Performance and Recommended Use of AB465A Combination 2-Port 2-Gb Fibre Channel / 2-Port Gigabit Ethernet Cards

From Results on an HP rx4640 Server

May 2005

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Introduction

This article highlights the excellent performance and high availability of HP's new AB465A multi-function card (Figure 1) that combines 2-ports for 2-Gbps Fibre Channel mass storage and 2 ports for Gigabit Ethernet networking.

This article also provides suggestions based on the performance and technology that will help you to best achieve your business needs.

Figure 1 AB465A Combination 2-Port 2-Gbps Fibre Channel / 2-Port Gigabit Ethernet Card

Recommended Use Based on Performance and Design

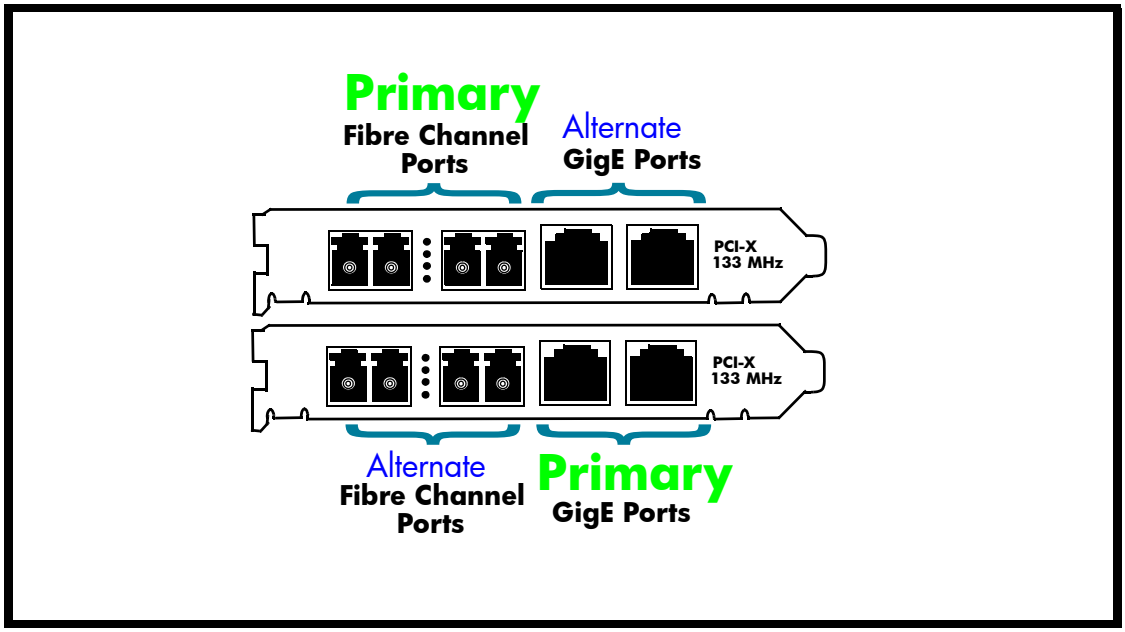
The AB465A can be thought of as a combination of an HP A6826A 2-port 2Gbps Fibre Channel card connected by a PCI-X to PCI-X bridge with a 2-port 1000Base-T card and sharing a common PCI-X bus. All the connections sharing this single common resource perform exceptionally well in a variety of configurations.

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

- Run the AB465A cards in the highest performing PCI-X-133 MHz slots. Slots 7 and 8 are the recommended high performance PCI-X 133 MHz slots in the HP Integrity rx4640 used in our performance testing.

- Schedule workloads for ports: All 4 ports can be cabled and connected. Schedule or prioritize applications so that 2 ports are running full traffic at any given time or all 4 ports are running traffic at reduced rates. The 2 ports selected can be both ports of a single technology or 1 port from each of the 2 technologies on the card. This provides the best possible per port data rates.
- Set up a pair of cards for high availability as shown in Figure 2. On the first card, configure one technology's pair of ports as *primary* or active. On the second card, configure the same technology's pair of ports as *alternate* or hot standby. This is another alternative to the scheduling technique summarized in the previous bullet. This setup would provide the best performance and high availability. Achieving a similar level of high availability would require using twice the number of A6826A (2-port 2Gbps Fibre Channel), A7012A (2-port GigE), or A9784A (combination Fibre Channel/GigE) cards.

