the Lambda Node 2000 integrated optical switches and dynamically manage inventory
- **Performance Management** – Allows network operators to track performance of circuits to manage service level agreements (SLAs) and provides optical and SONET/SDH performance monitoring counts
- **Security Management** – Allows network operators to protect the network from unauthorized users and/or sabotage by controlling user access
- **Network Engineering Tool** – Allows network operators to plan ahead for changes in network traffic and allocate bandwidth on existing equipment, or add new equipment to ensure SLAs are upheld. This includes examination of network grooming, capacity planning and traffic growth, failure simulation, resiliency designs, and end-to-end path protection schemes



## Intuitive Graphic Interface for Efficient Provisioning

LambdaCreate allows network operators to efficiently provision and optimize Lambda Node 2000 resources throughout the network. The software suite's intuitive point-and-click graphic interface provides a single view of the entire network and each Lambda Node, allowing network operators to manage the all-optical network remotely from any location, at any time. This functionality reduces the need for manual provisioning and network management – speeding service delivery and boosting network performance. LambdaCreate also includes a TMF-814 compliant CORBA interface to allow for easy integration with other network and service management systems.

For media inquiries, please contact: [press@lopsys.com](mailto:press@lopsys.com).

or

Rosanne E. Desmone  
Mt. Vernon PR & Communications  
PO Box 215  
Mt. Vernon, VA 22121  
703.799.8165  
703.946.3820 (cell)  
[rdesmone@mtvernonpr.com](mailto:rdesmone@mtvernonpr.com)  
[www.mtvernonpr.com](http://www.mtvernonpr.com)