

Performance and Recommended Use of AD193A / AD194A Combination 4-Gbps Fibre Channel / Gigabit Ethernet Cards From Results on an HP rx6600 Server



July 2007

Table of Contents

Introduction	3
Recommended Use Based on Performance and Design	4
Performance Summary	5
Gigabit Ethernet Only Performance	6
Fibre Channel Only Performance	7
1 FC Port and 1 GbE Port Combined Traffic Performance	8
Comparison of AD194A to AB465A for 1 FC Port and 1 GbE Port Combined Traffic Performance	9
2 FC Ports and 2 GbE Ports Combined Traffic Performance	10
Bidirectional Traffic Performance	10
How We Measured GbE and Fibre Channel Efficiency	11
Features and Benefits of the AD194A	13
For More Information	13

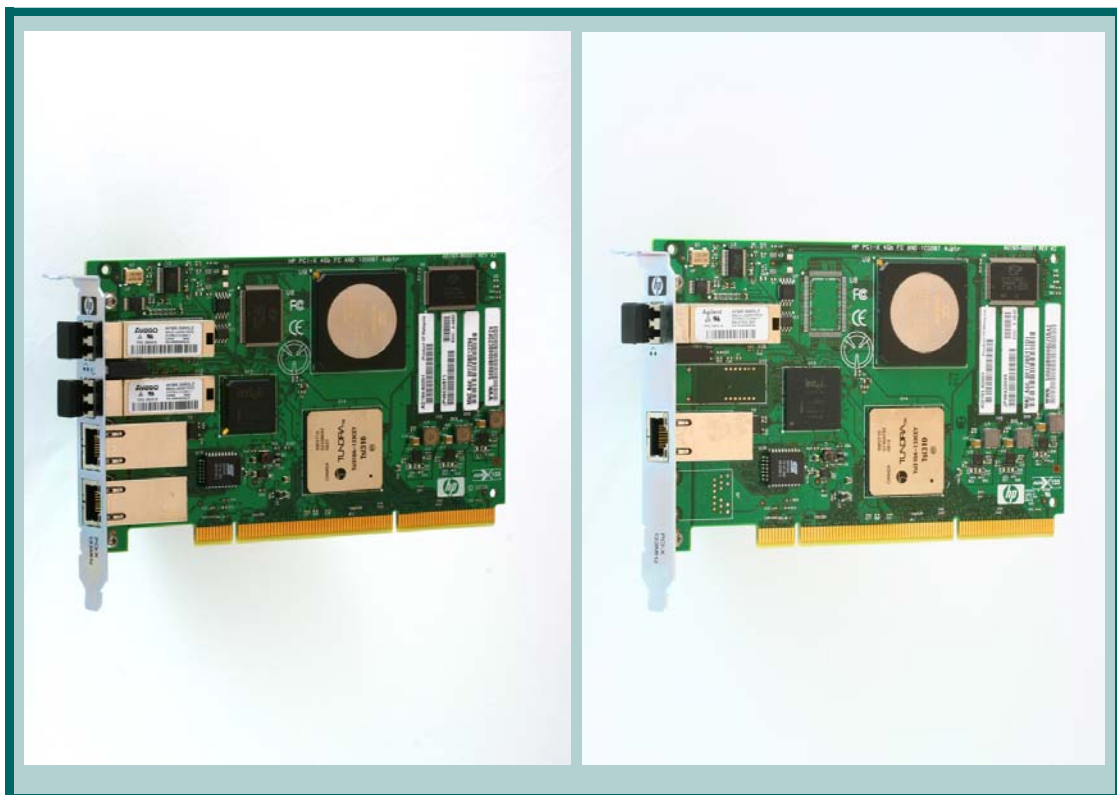
Introduction

This article highlights the excellent performance and high availability of HP's new AD193A and AD194A multi-function cards. The AD194A (Figure 1) combines 2-ports for 4Gbps Fibre Channel mass storage and 2 ports for Gigabit Ethernet networking. The AD193A (Figure 1) combines 1-port for 4Gbps Fibre Channel mass storage and 1 port for Gigabit Ethernet networking. Performance numbers for the AD193A are equivalent to single port numbers for the AD194A.