Figure 2 Setting Up a Pair of Cards for High Availability



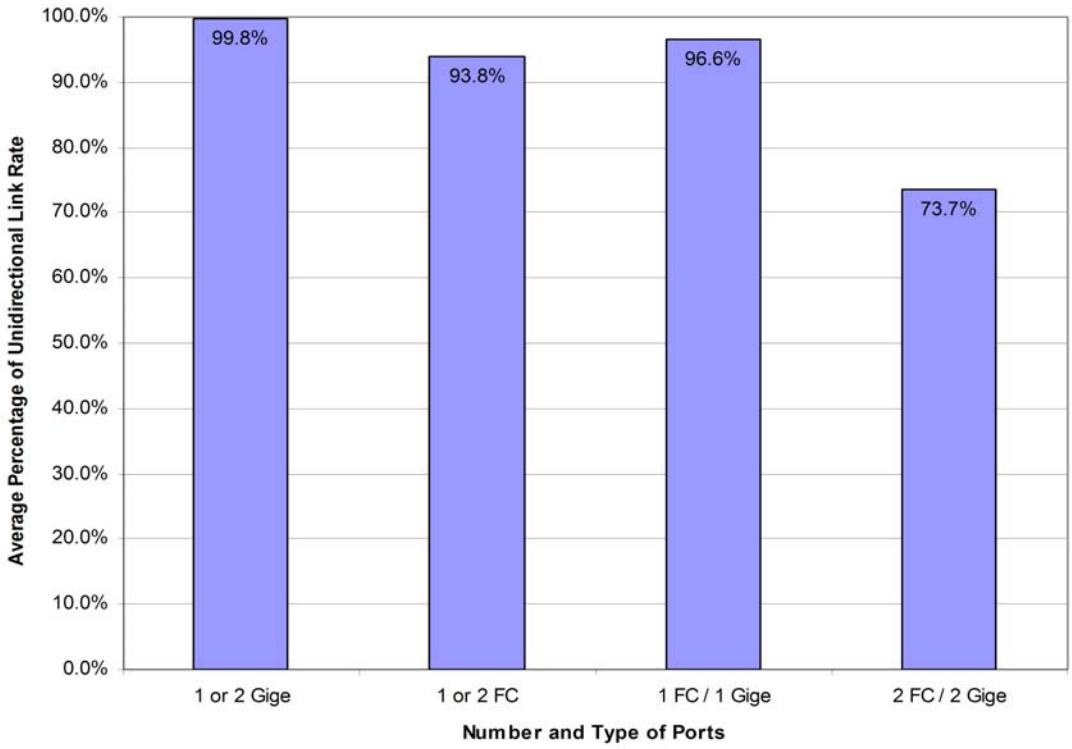
The recommendations mentioned here were followed to achieve the results shown in this article. Card throughput will be affected with configurations other than those recommended.

Besides providing exceptional performance, the AB465A provides increased connectivity compared to other HP networking cards such as the A6826A, A7012A and A9784A. Please contact an HP representative for additional help in understanding how to best deploy the AB465A multi-function card.

Performance Summary

The AB465A 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 AB465A Performance Summary in rx4640



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

- Either 1 or 2 Gigabit Ethernet ports,
- Either 1 or 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 AB465A has excellent performance. Averages range from 73.7-99.8% of link rate on the rx4640 system with different combinations of traffic types. The summary includes results for all 4 ports running sustained simultaneous traffic!

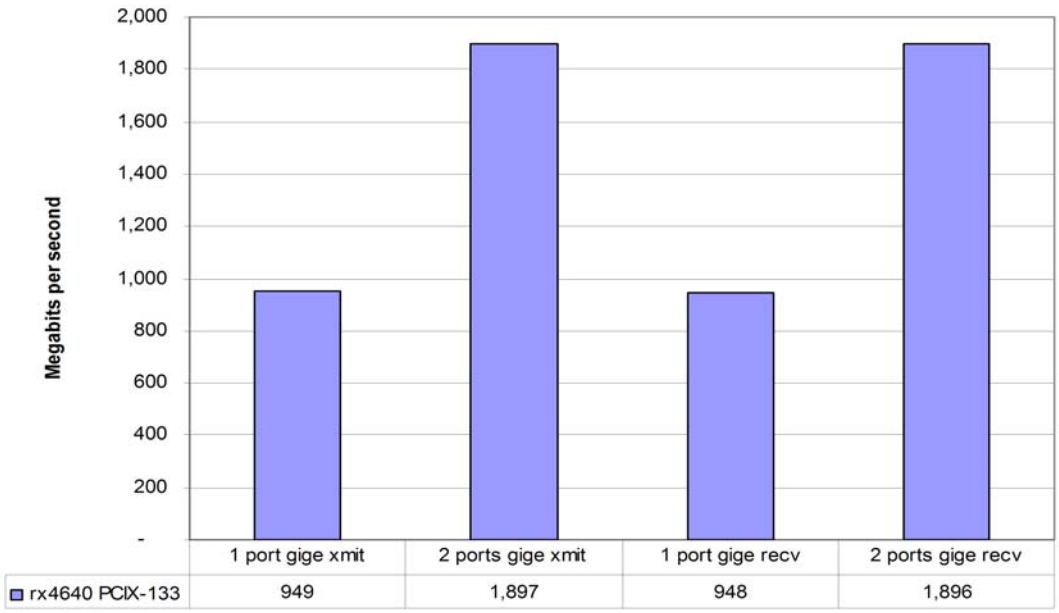
Many of the different types of traffic combinations achieve link rate and will be discussed in more detail later in the document.

