Photonic Integration & the Future of Optical Networking

EXECUTIVE SUMMARY

Recognition of the promise of photonic integration dates back to the late 1960s, but that promise went unexplored and unfulfilled for decades for a number of reasons, including a lack of technology maturity and a lack of so-called "killer applications" to drive deployment. But after a long dormancy, development of photonic integrated circuit (PIC) technology has finally begun in earnest. The first PICs combining multiple active functions debuted about four years ago – a tremendous achievement for the industry. The integration of today's PICs is still primitive compared to electronic ICs, which have an evolutionary head start of more than 30 years, but at least progress is being made.

Excerpt 1: Evolution of Photonic Integration

The greater reason for optimism today is that the killer apps that proved elusive in photonics for more than 30 years have now arrived. By all accounts, Internet and IP traffic growth continues to spiral upwards, and networks are becoming strained. Recent Heavy Reading research in optical transport has shown immediate operator demand not just for 40-Gbit/s transport, but also for 100G: In a worldwide survey of network operators conducted by Heavy Reading in the third quarter of 2007, 37 percent of respondents predicted that 100G transport would reach wide-scale deployment in their backbone networks in the 2010-2012 timeframe. Meanwhile, at the OFC/INFOEC
conference in February 2008, Ethernet inventor Bob Metcalfe was already outlining the communications industry migration to Terabit Ethernet, which he predicts will occur around 2015.

Excerpt 2: Network Operator 100G Deployment Timelines

In addition, we are seeing a boom in fiber-to-the-home (FTTH) deployment, driven largely by consumer demand for telco TV, IPTV, video on demand, Internet video, and other high-bandwidth applications. Heavy Reading estimates that 20 million households worldwide were connected to fiber at the end of 2007, up from just 6 million in 2005, and we expect this number to increase to 89 million by the end of 2012.

However, the universal problem in the telecom market – from the access network through the core – is that no one along the supply chain is willing or able to pay more for these bits. In fact, network operators must pay less for the capacity to transport them. In the case of 40G transport, network operators are demanding 40G transponders at 2.5 times (or less) the cost of 10G transponders, but the industry can only offer five to six times pricing today. For 100G transport, network operators are looking for 2.5 times the capacity of 40G transponders with no additional cost to the transponders. In the case of access networks, network operators are looking for optical network terminals (ONTs) to someday be comparable in cost to the ubiquitous DSL modems.

For the optical supply chain, it has become clear that major change is needed. Network equipment suppliers have already slashed headcounts, divested components businesses, and moved manufacturing to low-cost countries (or outsourced it altogether). Optical components suppliers, meanwhile, have been hit hardest of all and continue to struggle simply to remain afloat. Despite the renewed growth in the optical networking market over the past two years, the components industry remains very weak. For the industry to achieve the future it envisions, a new revolution in optical communications will be needed. Photonic integration – with the PIC at the center of it – may be the biggest contributor to this revolution over the next ten years, and beyond.

Photonic Integration & the Future of Optical Networking delves into the evolution of the PIC – past, present, and future – with the focus on its future. The report reviews the history of photonic integration and provides a framework for PIC market segmentation. It provides an overview of the photonic integration market, including the leading approaches for passive and optoelectronic photonic integration, and the primary applications today and over the next five years. The report also analyzes the nascent but potentially disruptive technologies of silicon photonics, including detailed information on commercial and laboratory innovations in this area.
The report profiles and analyzes more than a dozen emerging suppliers in the PIC sector. The findings and analysis in this report are based on four months of in-depth interviews with components suppliers, systems suppliers, network operators, and academic experts from the around the world.

Report Scope & Structure

Photonic Integration & the Future of Optical Networking is structured as follows:

Section I is an introduction to the report, with complete report key findings.

Section II provides a brief historical background on photonic integration, as well as Heavy Reading’s definitions and PIC market segmentation.

Section III provides an overview of the photonic integration market, including the leading approaches for passive and optoelectronic photonic integration, primary applications for today and over the next five years, and an overview of vendor landscape.

Section IV looks at the very nascent but potentially disruptive technologies of silicon photonics, including deep-dive views of some commercial and laboratory innovations in this area.

Section V provides a series of profiles of leading and innovative suppliers in photonic integration, based on our in-depth interviews with components suppliers, systems suppliers, network operators, and academic experts.

The report is essential reading for a wide range of industry participants, including the following:

- **Telecom service providers:** How will developments in photonic integration affect the economics of delivering ever-increasing amounts of bandwidth in your network? What is the most likely migration path for your network equipment from electronic IC-based gear to PIC-based products? What kinds of factors are most likely to drive – or stall – the continued development of PIC technology? Which suppliers are in the best position to meet your needs for next-generation optical products?

- **Telecom equipment manufacturers:** How will photonic integration shape supply and demand for next-gen optical equipment? Which PIC technology developers are emerging as the market leaders? Is your company "timing the market" correctly, or is there a chance that your need for PICs will materialize before your suppliers’ product portfolios are ready?

- **Component and subsystem suppliers:** What is the most likely demand curve scenario for PIC products? Which equipment suppliers are likely to emerge as the early leaders in this sector? Where are the market opportunities for your components and subsystems?

- **Investors:** How will the emergence of PICs affect the optical networking sector? Which technology providers are likely to emerge as the main suppliers of next-gen optical products, and when are they most likely to reap those benefits?

Photonic Integration & the Future of Optical Networking is published in PDF format.