The AD194A 2-port 4Gbps Fibre Channel/2-port Gigabit Ethernet card is a next generation replacement for the AB465A 2-port 2Gbps Fibre Channel/2-port Gigabit Ethernet card. Similarly, the AD193A 1-port 4Gbps Fibre Channel/1-port Gigabit Ethernet card is a replacement for the A9784A 1-port 2Gbps Fibre Channel/1-port Gigabit Ethernet card.

This article also provides suggestions based on the performance and technology that will help you to optimize the use of these products.

Figure 1 AD194A Combination 2-Port 4-Gbps Fibre Channel / 2-Port Gigabit Ethernet Card and AD193A Combination 1-Port 4-Gbps Fibre Channel / 1-Port Gigabit Ethernet Card



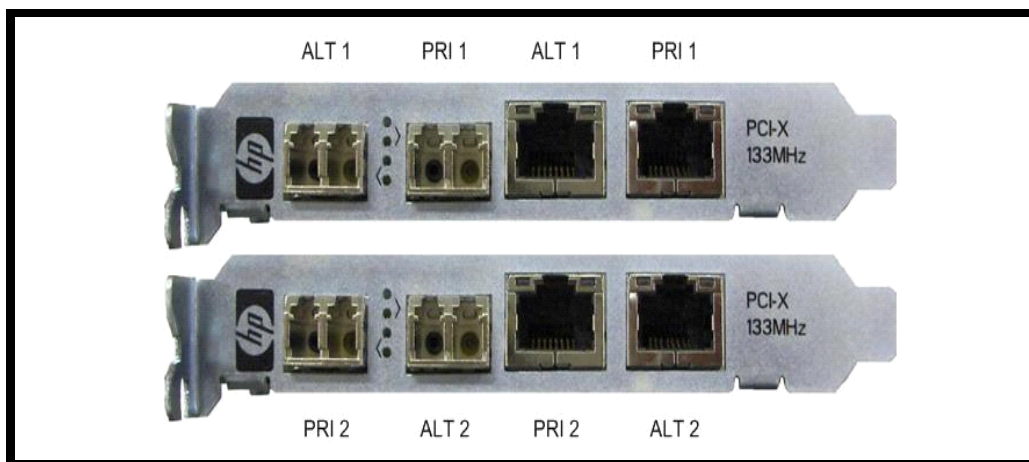
Recommended Use Based on Performance and Design

The AD194A can be thought of as a combination of an HP AB379B 2-port 4Gbps Fibre Channel card connected by a PCI-X to PCI-X bridge with an A7012A 2-port 1000Base-T card and sharing a common PCI-X bus. All the connections sharing this single common resource perform exceptionally well in a variety of configurations.

HP recommends the following usage model to achieve the best performance:

- Run the AD194A cards in the highest performing PCI-X 133 MHz slots. Slots 3, 4, 5 and 6 are the recommended high performance PCI-X 133 MHz slots in the HP Integrity rx6600 used in our performance testing.
- Set up a pair of cards for high availability as shown in Figure 2. On the first card, configure 1 Fibre Channel port and 1 Gigabit Ethernet port as *primary* or active and the second Fibre Channel port and Gigabit Ethernet port as alternates for the second card. On the second card, configure 1 Fibre Channel port and 1 Gigabit Ethernet port as *primary* or active and the second Fibre Channel port and Gigabit Ethernet port as alternates for the first card. This setup would provide the best performance and high availability. Achieving a similar level of high availability would require using twice the number of AB379B (2-port 4Gbps Fibre Channel) or A7012A (2-port GigE) cards.

Figure 2 **Setting Up a Pair of Cards for High Availability**



The recommendations mentioned here were followed to achieve the results shown in this article. Card throughput will be affected with configurations other than those recommended.

