

A Guide to 10G Ethernet Controllers and Adapters

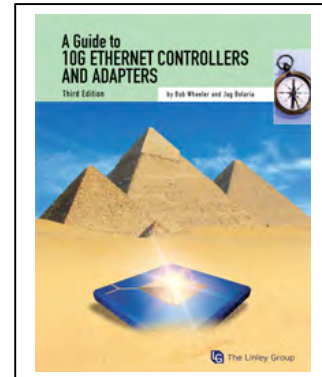
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[The Definitive Report on 10G Ethernet Server Connectivity](#)

The market for 10GbE server connectivity remains extremely dynamic with rapid shifts in technology and vendor market share. Evaluating the long-term outlook for adapter and controller vendors requires an in-depth understanding of their products and roadmaps. Now in its third edition, “A Guide to 10G Ethernet Controllers and Adapters” provides a uniquely detailed look at the vendors and products in this emerging market. This report offers complete chapters on the leading 10GbE NIC and controller vendors. Because OEMs source both board-level and chip-level products, we include full coverage and comparisons for both 10GbE NICs and 10GbE controller chips. Covered applications include LAN-on-motherboard (LOM), standard adapters (NIC), blade-server mezzanine cards, and converged network adapters (CNA).

With the transition to 10GbE, many new technologies are being added to Ethernet-controller designs. Most of these new features are designed to offload processing from the host CPU and therefore increase throughput or lower CPU utilization. These offloads are divided into three basic categories: stateless offloads that work with traditional operating system stacks; stateful offloads such as TOE that require stack changes; and virtualization offloads for environments such as VMware and Xen. For converged networks, new protocols such as Fibre Channel over Ethernet (FCoE), iSCSI, and iWARP (RDMA) also come into play. With all of this complexity, no single vendor can satisfy the requirements of all potential customers. We help you sort out which vendors meet your specific needs.

[We Map Out the Crowded Vendor Landscape](#)

“A Guide to 10G Ethernet Controllers and Adapters” begins with an extensive overview of this fast-growing market. The report provides tutorials that help you plow through the alphabet soup of acronyms and standards. We explore the market and technology trends for 10GbE server connections, followed by an explanation of the common attributes of these products.

Following these introductory chapters, the report delivers a complete chapter on eight major vendors of 10GbE controller chips and/or NICs: Broadcom, Chelsio, Intel, Mellanox, Myricom, Neterion, QLogic, and ServerEngines. Each major-vendor chapter includes company background information, full details of announced products, product-roadmap information where available, and our conclusions about the vendor and its products. An additional chapter covers newer entrants into the 10GbE adapter or LOM markets: Brocade, Emulex, and Solarflare. We then dedicate a chapter to detailed head-to-head comparisons of the many available controller, NIC, and CNA products.

The report concludes with our outlook for the server market for Ethernet and the leading vendors.

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This report is written for:

- Engineers designing servers or other systems that embed Ethernet connectivity.
- Network managers and end users who are evaluating 10GbE technology or planning deployments.
- Marketing and engineering staff at companies that sell related chips who need more information on 10GbE controllers.
- Technology professionals who wish an introduction to 10GbE technology and related chips for servers.
- Financial analysts who desire a detailed analysis and comparison of 10GbE semiconductor companies and their chances of success.

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The following excerpt is from "***A Guide to 10G Ethernet Controllers and Adapter Chips, Third Edition.***" This PDF contains the complete table of contents, list of figures, list of tables, preface, and executive summary. The full report may be purchased from The Linley Group.

