Atoga Offers First-to-Market in Software Tunable Bandwidth Provisioning Using the C-Port C-5 Network Processor

Metropolitan service providers face increasing demands from their business customers for flexible and comprehensive network solutions, such as video on demand, content hosting, and data mirroring. For service providers, offering on-demand bandwidth provisioning is time-consuming and costly, so they have been unable to fulfill their goals of becoming one-stop shops for network services. Seeking new revenue streams, service providers are also looking for ways to move from selling bandwidth as a commodity to using bandwidth as a way to offer higher-margin applications.

Recognizing these pressing needs in the metropolitan network market, Atoga conceptualized the Optical Application Router 5 (OAR 5), a system with dynamic optical scaling and intuitive network management software that would be the first of its kind in the market.

Offering instant scalability, the OAR 5 would help service providers attract new customers, improve services, and reduce costs. This case study tells how Atoga moved this system from concept to production quickly enough to capture a market ready for innovation.
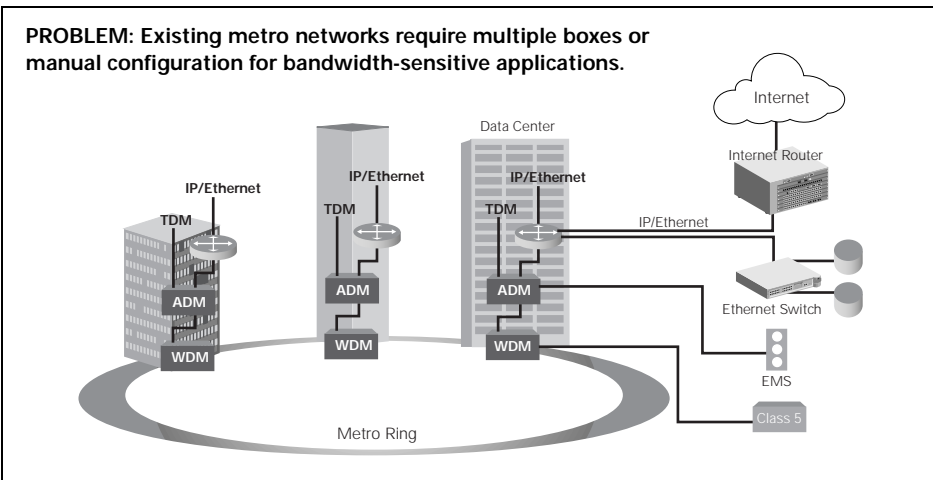
Seamless Integration for Metropolitan Service Providers

Most networks today are not flexible enough to accommodate the needs of bandwidth sensitive applications without either dedicating separate network equipment to each application or manually configuring the Internet Protocol (IP), Synchronous Optical Network (SONET), and Wavelength Division Multiplexing (WDM) layers to provision services. As a result, metropolitan service providers have not been able provide these applications to their clients at an attractive price point.

"With the C-5 network processor, we knew we had found the underlying technology on which we could easily build our tunable DWDM solution. Working closely with Motorola's C-Port team, we were able to achieve our goal quickly."

Debasish Biswas
Vice President of Software Engineering
for Atoga Systems

PROBLEM: Existing metro networks require multiple boxes or manual configuration for bandwidth-sensitive applications.

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Current network architecture has created other problems for service providers:

- Bottlenecks occur when traffic must be converted from optical to electrical and back to optical.
- Provisioning new users and new applications requires costly truck rolls.
- Bandwidth-intensive applications are limited to the speed of inefficient networks.
- Anticipating future technologies while migrating to new technologies and providing for legacy services is expensive and complex.
- Providing consistent service during periods of high congestion is a challenge.

Atoga's goal was to provide a seamless solution that would help service providers increase services, efficiency, and profitability. The OAR 5 would feature:

- An integrated, scalable platform. The IP, SONET, and WDM layers would seamlessly be combined in one system, allowing for smooth provisioning of services across IP routers and the underlying optical transport. A central policy server would automate network usage policies, eliminating the need for managing each network element individually. One box could do it all, allowing providers to reduce their operating costs by 30-40% through this change alone.
- Tunable lasers that intelligently groom network traffic, providing significant bandwidth flexibility and eliminating the bottlenecks associated with optical-to-electrical conversion. Tunable

lasers would also reduce the need for truck rolls when provisioning new users and applications.