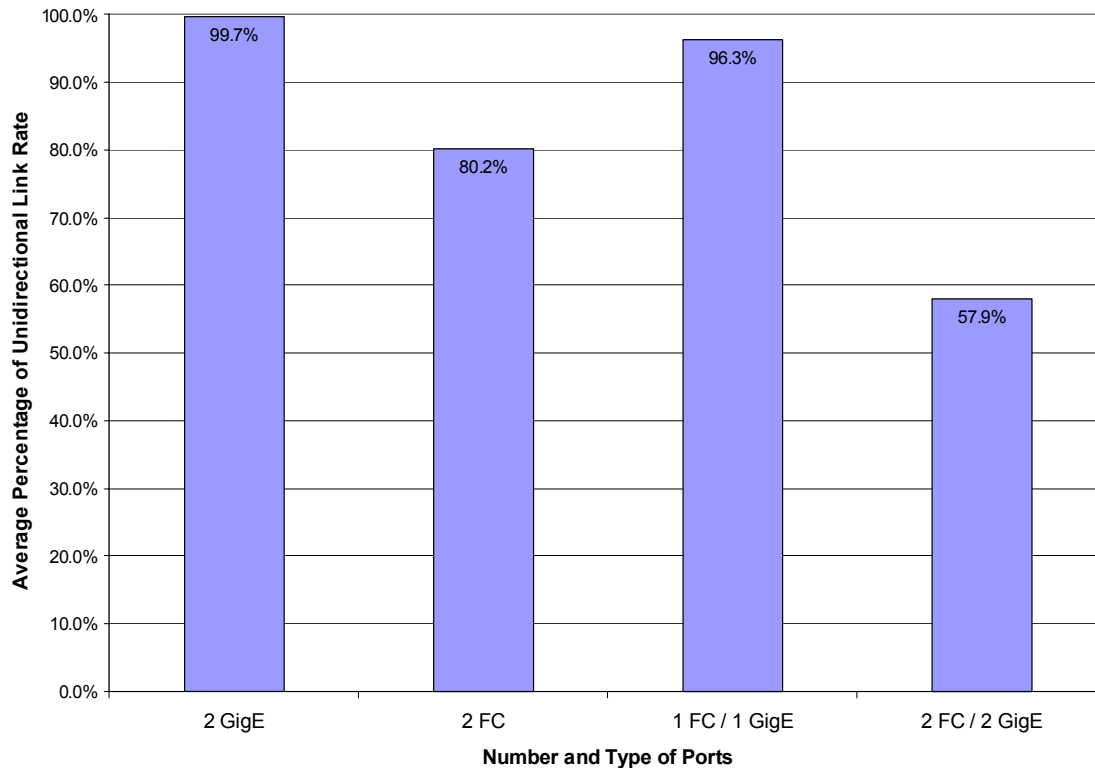
Besides providing exceptional performance, the AD194A and AD193A provide increased connectivity compared to other HP cards such as the AB379B, A7012A, AB465A and A9784A. Please contact an HP representative for additional help in understanding how to best deploy the AD194A and AD193A multi-function cards.

When used as recommended, the AD194A and AD193A provide equivalent performance to the ports on the AB379B and A7012A cards. In addition, the AD194A provides the benefit of high availability (HA) with no additional slot usage. In HA situations, when all four ports are being used, performance may be limited due to the bandwidth limitations of the PCI bus.

Performance Summary

The AD194A card provides excellent performance when used in accordance with the recommendations in this paper. Figure 3 summarizes the performance results possible when many different types of traffic combinations are used with the recommended models.

Figure 3 AD194A Performance Summary in rx6600



The graph shows the *average sustained unidirectional throughput relative to link rate* measured on:

- 2 Gigabit Ethernet ports,
- 2 Fibre Channel ports, or
- A mix of 1 Fiber channel port and 1 Gigabit Ethernet port, or
- A mix of 2 Fiber channel ports and 2 Gigabit Ethernet ports.

The AD194A has very good performance. Averages range from 57.9-99.7% of link rate on the rx6600 system with different combinations of traffic types. The summary includes results for all 4 ports running sustained simultaneous traffic!