A Guide to 10G Ethernet Controllers and Adapters

Third Edition

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By Bob Wheeler and Jag Bolaria



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Table of Contents

| | |
|---|----------|
| List of Figures | ix |
| List of Tables | xi |
| About the Authors..... | xiii |
| About the Publisher | xv |
| Preface | xvii |
| Executive Summary | xix |
| 1 Server Connectivity..... | 1 |
| What Is a LAN? | 1 |
| Evolution of Ethernet LANs..... | 1 |
| Cable Plants | 3 |
| Ethernet Switches | 3 |
| Client and Server Connections | 4 |
| Storage-Area Networks..... | 4 |
| Data Centers | 6 |
| 2 Ethernet Technology | 9 |
| Network Layers and IEEE 802 Standards | 9 |
| Link Layers..... | 11 |
| Spanning Tree and VLANs | 13 |
| Data Center Bridging | 14 |
| Link Aggregation | 15 |
| Authentication and Security | 15 |
| Ethernet Physical Layers..... | 15 |
| Fast Ethernet | 17 |
| Gigabit Ethernet | 17 |

| | |
|--|-----------|
| 10GbE Optical..... | 18 |
| 10GBase-LRM | 18 |
| 10GBase-CX4..... | 19 |
| 10GBase-T..... | 19 |
| 40GbE and 100GbE..... | 20 |
| Backplane Ethernet Standards | 21 |
| Physical-Layer Interfaces | 21 |
| Optical Modules..... | 23 |
| Upper-Layer Protocols..... | 24 |
| UDP | 24 |
| TCP..... | 25 |
| TCP Connection Setup and Teardown | 26 |
| TCP Congestion Management..... | 26 |
| 3 Server Technology | 29 |
| PCI Express..... | 29 |
| Background..... | 29 |
| Technology Overview | 31 |
| I/O Virtualization..... | 32 |
| Storage Protocols..... | 33 |
| SCSI..... | 33 |
| Fibre Channel | 33 |
| iSCSI..... | 34 |
| Operating Systems and Drivers..... | 34 |
| Virtualization | 36 |
| High-Performance Computing | 36 |
| RDMA and iWARP | 36 |
| MPI and OFED..... | 36 |
| Server Platforms..... | 37 |
| Processor and Chip-Set Technologies | 37 |
| Blade-Server Architecture | 38 |
| 4 10G Ethernet Controller Chips | 41 |
| Common Characteristics | 41 |
| PHY Integration and Interfaces..... | 43 |
| Performance..... | 44 |
| Offloads..... | 45 |
| Software Considerations | 46 |
| 5 Market Data and Trends..... | 47 |
| Market Size and Vendor Share..... | 47 |
| 10GbE Forecast | 49 |
| Market and Technology Trends | 51 |
| I/O Virtualization..... | 51 |
| Storage Convergence | 52 |

| | | |
|-----------|--------------------------------------|-----------|
| | Advanced Offloads and Features | 54 |
| | Blade-Server Evolution | 55 |
| 6 | Broadcom | 57 |
| | Company Background | 57 |
| | Controller Chips | 58 |
| | Product Roadmap..... | 60 |
| | Conclusions | 61 |
| 7 | Chelsio | 63 |
| | Company Background | 63 |
| | Controller Chips | 63 |
| | NIC Products | 65 |
| | Product Roadmap..... | 66 |
| | Conclusions | 66 |
| 8 | Intel | 69 |
| | Company Background | 69 |
| | Controller Chips | 70 |
| | NIC Products | 71 |
| | NetEffect iWARP NIC Products | 73 |
| | Product Roadmap..... | 73 |
| | Conclusions | 74 |
| 9 | Mellanox | 77 |
| | Company Background | 77 |
| | 10GbE Controllers | 78 |
| | 10GbE NIC Products..... | 79 |
| | Conclusions | 81 |
| 10 | Myricom | 83 |
| | Company Background | 83 |
| | 10GbE Controllers | 83 |
| | 10GbE NICs | 85 |
| | Conclusions | 86 |
| 11 | Neterion | 89 |
| | Company Background | 89 |
| | 10GbE Controllers | 89 |

