EXECUTIVE SUMMARY

Although deployments so far have been limited, 10-Gbit/s Ethernet (10GE) is widely seen as hav- ing a potentially enormous impact on both carrier and enterprise networks. 10GE promises not only to deliver an impressive throughput upgrade in the enterprise, but also to extend those high data rates through the edge and metro portions of the network into the WAN sphere.

A number of carriers have already committed to 10GE deployments, with more sure to follow; but adoption has been slower on the enterprise side. Although there is demand for 10GE backbone connectivity in the enterprise, the prohibitive cost of 10GE interfaces, at up to $4,000 per user, has prevented wide-scale adoption. This is now changing, as port prices continue to fall and vol- ume production ramps up.

System manufacturers have identified the high cost and power demands of 10GE transponders and PHY (physical layer) devices as the key barriers to making equipment more affordable for carrier and enterprise customers. Transponder and PHY vendors have responded to this chal- lenge with next-generation devices that cost less to manufacture and that use less power. As a result of these component advances, 10GE system prices are now tumbling and port shipments are starting to grow, as the per-user price of 10GE backbone connectivity comes below $200.

10-Gbit/s Ethernet Components: A Heavy Reading Competitive Analysis delivers a compre- hensive analysis of components vendors that are developing PHY devices and transponder mod- ules for the 10GE market. It not only provides detailed information on the components themselves – of interest to chip manufacturers and purchasers – but also offers insights into how the overall market for 10GE systems and components is likely to develop – of interest to a wide audience including carriers and investors.

The report is based on dozens of interviews with more than 30 different suppliers of 10GE PHY devices and transponders, along with detailed, feature-by-feature comparisons of every 10GE PHY and transponder component now on the market. In total, 195 products (128 transponders and 67 PHY devices) from 44 different 10GE component vendors are detailed and analyzed. Full comparative product matrices deliver more than 3,000 unique data fields covering every 10GE component product from every vendor.

The report covers all of the following component types:
10GE transponders:

- 300-pin
- Xenpak
- XPAK
- X2
- XFP

PHY devices:

- XSBI PHYs
- XSBI transceivers
- XAU1 transceivers
- XAU1 10-Gbit/s serial PHYs
- XAU1 retimer and backplane muxes
- XGMII – XFI PHYs
- 10-Gbit/s serial retimers

Key Findings

Key findings of the report include the following:

- **After two years of low sales, shipments of 10GE products are now rising sharply.** Port shipments of 10GE products rose by nearly 300 percent from the third quarter of 2003 to the fourth quarter, according to In-Stat/MDR. Dell’Oro reported “very strong port shipment and revenue growth” for 10GE in 3Q03.

- **10GE prices will soon be low enough for wide deployment in enterprise networks.** Over the last year, the average price of a 10GE port has plunged by about $30,000. At $10,000 per port, the market is now showing strong growth. Per-port prices of $3,000 or less will make 10GE an option for any midsize to large enterprise network.

- **Second-generation PHY silicon is driving 10GE prices lower because of reduced power requirements.** 10GE PHY devices now in production are less than one quarter of the price of first-generation components. The power required by a typical PHY is down from 3W to 1.5W, with 0.8W devices now sampling.

- **Xenpak is displacing the 300-pin form factor for all 10GE applications.** Xenpak is already the highest-volume transponder form factor. Xenpak transponders are now available for more standard IEEE port types than any other form factor. Seven components makers are now in production with Xenpak modules.

- **Intel, JDS Uniphase, and Opnext lead the transponder market with the widest product ranges.** Intel, JDSU, and Opnext all offer transponders with 850nm, 1310nm, and 1550nm serial optics. All three support 300-pin, Xenpak, and XFP form factors; Intel is shipping XPAK samples, while both JDSU and Opnext are shipping X2 samples.

- **Among makers of 10GE PHY components, Broadcom offers the best range of products.** Broadcom has PHY components in five out of the seven categories covered by this report. Close behind are Intel, Marvell Technology Group, and Vitesse Semiconductor, each of which covers four of the categories.

Report Structure

10-Gbit/s Ethernet Components: A Heavy Reading Competitive Analysis begins with a concise survey and analysis of key 10GE market and technology trends, examining how advances in
component technologies are affecting those trends. The report then delivers a comprehensive overview of the components used in typical systems supporting 10GE.