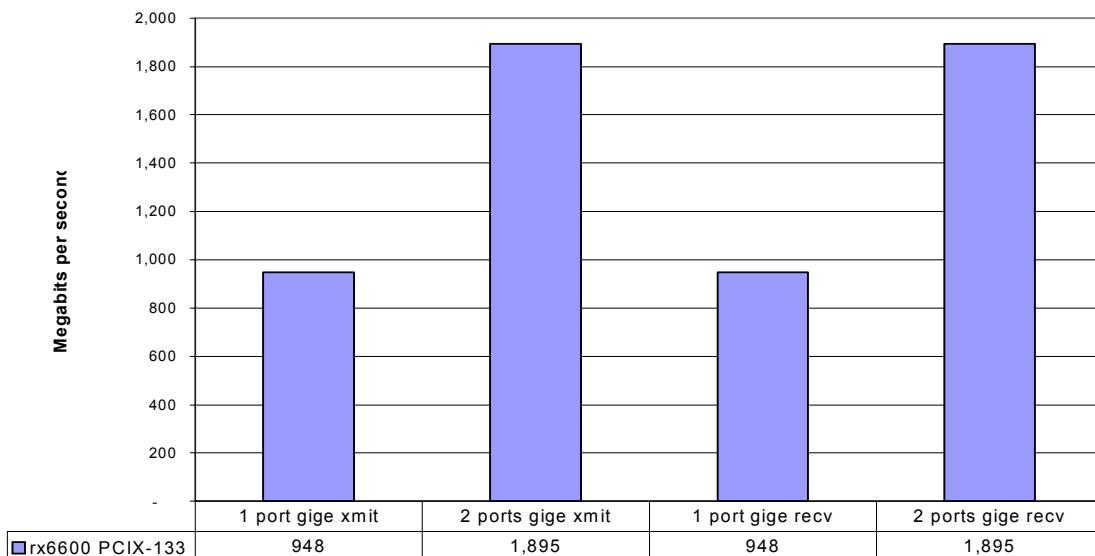
Many of the different types of traffic combinations achieve link rate and will be discussed in more detail later in the document.

Gigabit Ethernet Only Performance

Figure 4 shows the performance results of the Gigabit Ethernet ports when unidirectional Gigabit Ethernet traffic using a standard 1500-byte MTU is being run through the card.

The following highlights show the exceptional performance achieved during Gigabit Ethernet traffic testing:

Figure 4 AD194A Gigabit Ethernet Throughput in rx6600



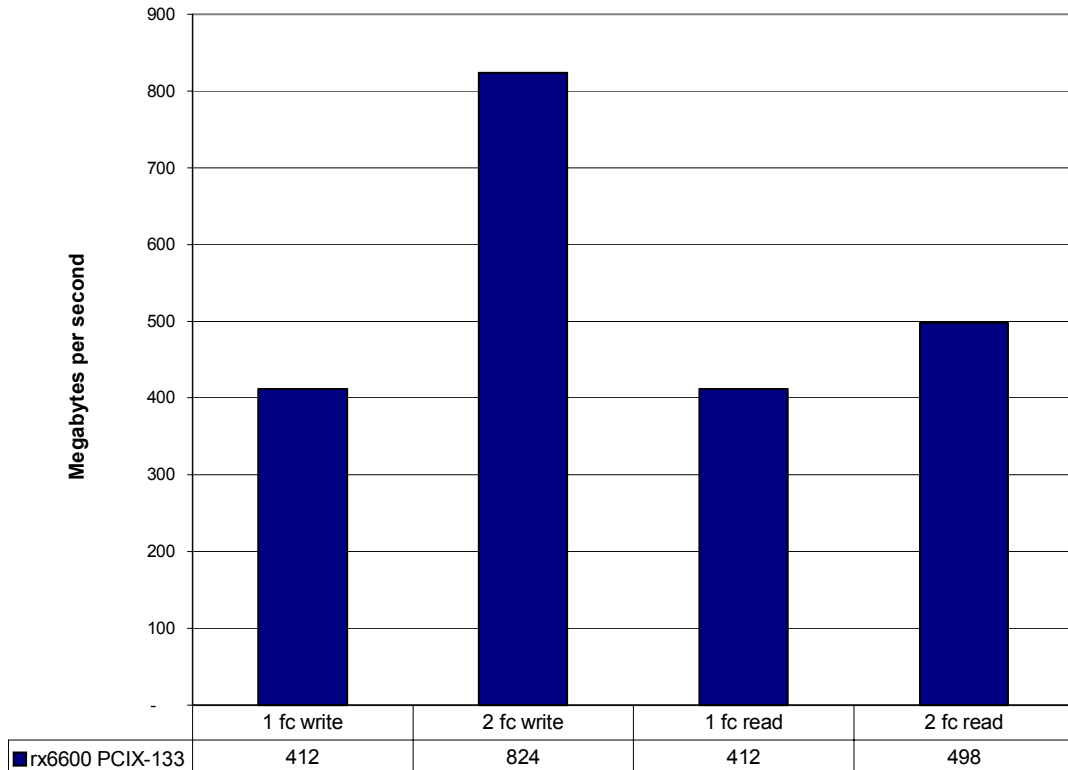
- Transmit traffic achieved link rate on the rx6600 reaching 948 megabits per second on one port and 1.895 gigabits of application data per second of throughput using both 1000 Base-T ports.
- Receive Traffic achieved link rate on the rx6600 reaching 948 megabits per second on one port and 1.895 gigabits per second using both 1000 Base-T ports.