| | |
|-------------------------------------|------------|
| 10GbE NIC Products..... | 91 |
| Conclusions | 92 |
| 12 QLogic..... | 95 |
| Company Background | 95 |
| NetXen 10GbE Controllers | 96 |
| QLE3xxx NIC Products..... | 97 |
| QLE81xx CNA Products..... | 98 |
| Product Roadmap..... | 99 |
| Conclusions | 100 |
| 13 ServerEngines | 103 |
| Company Background | 103 |
| 10GbE Controllers | 104 |
| 10GbE NICs | 105 |
| Product Roadmap..... | 105 |
| Conclusions | 106 |
| 14 Other 10GbE Vendors | 107 |
| Alacritech | 107 |
| Brocade | 108 |
| Company Background | 108 |
| CNA Products | 109 |
| Conclusions | 110 |
| Emulex..... | 110 |
| Company Background | 110 |
| CNA Products | 111 |
| Conclusions | 113 |
| Solarflare | 114 |
| Company Background | 114 |
| 10GbE Controllers | 115 |
| Conclusions | 116 |
| 15 Product Comparisons | 119 |
| 10GbE Controller Chips | 120 |
| Stateless 10GbE NICs | 124 |
| Stateful 10GbE NICs | 125 |
| CNAs and NICs for FCoE | 127 |
| Conclusions | 129 |

| | |
|---------------------------------------|------------|
| 16 Conclusions | 131 |
| Market Directions | 131 |
| Vendor Outlook..... | 132 |
| Intel | 132 |
| Broadcom..... | 133 |
| Chelsio | 133 |
| QLogic..... | 134 |
| Emulex and ServerEngines | 134 |
| The Rest of the Pack | 135 |
| Appendix: Further Reading..... | 137 |
| Index | 139 |

List of Figures

| | |
|--|----|
| Figure 1-1. Typical LAN architecture | 2 |
| Figure 1-2. Storage-networking model | 5 |
| Figure 1-3. Typical data-center architecture | 7 |
| Figure 2-1. IEEE 802 standards | 10 |
| Figure 2-2. IEEE 802.3 basic frame format | 11 |
| Figure 2-3. Ethernet physical layer | 16 |
| Figure 2-4. 10G Ethernet physical layer | 18 |
| Figure 2-5. 40G/100G Ethernet layer model..... | 20 |
| Figure 2-6. Optical module size, power, and estimated price..... | 24 |
| Figure 2-7. TCP segment format | 25 |
| Figure 3-1. PCI Express system topology | 30 |
| Figure 3-2. Linux network-stack simplified diagram..... | 35 |
| Figure 3-3. Typical blade-server architecture | 39 |
| Figure 4-1. Stateless 10GbE controller simplified block diagram | 42 |
| Figure 5-1. 10GbE NIC/LOM 2008 market share (ports)..... | 48 |
| Figure 5-2. 10GbE switch and NIC/LOM shipment forecast, 2008–2013..... | 50 |
| Figure 6-1. Broadcom BCM57711 dual-SFP+ NIC reference design | 60 |
| Figure 7-1. Chelsio S320E-CR dual-SFP+ NIC | 66 |
| Figure 8-1. Intel X520-SR2 dual-port SFP+ NIC..... | 72 |
| Figure 9-1. Mellanox ConnectX-2 EN dual-port SFP+ NIC..... | 81 |
| Figure 10-1. Myricom Myri-10G SFP+ NIC..... | 86 |
| Figure 11-1. Neterion X3120 SR dual-port NIC | 92 |
| Figure 12-1. QLogic QLE3142 dual-SFP+ NIC..... | 98 |

