

## Microsemi Optical Transport Networking (OTN) Processors ECI and Microsemi Partnership

With over 50 years of experience in the optical networking business, ECI has more than 250 active customers worldwide, operating in more than 70 countries across 5 continents. ECI's customers include leading Research and Education Networks, critical Utility Networks, and some of the world's largest Service Providers.

The latest entry in ECI's innovative optical network product portfolio is the Apollo<sup>™</sup> line, which offers traditional optical networking as well as Layer 2 and OTN switching solutions that rely on Microsemi's DIGI OTN processors to provide a comprehensive feature set and allow a scalable architecture to drive the mass deployment of 100G.

# Service Providers Need Flexible, High-Capacity, and Secure Networks

To meet the varying needs of global service providers and data center customers, original equipment manufacturers (OEMs) such as ECI need to find ways of optimizing their R&D resources to create a wide range of products that are competitive in the marketplace. Many service providers are deploying OTN switching solutions to groom their traffic and optimize wavelength usage. Within these deployments, there will be cases where low-capacity switches are required and others where high-capacity switches are required. Service providers and data center operators may also be looking for non-switch-based solutions, such as transponders and muxponders to provide point-to-point connectivity. Within each of these applications, there will be varying requirements for the client rates and protocols supported, as well as potential encryption requirements for network security.

The only economically feasible way to address this wide range of requirements is to leverage R&D efforts across the designs, which is why ECI chose Microsemi's DIGI family of OTN processors.

As the pioneer in enabling OTN switching over packet fabrics, Microsemi's DIGI family of OTN processors are globally deployed in service provider and hyperscale data center wide area networks (WANs) today. The DIGI family enables a single flexible hardware and software silicon platform for OTN switching and OTN transport product lines, thereby reducing R&D investment while ensuring a consistent feature set.

The DIGI OTN processors provide a flexible development platform that form the foundation for a number architectures and applications, including:

- Dense 100G and 400G capacity client and line-side cards for P-OTPs
- Multi-terabit OTN and packet/MPLS switching
- Cost-optimized fabric-less switching platforms for the metro
- Dense 100G transponders and muxponders
- Wavelength and sub-wavelength level encryption solutions

ECI and Microsemi have worked together to develop and implement each of the described solutions, all based around a single DIGI device. This has enabled ECI to have optimized solutions for a large range of service providers and data center operators, helping them with deployment efforts and reducing operating costs.

#### **Executive Summary**

ECI and Microsemi have partnered to enable the economics required for mass deployment of 100G, with ECI leveraging Microsemi's DIGI OTN processors for its Apollo Packet Optical Transport Platform.

#### Challenge

Core, metro and data center networks drive a range of hardware platform and cost configurations that must be solved by original equipment manufacturers (OEMs) such as ECI. ECI must provide its customers with products that match their specific requirements, and needs to develop these products in a costeffective and efficient manner that allows the company to compete in the market while growing and investing in new technologies.

#### **Solution**

Microsemi's DIGI family of OTN processors enables a platform development strategy through its flexibility, broad feature set, and carriertested software development kit. This allows ECI to leverage their investment in hardware and software to develop a broad portfolio of advanced networking solutions, resolving the problems and addressing the challenges that their broad customer base faces—giving ECI a differentiated market advantage.

#### Result

ECI has selected Microsemi as their primary OTN solutions partner for the Apollo platform. Microsemi's processors have enabled ECI to build best-in-class OTN platforms and deliver them to their customers around the world.

Microsemi's DIGI OTN processors have the lowest power per port, carrier-grade software features such as hitless restart, the industry's most advanced OTN encryption, and scalability for seamless mass deployment of 100G packet optical transport architectures. They have met the capacity, speed, power, and security requirements while providing ECI with the flexibility to use the product line across several applications, line cards, and platforms, thus creating numerous solutions for addressing today's OTN challenges.



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#### **ECI Apollo Product Line**



Features	OPT9603	OPT9608	OPT9624	OPT9904X	OPT9914	OPT9932
Application	Flexible OTN/DWDM transport			High-capacity OTN/packet switching		
Maximum capacity (client + line)	1.0T	3.2T	9.6T	2Т	5.6T	16T
Transponders and muxponders	$\checkmark$	$\checkmark$	$\checkmark$			
Switching (ODU-XC + packet/L2)				$\checkmark$	$\checkmark$	$\checkmark$
Layer 2	Stand-alone blade			Fabric interface blades		
Photonics	Amplifiers, ROADMs					
Height	2U	5U	15U	5U	22U	FR

ECI's Apollo<sup>™</sup> family of packet-optical transport systems provide scalable, high-density, and efficient solutions to access, metro, and core networks. The Apollo platform enables service providers to deploy highly cost-effective, multi-service/multi-rate, and flexible OTN transport/OTN switching optical networks. ECI's Apollo platform enables high performance and low latency OTN transport and switching with software-configurable adaptability and agility for maximum efficiency and network performance.