Fibre Channel Only Performance

Figure 5 shows the performance results for the 4Gb Fibre Channel ports when unidirectional disk traffic is being run through the card.

The following highlights show the excellent performance achieved during Fibre Channel traffic testing:

Figure 5 AD194A Fibre Channel Throughput in rx6600



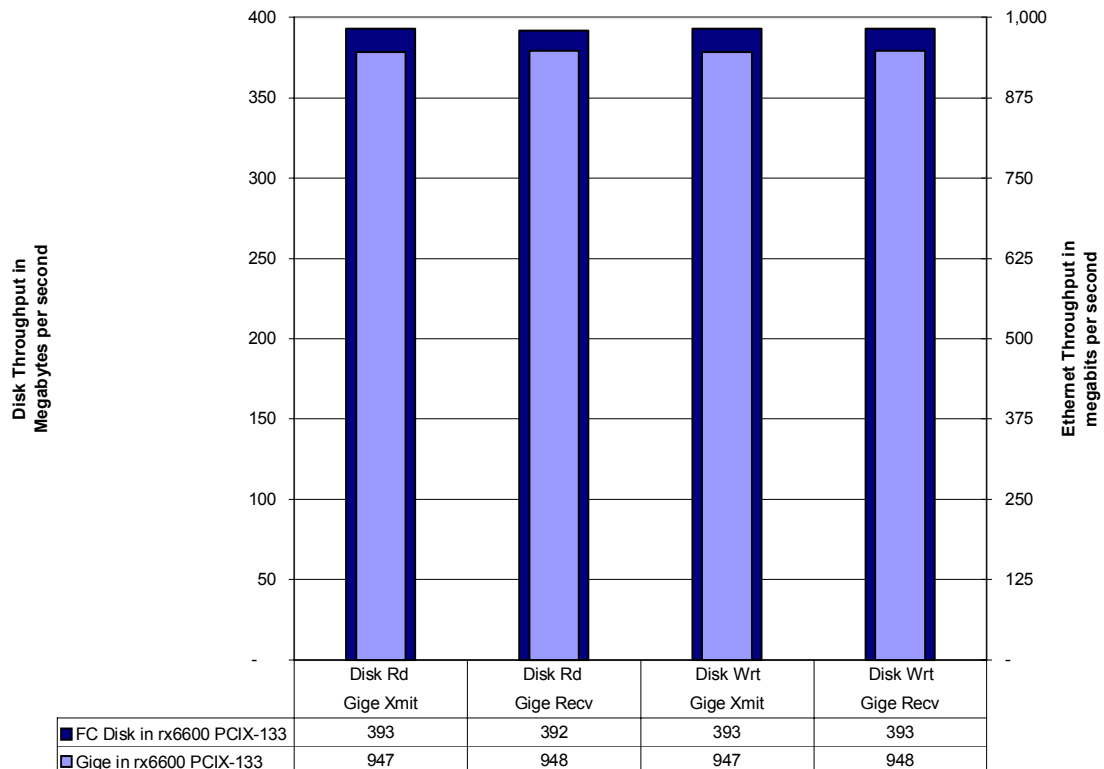
- Disk write traffic achieved link rate on the rx6600 with one port achieving 412 MB/s and two ports reaching 824 MB/s.
- Disk read traffic on one port achieved link rate of 412 MB/s on the rx6600 system.
- Disk read traffic on two ports achieved 498 MB/s on the rx6600 system which is 132% of the equivalent AB465A disk read performance.