List of Tables

| | |
|---|-----|
| Table 2-1. OSI reference model | 10 |
| Table 2-2. Ethernet PHY standards..... | 17 |
| Table 3-1. PCI revisions and characteristics | 29 |
| Table 5-1. 10GbE NIC/LOM 2008 market share | 48 |
| Table 6-1. Key parameters for Broadcom CNIC controllers | 59 |
| Table 7-1. Key parameters for Chelsio 10GbE controller..... | 64 |
| Table 7-2. Key parameters for selected Chelsio NICs..... | 65 |
| Table 8-1. Key parameters for selected Intel GbE and 10GbE controllers..... | 70 |
| Table 8-2. Key parameters for selected Intel GbE and 10GbE NICs | 71 |
| Table 9-1. Key parameters for Mellanox ConnectX-2 controllers | 78 |
| Table 9-2. Key parameters for selected Mellanox 10GbE NICs | 80 |
| Table 10-1. Key parameters for Myricom 10GbE controller | 84 |
| Table 10-2. Key parameters for selected Myricom 10GbE NICs..... | 85 |
| Table 11-1. Key parameters for Neterion 10GbE controller for PCIe | 90 |
| Table 11-2. Key parameters for selected Neterion 10GbE NICs..... | 91 |
| Table 12-1. Key parameters for QLogic/NetXen 10GbE controller..... | 96 |
| Table 12-2. Key parameters for QLogic Intelligent Ethernet Adapters | 97 |
| Table 12-3. Key parameters for QLogic second-generation CNAs | 99 |
| Table 13-1. Key parameters for ServerEngines 10GbE controller | 104 |
| Table 13-2. Key parameters for ServerEngines 10GbE NIC | 105 |
| Table 14-1. Key parameters for Brocade CNAs | 109 |
| Table 14-2. Key parameters for Emulex CNAs..... | 112 |
| Table 14-3. Key parameters for Solarflare 10GbE controllers..... | 115 |
| Table 15-1. Comparison of stateless 10GbE controllers | 120 |
| Table 15-2. Comparison of stateful 10GbE controllers..... | 121 |

Table 15-3. Comparison of stateless 10GbE SFP+ NICs..... 124
Table 15-4. Comparison of stateful 10GbE SFP+ NICs 126
Table 15-5. Comparison of CNAs and NICs with FCoE offloads..... 128

About the Authors

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Before 1997, Bob was division marketing manager for the Network Products Division of AMD. He was responsible for marketing local-area network (LAN) products, including Ethernet and wireless LAN controllers and transceivers. Strategic customers included Cisco, Compaq, HP, 3Com, and many other PC and networking OEMs. During his four-year tenure at AMD, Bob's roles included strategic marketing, product marketing, and technical marketing positions.

Before joining AMD, Bob was head of operations for Way To Go, a technology startup. The company launched an appliance and service for wireless traffic information in the San Francisco Bay Area. Bob was responsible for taking the product from proof-of-concept prototypes to production, including field-testing, contract manufacturing, and establishing the traffic-operations center. This challenging role built on his experience as engineering manager at Sysgen, a manufacturer of PC peripheral products. At Sysgen, Bob was responsible for developing one of the first client/server tape-backup systems for local-area networks.

Bob spent the early part of his career as a software engineer, including seven years at microcomputer pioneer North Star Computers. While working for North Star in the mid-1980s, he was responsible for one of the first ports of Novell NetWare to an OEM platform. In the early 1980s, he worked as an independent consultant at the U.C. Berkeley School of Business, serving as a microcomputer programmer.

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Before these positions, Jag worked in Intel's communications group in technical marketing, product marketing, strategic marketing, and marketing management roles. He had worldwide product management responsibility for codecs/filters, modems, ISDN components, and LAN devices. During that time, he worked with engineers at AT&T, Fujitsu, IBM, NEC, Nortel/BNR, Rolm, and Siemens, among others.

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- Assisting an equipment vendor to select key components that are most appropriate for its application
- Providing valuable insights and technical due diligence to an investment group evaluating whether to invest in a semiconductor company

Our analysts start with a deep understanding of the key technologies in these markets, ignoring the hype and finding the features that make a difference. But we also understand that market success is based on business strategy as much as on technical excellence, and our recommendations are always steeped in the realities of the marketplace. We understand the dynamics of startups and established corporations alike and can shape our message to apply to the client's situation.

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Preface

What This Report Covers

Our coverage focuses on 10 Gigabit Ethernet (10GbE) adapters (or NICs) available to OEM customers and on the controller chips used in these adapters as well as in LAN-on-motherboard (LOM) designs. The primary market for these products is in servers; secondary markets include networked storage systems (NAS and IP storage) and high-performance computing (HPC).