- Advanced Quality of Service (QoS) architecture for maximum use of network assets. Combining the optical transport layer's capacity with the application layer's flexibility, the OAR 5 would create a flexible, stable, and dynamic system for efficient delivery of legacy services as well as a smooth migration path to high-bandwidth applications.
- Intuitive network management software. Atoga's AppDirector, with an intuitive graphical interface, would allow providers to easily manage applications and bandwidth.

Atoga realized that ASIC-based development would not meet their time-to-market requirements. They needed a flexible processing solution that would enable them to quickly program their unique provisioning solution, while providing the needed performance for their optical applications router. Atoga researched network processors as their possible 'fast path' to market. They discovered that only the C-Port C-5 Network Processor (NP) offered them a complete solution that would dramatically reduce their time to market. The performance of the C-5 NP, along with its integrated software forwarding, flexible interfaces, and compact size, was critical in allowing
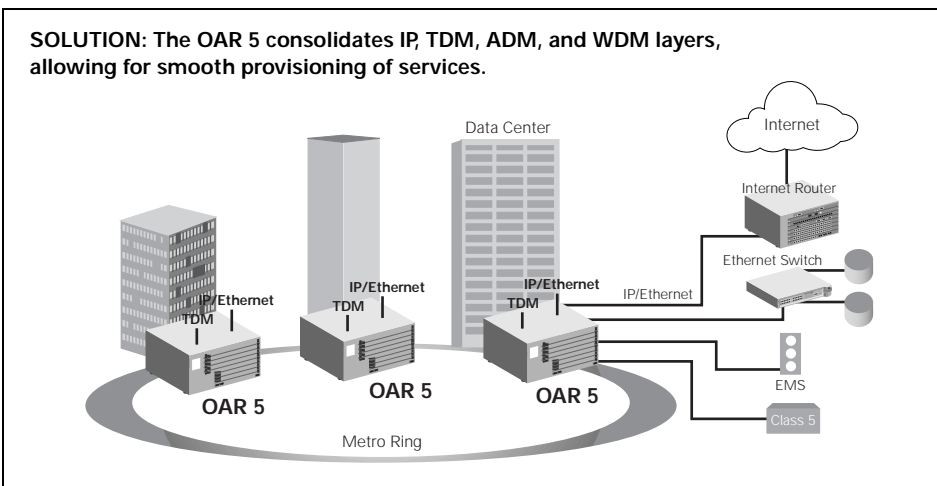
Atoga to move from concept to production in ten months.

C-5 NP Flexibly and Efficiently Handles Forwarding in the Atoga System

The C-Port C-5 NP combines complete programmability, massive processing power, and maximum flexibility into a compact and efficient device. For Atoga, it was this combination of features that made the C-5 NP the most comprehensive solution available.

Unlike the networking solutions of the past or many network processors of today, the C-5 NP offers software programmability in C-language of virtually all communications functions. The C-5 NP has sixteen Channel Processors, which receive, transmit, and process cells and packets, and five coprocessors, which offload many common networking tasks. Together, these processors create a highly integrated architecture that delivers the flexibility of software with the speed of hardware and that allows vendors to implement advanced functions quickly rather than devoting precious time to hardware development.

Atoga uses two C-5 NPs for the forwarding functions of the OAR 5. One C-5 NP handles packet traffic from local interfaces, while the other C-5 NP, mated to standard SONET interfaces, handles packet traffic for the ring or Dense Wavelength Division Multiplexing (DWDM) network. In the OAR 5, any communications function not related to SONET transport or tunability is implemented by the Atoga Operating System (AOS) on the C-5 NPs, often in conjunction with a host processor. These functions and pro-

SOLUTION: The OAR 5 consolidates IP, TDM, ADM, and WDM layers, allowing for smooth provisioning of services.

Data Center

Internet

Internet Router

Ethernet Switch

IP/Ethernet

IP/Ethernet
TDM

IP/Ethernet
TDM

IP/Ethernet
TDM

EMS

OAR 5

OAR 5

OAR 5

Class 5

Metro Ring

Atoga Operating System

tocols include accelerated IP packet lookup, metering/policing algorithms, ATM traffic termination, Packet over SONET (PoS), Border Gateway Protocol 4 (BGP4), Intermediate System to Intermediate System (IS-IS), Open Shortest Path First (OSPF), and Multiprotocol Label Switching (MPLS).

Needing to support various physical connections, Atoga also appreciated the flexibility of the C-5 NP interfaces. Each of the sixteen ports has individually programmable dual Serial Data Processors that support a variety of industry-standard serial and parallel protocols. These interfaces can support individual port data rates from DS1 (1.544Mbps) up to OC-48 when aggregated.