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 AB465A Gigabit Ethernet Throughput in rx4640



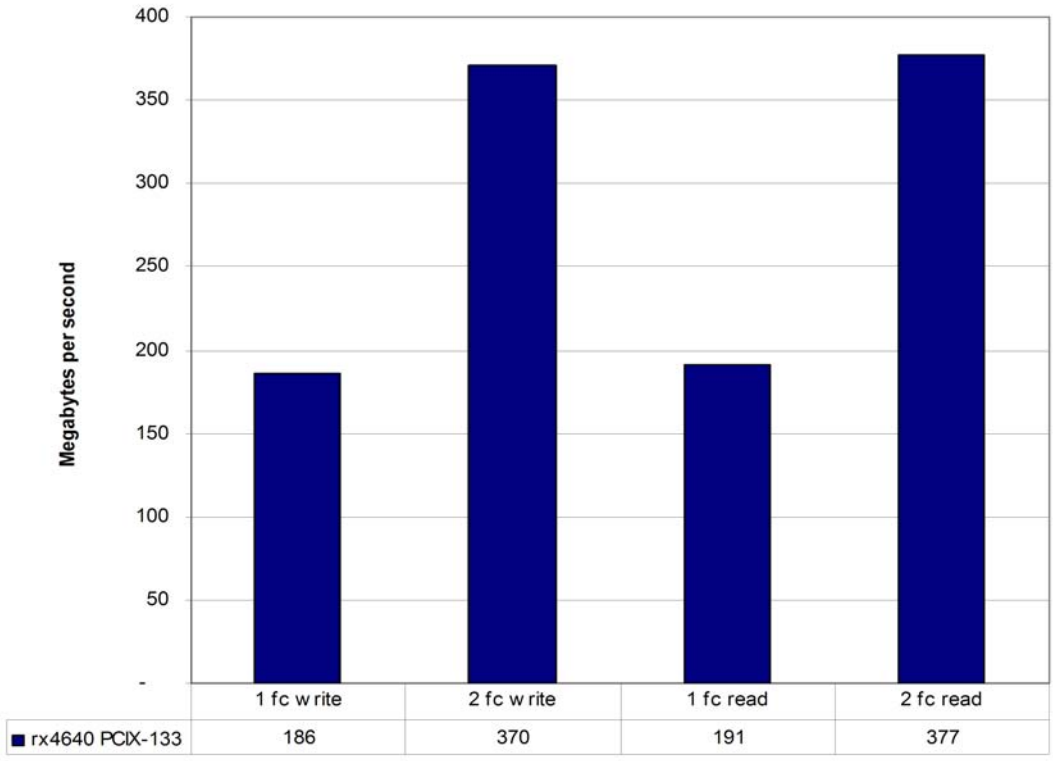
- Transmit traffic achieved link rate on the rx4640 reaching 949 megabits per second on one port and 1.897 gigabits of application data per second of throughput using both 1000 Base-T ports.
- Receive Traffic achieved link rate on the rx4640 reaching 948 megabits per second on one port and 1.896 gigabits per second using both 1000 Base-T ports.