Although many 10GbE vendors offer both chips and NICs, some vendors offer only one or the other. Also, some OEMs prefer to source a board-level product, whereas others want a chip for a custom design. For these reasons, we cover both controller chips and NICs for 10GbE.

Coverage of 10GbE switch chips, which are important to blade-server designs, appears in our companion report *A Guide to Ethernet Switch and PHY Chips*. This companion report also covers 10GbE PHY chips, including those for 10GBase-T, which can be used in NIC designs.

We do not cover custom chips (ASICs) designed by or for a specific OEM, because these devices are not available to other customers. Specifically, we view Sun Microsystems' Neptune chip as such an ASIC. We also exclude NICs that use an FPGA to implement the 10GbE controller, because these designs are not cost competitive for high-volume applications.

Who Should Read This Report

This report is designed to meet the needs of a variety of readers:

- Engineers designing servers or other systems that embed Ethernet connectivity
- Network managers and end users who are evaluating 10GbE technology or planning deployments
- Marketing and engineering staff at companies that sell related chips who need more information on 10GbE controllers

- Technology professionals who wish an introduction to 10GbE technology and related chips for servers
- Financial analysts who desire a detailed analysis and comparison of 10GbE semiconductor companies and their chances of success

As described below, the report is structured to allow different readers to skip certain sections as needed. For example, experienced communications engineers may wish to focus on the vendor and comparison chapters; financial analysts may instead focus on the tutorial, introduction, comparisons, and conclusions chapters.

Organization of the Report

The first three chapters provide a tutorial and introduction to Ethernet, LANs, SANs, and server connectivity. Chapter 1 provides background information on LANs and data-center networking; Chapter 2 focuses on Ethernet technology; Chapter 3 covers PCI Express, storage protocols, and server software/hardware design. Readers who are familiar with server connectivity may wish to skim or skip these chapters.

Chapter 4 describes the common requirements and design considerations for the 10GbE silicon discussed in this report, setting the stage for later chapters that study individual products. Chapter 5 provides quantitative market-size and vendor-share data, our forecast for 10GbE, and a look at key technology and market trends.

Chapters 6 through 13 cover eight major 10GbE NIC/controller vendors: Broadcom, Chelsio, Intel, Mellanox, Myricom, Neterion, QLogic, and ServerEngines. For each vendor, the report provides a company overview, strategic analysis, detailed controller and/or NIC descriptions, and overall conclusions. Chapter 14 covers newer entrants into the 10GbE NIC/LOM market including Fibre Channel HBA vendors offering converged network adapters (CNAs) for Fibre Channel over Ethernet (FCoE).

Chapter 15 compares the newest products from selected vendors across multiple categories, including 10GbE controller chips, 10GbE NICs (adapters), and CNAs/NICs for FCoE.

Chapter 16 concludes the report with our high-level analysis of the market and our outlook for 10GbE NIC/controller vendors.

Acknowledgments

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Executive Summary

Over the last few years, the market for 10G Ethernet (10GbE) adapters and controllers has grown rapidly. In 2006, HP, IBM, and Sun began offering 10GbE network interface cards (NICs) for their Unix servers. In 2007, HP, IBM, and Dell began offering standard 10GbE NICs for high-volume x86 servers. HP and IBM also introduced blade-server mezzanine cards for BladeSystem c and BladeCenter H, respectively. A long-term transition from board-level products to chips began during 2008 as Intel and Broadcom ramped 10GbE controller shipments. In 2008, HP introduced the first blade server to include 10GbE LAN on motherboard (LOM), making 10GbE a standard feature.

Despite this widening adoption, 10GbE shipments in 2008 reached only 1.5% of total server NIC/LOM port shipments. In 2009, 10GbE NIC/LOM and switch shipments remain a tiny fraction of Gigabit Ethernet (GbE) port shipments. As in the early stages of the transition to GbE, 10GbE NIC/LOM shipments trail switch-port shipments by a wide margin. The first switches to support 10GbE over copper wiring (10GBase-T) have reached production, but shipments remain small compared with those of optical ports.