A Core Technology for Accelerated Product Development

C-Port's extensive development environment — consisting of a comprehensive software toolset and a robust development system — helped dramatically reduce Atoga's time-to-market.

The C-Ware Software Toolset (CST), a comprehensive suite of development tools, helps developers quickly and efficiently design and code networking applications. The CST features Application Programming Interfaces (APIs), an applications library, a host application environment, and a full set of development tools (including a performance-

accurate simulator, a GNU-based debugger and compiler, and support tools for analysis and microcoding). The CST was an especially important part of Atoga's rapid development process. Atoga made full use of the C-Ware API in their software development, realizing its benefits for easier programming and portability. To create all the differentiating features and services for the OAR 5, Atoga extensively customized the software running on the Channel Processors (coding in C-language). They were able to use the Serial Data Processor microcode largely as provided because it adheres to industry standards for implementing the MAC functions of the interface.

To quickly track down complicated problems and fine-tune the performance of the OAR 5 software, Atoga used the C-5 Simulator in conjunction with the C-Ware Debugger and C-Ware Performance Analyzer. Then, they were then able to fully debug and tune the performance of their software for the OAR 5 in an actual hardware environment using the C-Ware Development System (CDS). The CDS is a flexible testing environment consisting of a modular chassis with one or more C-5 Switch Modules, support for a variety of interfaces (such as OC-3, OC-12, and Gigabit Ethernet), and a Host Application Module. It also includes reference documentation for hardware design.

Because of the accuracy and robustness of the C-Port development environment for modeling the C-5 NP in real-world environments, Atoga was able to quickly port their software onto the OAR 5 hardware once it was available.

About the Atoga OAR 5 and OAR 30

The award-winning Atoga Optical Applications Router (OAR 5) with tunable wavelength selection is first-to-market to set in motion on-demand, high-speed application delivery on the optical Internet. By vertically integrating per-application bandwidth policing, IP routing and SONET/SDH add/drop multiplexing with tunable WDM laser technology, the OAR 5 is a one-box solution that allows users to directly access application services on the optical metro network.

The WDM layer in the OAR 5 uses tunable lasers to groom traffic on to high-speed metro rings, allowing for flexible ring re-provisioning. The SONET/SDH layer enables integrated TDM—data and voice—services, offering enhanced protection against network failure. The IP routing and layer-3/layer 4 features enable support for mesh topologies as well as intelligent packet services.

The OAR 30, the latest award-winning product from Atoga, is a carrier-class switch that enables service providers to take advantage of high-margin revenue opportunities, such as offering bandwidth-trading services and serving bandwidth-intensive applications like video conferencing and Enterprise Resource Planning (ERP) over their networks.

For more information about Atoga products, go to www.atoga.com.

With C-Port Network Processors, Atoga is the First to Offer Innovative Services in the Metro Market — Again and Again

Atoga wanted to offer service providers a means to satisfy the increasing demands of business customers in the metro network. The OAR 5 did just that: this innovative one-box solution made it possible for service providers to offer high-bandwidth applications, eliminate bottlenecks, and reduce operating expenses by 30% to 50%. Atoga's customers now have higher profits and are closer to becoming one-stop shops for the networking needs of their business clients.

But Atoga had to first get the OAR 5 to the market. Using more traditional development methods or less programmable solutions, Atoga may have faced a two-year lead-time from concept to completion. Instead, Atoga found that the C-Port C-5 NP could help them cut their development time dramatically. Atoga was able to rely on the C-5 NP for the forwarding technology that was central to the OAR 5. In addition, the C-Ware Software Toolset and the C-Ware Development System provided an extensive development environment that helped Atoga be first to market with their product. Beginning with the concept for the OAR 5 in May of 2000, Atoga had its first schematics in

June, its first boards back by the first of September, and a unit running by the end of September. By early November, only six months after first developing the concept, the OAR 5 was arriving at beta sites. In March of 2001, the OAR 5 was released to production.

The C-5 NP enabled Atoga to compress the development cycle of the OAR 5 from years to months. And now, Atoga is taking advantage of the C-5 NP's scalability and portability in their new OAR 30, a larger capacity, carrier-class switching platform. Designed for deployment in metropolitan points of presence (PoPs), co-location facilities, or major data centers, the OAR 30 supports efficient use of network assets and vastly simplifies service operations. The OAR 30 was announced in May 2001 and is available for trials in Q4 2001. With the help of the C-5 NP's flexible and scalable network system architecture and simple programming model, Atoga claims another first for the metropolitan market.

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