Excerpt 1: IEEE 802.3ae PHY Implementations

The heart of the report is a complete competitive analysis of all 10GE PHY devices and transponders now on the market. Detailed product matrices allow for fast and thorough comparisons of vendor offerings by a full range of criteria, including:

For transponders:

- Form factor
- Wavelength
- IEEE 802.3ae port type
- Sonet/SDH compatibility
- DWDM compatibility
- Operating range
- Physical specifications (length, width, height)
- Power
- Price
- Availability

For PHY devices:

- System interfaces
- Compatibilities
- WIS (WAN interface sublayer) support
- Fabrication technology
- Package dimensions
- Power
- Price
- Availability
### Excerpt 2: Low-Power 300-Pin Transponder Modules

<table>
<thead>
<tr>
<th>COMPANY</th>
<th>IEEE802.3ae PORT TYPE</th>
<th>RANGE</th>
<th>POWER</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finisar</td>
<td>10GBase-LR/LW</td>
<td>10km</td>
<td>5W (Max)</td>
<td>Production</td>
</tr>
<tr>
<td>Intel</td>
<td>10GBase-LR/LW</td>
<td>10km</td>
<td>5W (Typ) 6W (Max)</td>
<td>Sampling</td>
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<tr>
<td>JDS Uniphase</td>
<td>10GBase-LR</td>
<td>10km</td>
<td>3.5W (Typ)</td>
<td>Production</td>
</tr>
<tr>
<td>JDS Uniphase</td>
<td>10GBase-ER</td>
<td>40km</td>
<td>6W (Typ)</td>
<td>Production</td>
</tr>
<tr>
<td>Multiplex Inc.</td>
<td>10GBase-LW</td>
<td>10km</td>
<td>5W (Typ)</td>
<td>Production</td>
</tr>
<tr>
<td>Multiplex Inc.</td>
<td>10GBase-EW</td>
<td>40km</td>
<td>5W (Typ)</td>
<td>Production</td>
</tr>
<tr>
<td>Network Elements</td>
<td>10GBase-LR</td>
<td>10km</td>
<td>4.5W (Typ)</td>
<td>Production</td>
</tr>
<tr>
<td>Network Elements</td>
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<td>40km</td>
<td>5W (Typ)</td>
<td>Production</td>
</tr>
<tr>
<td>Oplink</td>
<td>10GBase-ER/EW</td>
<td>40km</td>
<td>6W (Max)</td>
<td>Production</td>
</tr>
<tr>
<td>Optium</td>
<td>10GBase-LR/LW</td>
<td>10km</td>
<td>5W</td>
<td>Production</td>
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<tr>
<td>Optium</td>
<td>10GBase-ER/EW</td>
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<td>6W</td>
<td>Production</td>
</tr>
<tr>
<td>TriQuint</td>
<td>10GBase-LR/LW</td>
<td>10km</td>
<td>4W</td>
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</table>

### Excerpt 3: XSBI PHY Summary

<table>
<thead>
<tr>
<th>COMPANY</th>
<th>DEVICE NUMBER</th>
<th>SYSTEM INTERFACE</th>
<th>WIS</th>
<th>POWER</th>
<th>PRICE</th>
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</thead>
<tbody>
<tr>
<td>Nighthawk</td>
<td>A2110</td>
<td>SPI-4.2 and XGMII</td>
<td>✓</td>
<td>4W</td>
<td>$275</td>
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<td>Skyhawk</td>
<td>A2111</td>
<td>XGMII</td>
<td>✓</td>
<td>2.7W</td>
<td>$150</td>
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<tr>
<td>Intel</td>
<td>IXF18101/3</td>
<td>SPI-4.2 (with MAC)</td>
<td>✓</td>
<td>3.7W</td>
<td>Not disclosed</td>
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<tr>
<td></td>
<td>IXF18104</td>
<td>SPI-4.2 (with MAC)</td>
<td>×</td>
<td>2.4W</td>
<td>Not disclosed</td>
</tr>
<tr>
<td>PMC-Sierra</td>
<td>S/UNI® 9953 PM5390</td>
<td>SPI-4.2 (with MAC)</td>
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<td></td>
<td>S/UNI®-1x10GE PM3392</td>
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<td>×</td>
<td>6W</td>
<td>$399</td>
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</tbody>
</table>

Along with specific feature-by-feature comparisons of components, the report includes insightful analyses of product and market strategies for all 44 manufacturers included in the report. Included in these profiles are comments from individual vendors about their future strategies and the scope and timing of anticipated improvements in 10GE components.

The report is essential reading for a wide range of industry participants, including:
• **10GE components vendors**: How do your products compare with those of your competitors? Are you able to present your customers with an accurate portrayal of the value of your products compared with the competition? What are the key advantages that you hold over each of your rivals? What are the areas that you need to address to maintain a competitive edge in the marketplace?

• **10GE systems manufacturers**: Is your stable of components suppliers the best it can be, or are there better products now available? What kinds of price/performance improvements can you expect from 10GE components, and what is the likely time frame for those improvements to kick in? What competitive pressures in the components markets can you potentially use to your advantage in striking deals with suppliers?

• **Investors**: Which 10GE components suppliers have the strongest product lines, and which ones are more likely to struggle for customer acceptance? Which private companies are emerging as likely success stories in this competitive field? Which ones are in danger of falling by the wayside?

**10-Gbit/s Ethernet Components: A Heavy Reading Competitive Analysis** is published in PDF format.