Aside from the generic trends of falling prices and growing bandwidth demands, we see three major drivers for 10GbE adoption in servers: blade servers, server virtualization, and storage-network (SAN) convergence. Because of these positive trends, we expect 10GbE NIC/LOM shipments to grow rapidly through 2013, surpassing 10 million ports in that year.

The newest 10GbE controllers implement advanced technologies for server virtualization and storage networking. For virtualization, new designs implement virtual-NIC functions, and many now support the PCIe single-root I/O virtualization (SR-IOV) standard. For storage networking, some products support an iSCSI host-bus adapter (HBA) function, whereas others are supporting the emerging Fibre Channel over Ethernet (FCoE) protocol. Most 10GbE controllers also include advanced TCP-offload techniques, such as Microsoft TCP Chimney, to reduce the burden on server processors.

The technology discontinuity created by 10GbE has attracted a massive cumulative investment by a combination of venture-funded startups and larger vendors. Already a leader in GbE controllers and NICs, Intel introduced the industry's first 10GbE NIC. Starting with a relatively simple

controller design, Intel has added advanced offloads for virtualization as well as TCP and FCoE processing. The company's newest 10GbE controller chip offers excellent integration and low power dissipation. Intel offers a broad line of NICs based on this chip as well as a separate design for clustering (iWARP) from its acquisition of NetEffect.

Broadcom is the leading vendor of GbE controllers, and it grabbed the volume lead in 10GbE controllers in 2008. The company offers what it calls converged-NIC (CNIC) controllers for GbE and 10GbE. These chips are designed for TCP Chimney and IP storage using the iSCSI protocol. In 2009, leading server vendors Dell, HP, and IBM are all shipping Broadcom's GbE and 10GbE CNIC chips. Broadcom is the only 10GbE vendor to offer switch and PHY chips in addition to controllers, providing OEMs with a complete solution for blade-server fabrics.

Chelsio was the first to offer a 10GbE NIC with TCP offload, which is attractive for IP-storage applications. The startup later added iWARP support, opening up high-performance computing (HPC) applications. Chelsio's NIC shipments are growing thanks to design wins across the storage, HPC, and server segments. To remain competitive, however, the startup needs a next-generation chip that improves integration and supports new standards such as PCI Express v2.0 and SR-IOV.

QLogic, the leading Fibre Channel (FC) HBA vendor, is making a two-pronged push into the Ethernet market with converged network adapters (CNAs) for FCoE plus NIC/LOM products from its acquisition of 10GbE-startup NetXen. QLogic was first to market with a single-chip CNA design that uses existing FC drivers. Emulex, the other leading vendor of FC HBAs, has teamed with chip-vendor ServerEngines to produce CNAs. Unlike QLogic's CNA, the Emulex/ServerEngines design supports TCP Chimney and iSCSI HBA drivers in addition to FCoE. Brocade, a newer entrant in FC HBAs, has developed a single-chip CNA with features similar to those of QLogic's product.

Startup Neterion was an early leader in 10GbE NICs, thanks to a simple design that integrated easily with existing operating systems. But the company fell behind in the transition from PCI-X to PCI Express, resulting in significant share loss. Myricom, an incumbent vendor of cluster networks for HPC, offers 10GbE NICs along with software for specialized vertical applications. Mellanox, the leading vendor of InfiniBand chips, offers 10GbE NICs and controller chips that share a common architecture with the company's InfiniBand products. Solarflare, a 10GBase-T pioneer, has introduced the industry's first LOM chip that combines a 10GbE controller and 10GBase-T PHY on a single piece of silicon.

In 2009, nearly a dozen vendors are offering 10GbE NICs or controller chips, but no single product satisfies all applications. Instead, we see increasing specialization: some vendors are interested in only high-volume server applications, whereas others are addressing the unique needs of storage or HPC. Even with its high growth rate, however, the 10GbE market cannot support the current number of vendors.

This report analyzes the announced 10GbE NICs and controller chips to determine which are most suitable for common applications. It also analyzes the vendors to determine which are most likely to survive the coming consolidation.