The Apollo OPT9600 family can support a maximum line and client capacity of up to 9.6T with a variety of OTN-enabled transponders, while the Apollo OPT9900 family includes native OTN switching fabrics with up to 16T of capacity.

ECI has released the Apollo OPT 9932, a high-capacity switching platform supporting up to a 16T hybrid OTN/packet switching fabric to address the needs of service providers. In addition to the large switching fabric, the OPT 9932 employs client cards that support a wide range of protocols and line cards that can aggregate the traffic and connect to other parts of the network with high-capacity optics. In order to build these client cards and line cards, Microsemi and ECI worked together to create several ground-breaking solutions around the DIGI family of OTN processors. Microsemi's DIGI platform-differentiated by power, density, security, and software-has the scalability to enable mass deployment of 100G+ packet optical transport networks. ECI has selected Microsemi's DIGI OTN processors with multiple generations of field-proven, carrier-grade software API libraries and successfully implemented numerous client and line card designs, applications, and flexible equipment platforms while reducing the development costs and accelerating the time to market.

#### CUSTOMER CASE STUDY



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#### **High-Capacity Switches**

An OTN-switched network core, as shown in the following illustration, offers significant advantages to network operators with multiple customers and service types. It allows traffic to be groomed down to the ODU0 level to optimize overall bandwidth usage, resulting in substantial reduction to both CAPEX and OPEX. "The ability to switch at the OTN layer means more flexible service provisioning end-to-end and minimal chance of blocking. Microsemi's DIGI OTN processors in Apollo's Fabric Interface cards provide a centralized switching architecture for complete flexibility in the OTN infrastructure, eliminating blocking and providing any-to-any connectivity at an ODU0 level." —Jimmy Mizrahi, VP of Product Management at ECI



The cards are connected to the OTN and packet switch fabric of the packet-optical transport platform, enabling a high-capacity switching system. The DIGI device interfaces to the optics and the Fabric Interface Chip (FIC) and performs the OTN processing functions. As the DIGI device is a platform solution, it is able to be used on both the client and line cards that interface to the fabric.

On the line cards, the DIGI device enables a hybrid OTN/packet switching system by interfacing to and multiplexing both OTN and packet traffic for simultaneous transport over the same wavelength, thus maximizing 100G WDM utilization and providing a high degree of flexibility and cost savings for the service provider to optimally handle different traffic types. On the client cards, the DIGI device can support a variety of protocols including OTN, Ethernet, SONET, and Fiber Channel. Hybrid OTN/packet switching capabilities are also supported with DIGI-based client cards. Such client cards can support natively terminating Ethernet clients to send packets to the FIC while simultaneously sending OTN traffic to the FIC from OTN clients on the same card.

In addition, DIGI OTN processors can support hitless ODUflex re-sizing and adjustment as per the G.HAO (ITU-T G.7044) standard. G.HAO enables service providers to dynamically scale the available bandwidth for packet services based on their network's capacity requirements and traffic patterns.



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### Fabricless Switches and Flexible Platform Solutions

100G WDM ports in metro networks are growing rapidly, with a 45% CAGR (according to the 2016 IHS Technology Report on 100G+ Coherent Optical Equipment Ports Market Report). As many of the service rates are 10G and below, this drives a need for OTN switching to optimally fill the 100G wavelengths. The deployment of OTN switching closest to the metro edge creates a need for economical, low-power, and flexible-capacity or pay-as-you-grow OTN switching platforms.

The DIGI platform has been designed with this requirement in mind by enabling a single-chip line card with integrated OTN switching. By connecting DIGI line cards together in a meshed architecture, a fabricless and distributed OTN switch system can be created. This architecture eliminates the need for a separate FIC device, which results in BOM cost and power reductions of more than 25% on the line card. These reductions are quite valuable for metro-access networks that are cost and power sensitive.

ECI has implemented Microsemi DIGI OTN processors to develop Fabricless Switch Cards for the flexible OTN switching platforms in order to meet the metro edge network requirement.

"The fabricless switch cards, enabled uniquely by the Microsemi's DIGI OTN processors, allow ECI's customers to build an OTN switch card-by-card in a standard WDM platform. This unique capability reduces startup costs and allows a pay-as-you-grow strategy at the node level in bringing the benefits of OTN switching to the network edge."