1 FC Port and 1 GbE Port Combined Traffic Performance

Figure 6 shows the performance results when a mix of unidirectional traffic is run simultaneously through one 4Gb Fibre Channel port and one 1000Base-T port on the AD193A or AD194A card.

The following highlights show the exceptional performance the AD194A achieved during combination traffic testing:

Figure 6 AD194A Throughput with 1 Fibre Channel and 1 GbE



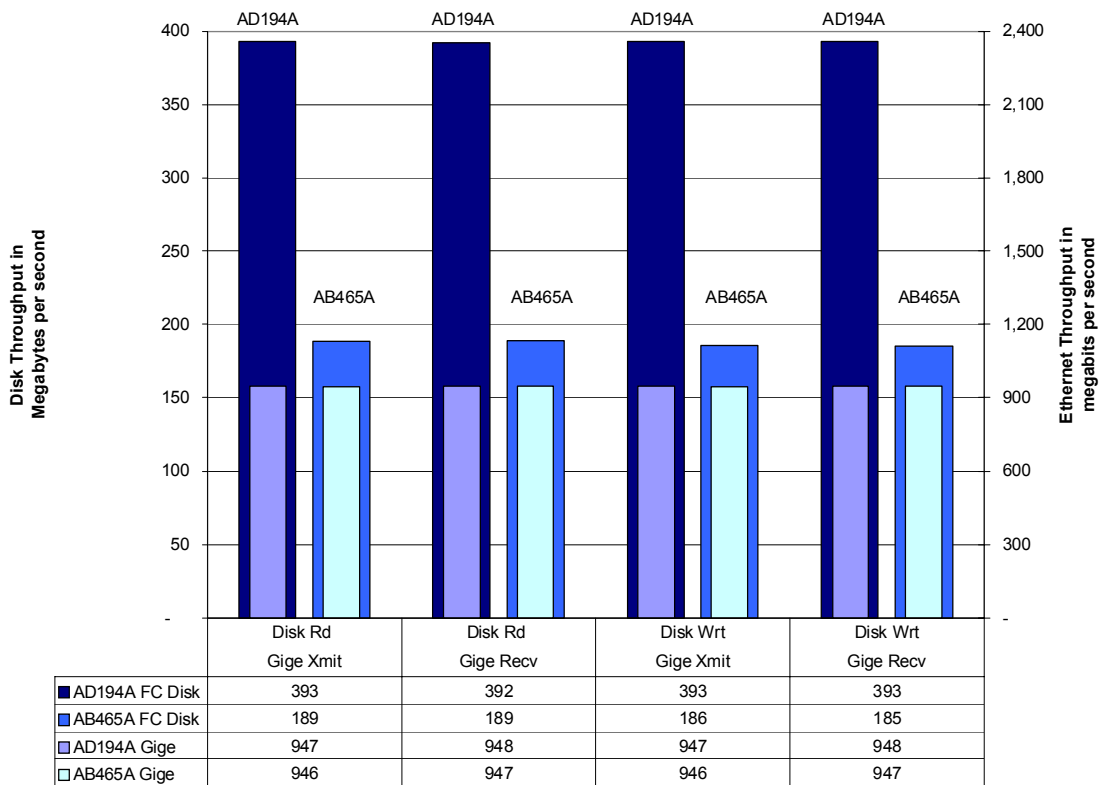
- The first two dark bars show disk read traffic consistently achieved greater than 95% of link rate on the rx6600 system. The active port achieved 392 MB/s or greater of disk read throughput. This was while continuous, full standard-Ethernet-frame traffic was occurring on the active 1000Base-T port.
- The last two dark bars show disk write traffic achieved greater than 95% of link rate on the rx6600 system. The active FC port achieved 393 MB/s disk write throughput. This was while continuous, full standard-Ethernet-frame traffic was occurring on the active 1000Base-T port.
- The light small bars show unidirectional Ethernet traffic achieved link rate on the rx6600 reaching 946 megabits of application data per second for transmit and 947 megabits per second for receive traffic on the 1000 Base-T port. This was while continuous disk traffic was occurring on the active FC port.