-Jimmy Mizrahi, VP of Product Management at ECI



#### Fabricless Distributed OTN Switch



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### **Transponders and Muxponders**

Transponders and muxponders are important elements in an optical transport network. Transponders are used to enable point-to-point connections over long distances when the client rate matches the optical wavelength. In cases where the client rates are lower than the optical wavelength, a muxponder is used to multiplex multiple sub-rate clients onto the line interface.

Data centers are being deployed closer to the edge of the network to improve performance for content delivery and the internet of things. As data center operators expand their geographical footprint, transponders and muxponders are deployed for data centers interconnectivity.

The DIGI device is a high-capacity, multi-rate, fully channelized single-chip OTN processor optimized for transponders, muxponders, and Data Center Interconnect (DCI) optical transport platforms in a multi-service and multi-reach network environment.

An alternative solution to implementing transponders and muxponders are FPGAs, but these require multiple boot images to support different client types and cannot support in-field software upgrades (meaning live traffic is impacted when new features are added to the card).

For ECI to meet their customers' requirements, they used the DIGI family of devices to implement transponders and muxponders as a single device to support multiple client types. The DIGI has a single software platform that is a carrier-grade SDK and supports hitless upgrades. Thus, ECI's customers can add new features without impacting traffic. Furthermore, the DIGI device supports full bi-directional Performance Monitoring (PMON) along with per port link layer discovery protocol (LLDP) capabilities, enabling an automated discovery of router-to-transport connections. This gives the Software-Defined Network (SDN) controllers used in data centers an efficient and accurate view of the optical transport layer and eliminates the need to manually maintain static connectivity tables.



#### **Transponder and Muxponder Applications**



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## Security Solutions Through OTN Encryption

The security of communication lines is a top priority of service providers and data center operators. DIGI OTN processors can enable secured and low-latency WDM transport with the industry's most flexible and comprehensive OTN payload encryption at wire-speed for protocol-agnostic datacenterinterconnect and cloud applications.

The DIGI supports sub-180 ns end-end optical layer encryption and includes the industry's first sub-wavelength OTN encryption solution. This allows carriers to have flexible business models on how they monetize the encryption capability and make encrypted services compatible with the OTN switched networks that are fast becoming the backbone of optical networks worldwide. These capabilities enable a new class of low-power, high-capacity transport platforms optimized specifically for the hyper-scale data center interconnect market.

OTN encryption between data centers is enabled by DIGI processors in transponder/muxponder applications to ensure the optical data lines leaving the data centers are secure. Service providers and data center operators can add a new OTN encryption-capable line-side card using the DIGI processor into the system and gracefully switch over all the uplink traffic onto the new card.

The DIGI OTN processors integrate CrypOTN, an AES-256 CTR mode OTN payload encryption with GMAC authentication solution that is compliant with the Federal Information Processing Standard (FIPS) 197 standard through the Cryptographic Algorithm Validation Program (CAVP). The OTN encryption capability of DIGI OTN processors offer an attractive path for service providers and data center operators to add encryption capabilities on their platforms in order to make the lines secure.

## Feature Upgrades

As ECI's customers' needs change, it is often necessary to add features to a system that is already deployed in the field. This might include the addition of a new client type, or adding packet switching capabilities to an OTN switching system. Through ECI software capabilities on the Apollo platform and Microsemi's software design kit (SDK) and feature flexibility with the DIGI platform (which has a common SDK across all the applications that DIGI enables), it is possible to add new features to systems carrying traffic in the field without causing any hits to the traffic. Interruption of customer traffic, especially for critical infrastructures, must be avoided whenever possible by network providers. Customer Service Level Agreements (SLAs) strictly dictate the amount of dropped traffic in a year, and service providers do not expect to have to interrupt traffic for a software upgrade. Thus, a DIGI-based platform allows ECI to seamlessly stage product releases and to be highly flexible to address customers' requirements.

### Summary

ECI and Microsemi have collaborated to deliver innovative optical networking platforms to address today's OTN challenges in terms of capacity, speed, power, and security. Microsemi's DIGI OTN processing devices have the feature integration, lowest power per port, and scalability to enable economical deployment of 100G+ packet optical transport networks.

Leveraging multiple generations of field-proven, carrier-grade Microsemi OTN software API libraries, the DIGI OTN processors can be implemented across multiple line-card designs, applications, and equipment platforms to reduce the development costs while accelerating the time to market.

Microsemi's DIGI OTN processing devices and software API libraries empower ECI to provide its customers with dynamic and resilient network solutions that are future-proof, secure, and flexible to evolve with the changing requirements for speed and bandwidth capacity, thus creating value and competitive edge in operational simplicity, equipment costs, and advanced feature capabilities.

For more information, visit Microsemi's DIGI multi-service OTN processors products page at: <u>http://www.microsemi.com/products/optical-networking/otn/multi-service-otn-processors/multi-service-otn-processors.</u>



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