Comparison of AD194A to AB465A for 1 FC Port and 1 GbE Port Combined Traffic Performance

Figure 7 shows the performance results when a mix of unidirectional traffic is run simultaneously through one Fibre Channel port and one 1000Base-T port on the AD194A and AB465A card.

The following highlights show the exceptional performance the AD194A achieved during combination traffic testing:

Figure 7 AD194A and AB465A Throughput Comparison with 1 Fibre Channel and 1 GbE



- The above chart shows that 392 MB/s disk throughput for the AD194A card is double the 189 MB/s disk throughput for the AB465A card. This increase is provided by the technology change to 4-Gbps Fibre Channel ports on the AD194A compared to 2-Gbps Fibre Channel ports on the AB465A card.
- Ethernet performance remains at link rate for both cards.

2 FC Ports and 2 GbE Ports Combined Traffic Performance

Using both 4Gb Fibre Channel ports and both 1000Base-T ports on the AD194A card simultaneously works very well for applications such as web servers or file servers. The amount of networking traffic performed by this type of application regulates or controls the amount of disk traffic. Using all four ports on the AD194A works exceptionally well for those deployments which require more connectivity and less bandwidth per port. Performance using all four ports concurrently on the AD194A is highly dependent on the unique demands of applications running on the system. All four ports running at link rate would require significantly more bandwidth than is available on a single PCIX-133 bus.

Bidirectional Traffic Performance

The AD194A maintained a balance of transmit and receive throughput during bidirectional (two-way) traffic tests. Results for Bidirectional traffic varied depending on the types of traffic which are combined. Most applications and system work loads do not generate sustained bidirectional traffic patterns.

- Bidirectional Ethernet only traffic through a single port achieved an excellent 1.89 gigabits per second on the rx6600. Two ports of bidirectional Ethernet only traffic achieved 3.75 gigabits per second of throughput.
- Combined disk read and write traffic through a single FC port is excellent – achieving:
 - 723 MB/s on the rx6600 with no Ethernet traffic, and
 - greater than 493 MB/s while any type of Ethernet traffic was occurring on a single active 1000Base-T port.
- Combined disk read and write traffic on two FC ports reaches an amazing 685 MB/s of throughput.
- Bidirectional Ethernet traffic through a single port while running maximum sustained concurrent disk traffic varied from .94 to 1.88 gigabits per second depending on the type of disk traffic occurring on a single active FC port. Most importantly the 1000 Base-T port maintained a balance of transmit and receive throughput even with the added stress of the disk traffic.

Sustained bidirectional traffic on all 4 ports doubles the bandwidth requirements of the ports being actively used and pushes the total needed bandwidth closer to or beyond the limits imposed by PCIX-133 bus and bridge technologies.

How We Measured GbE and Fibre Channel Efficiency

This article highlights the AD194A and AD193A throughput. Throughput is the data transfer rate, or data rate – the amount of time it takes data to move from one place to another. In this article, it's shown for one-way signals as well as 2-way. Throughput measures how well programs run with a certain workload and how quickly user requests can be handled.

The performance results shown in this article were measured with the `netperf4` benchmarking software. Tests were run with one AD194A card residing in slot 3 in an 8-way HP Integrity rx6600 server. Details of the systems used and the software versions are shown in Table 1. The Gigabit Ethernet transmit, receive, and bidirectional tests were run using `netperf4` with a socket size of 128K bytes, a message size of 32K bytes, and a maximum transmission unit (MTU) size of 1500 bytes. The Fibre Channel read, write, and bidirectional tests were run using `netperf4` with a blocksize of 128K bytes.





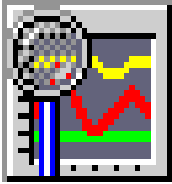
Performance will vary when this product is used on different systems or software.

NOTES:

- The observed performance results are consistent across all of the same type of I/O slots of the system.
- The core I/O card in the rx6600 carried minimal site LAN traffic during performance tests.
- The line rate for GbE is 1.25gbps, removing the 8b/10b encoding overhead yields 1Gbps un-encoded payload. The line rate for 4Gb FC is 4.25Gbps, removing the 8b/10b encoding overhead yields 3.4Gbps un-encoded payload. The total full-duplex un-encoded payload is therefore $6.8\text{Gbps(FC)} + 2\text{Gbps(GigE)} = 8.8\text{gbps}$.

Table 1 summarizes the products used to measure the performance:

Table 1 Products Used in the Performance Measurement Tests

<p>Server Tested</p>		<p>HP Integrity rx6600 Server. Four 1.6 GHz Itanium2 CPUs (2 cores each) 9MB cache per CPU Operating System - HP-UX 11i version 3.0 of January 2007 (B.11.31).</p>
<p>Card Tested</p>		<p>AD194A 2-Port 4 Gigabit Fibre Channel and 2-Port Gigabit Ethernet card</p> <ul style="list-style-type: none"> • PCI-X (64-bit, 133 MHz, 3.3v) • GigE LAN Driver version – IEther-00 B.11.31.01 • Fibre Channel Driver version – FibrChanl-01 B.11.31.01
<p>Clients generating the test load for Gigabit Ethernet</p>		<p>Two rx2600 servers</p> <ul style="list-style-type: none"> • Two, 1.5 GHz Intel Itanium2 CPUs each • HP-UX 11i version 2 (B.11.23.0303.4) • One A7012A PCI-X 1000Base-T card per rx2600 • LAN Driver version – IEther-00 B.11.23.05
<p>HP StorageWorks 1500cs Modular Smart Array</p>		<p>Sixteen MSA 1500cs 2Gb/s FC disk systems with a mix of drives for Fibre Channel tests.</p>
<p>Benchmark software for Gigabit Ethernet tests</p>		<p>Netperf4+ is the benchmarking software suite that generated LAN and disk traffic for the performance tests. For more information about netperf or to get a free copy, go to http://www.netperf.org</p>

Features and Benefits of the AD194A

Features and benefits of the AD194A include:

- The Gigabit Ethernet ports support virtual LANs (VLANs). A Virtual LAN (VLAN) is a logical or virtual network segment that can span multiple physical network segments. VLANs isolate broadcast and multicast traffic by determining which destinations should receive that traffic, thereby making better use of switch and end-station resources. With VLANs, broadcasts and multicasts go only to the intended nodes in the virtual LAN.
- Supports 16k LUNs on the Fibre Channel ports.
- Auto speed sensing on the Fibre Channel ports.
- Supports readout of Vital Product Data (VPD) for Fibre Channel and LAN.
- Supports Virtual Partitions (vPars 3.02 or higher) on specified HP-UX-based systems. Boot over vPars is supported on the Fibre Channel ports.
- Supports Ignite UX. Ignite-UX (IUX) is an HP-UX administration toolset to help you install and configure (or recover) HP-UX systems.
- Supports HP Serviceguard and Auto-Port Aggregation (APA) for high availability.
- Supports PCI-X online addition/replacement (OLA/R) on specified systems.
- Offline and online diagnostic tools for both Fibre Channel and LAN.

For More Information

For more information about the products described in this paper such as a current list of tested HP products or supported systems, please go to:

<http://www.hp.com/products1/unixserverconnectivity>.

This paper is the latest in a series of white papers detailing the performance of HP's link and server products. For a complete list of white papers on HP's networking and I/O products including Gigabit Ethernet and Fibre Channel solutions, go to

[:http://docs.hp.com/en/netcom.html](http://docs.hp.com/en/netcom.html).

For further assistance including a detailed analysis of your specific requirements and needs, please contact your local HP Sales Representative.

© 2007 Hewlett-Packard Company, L.P. The information contained herein is subject to change without notice.

The only warranties for HP products and services are set forth in the express warranty statements accompanying such products and services. Nothing herein should be construed as constituting an additional warranty. HP shall not be liable for technical or editorial errors or omissions contained herein.

HP-UX®, Serviceguard®, and Superdome® are registered trademarks of the Hewlett-Packard Corporation. PCI-X is a registered trademark of the PCI SIG.

All other trademarks and registered trademarks are the property of the respective corporations.



Features and Benefits of the AD194A