Fibre Channel Only Performance

Figure 5 shows the performance results for the 2Gb 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 AB465A Fibre Channel Throughput in rx4640



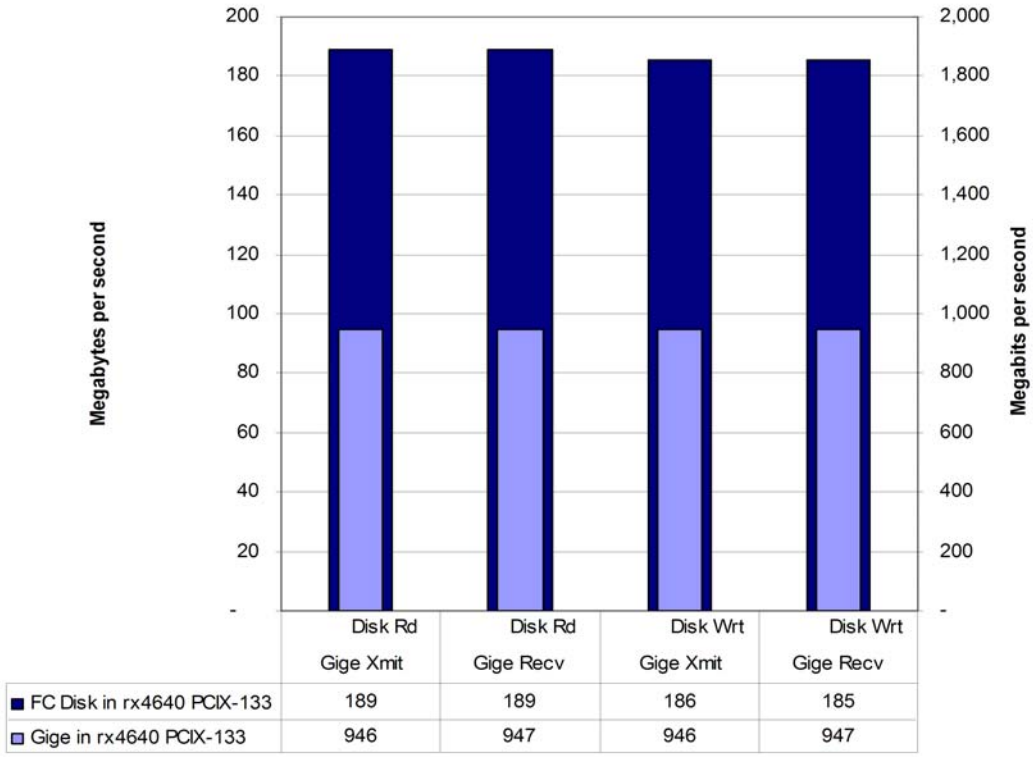
- Disk write traffic achieved greater than 92% of link rate on the rx4640 with one port achieving 186 MB/s and two ports reaching 370 MB/s.
- Disk read traffic consistently achieved greater than 94% of link rate on the rx4640 system. One port achieved 191 MB/s for disk reads and 2 ports achieved 377 MB/s.

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 2Gb Fibre Channel port and one 1000Base-T port on the AB465A card.

The following highlights show the exceptional performance the AB465A achieved during combination traffic testing:

Figure 6 AB465A Throughput with 1 Fibre Channel and 1 GbE



- The first two dark bars show disk read traffic consistently achieved greater than 94% of link rate on the rx4640 system. The active port achieved 189 MB/s 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 92% of link rate on the rx4640 system. The active FC port achieved 185 MB/s or greater 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 rx4640 reaching 946 megabits of application data per second for transmit and 947 megabits per second for receive traffic on the used 1000 Base-T port. This was while continuous disk traffic was occurring on the active FC port.

2 FC Port and 2 GbE Port Combined Traffic Performance

Using both 2Gb Fibre Channel ports and both 1000Base-T ports on the AB465A 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 AB465A works exceptionally well for those deployments which require more connectivity and less bandwidth per port. Performance using all four ports concurrently on the AB465A 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 AB465A 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 1.7 gigabits per second on the rx4640. Two ports of bidirectional Ethernet only traffic achieved 2.46 gigabits per second of throughput.
- Combined disk read and write traffic through a single FC port is excellent -- achieving:
  - 352 MB/s on the rx4640 with no Ethernet traffic, and
  - greater than 328 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 523 MB/s of throughput.
- Bidirectional Ethernet traffic through a single port while running maximum sustained concurrent disk traffic varied from 1.2 to 1.6 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 AB465A 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 `netperf` benchmarking software. Tests were run with one AB465A card residing in slot 7 in a 4-way HP Integrity rx4640 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 `netperf` 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 diskbench with a blocksize of 128K bytes.

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

NOTES:

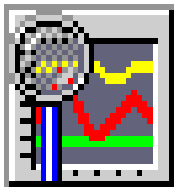
- The observed performance results are consistent across all of the same type of I/O slots of the system.
- The core I/O card in the rx4640 carried minimal site LAN traffic during performance tests.

Table 1 summarizes the products used to measure the performance:

Table 1 Products Used in the Performance Measurement Tests

Server Tested		HP Integrity rx4640 Server. Four 1.5 GHz Itanium2 CPUs 6 MB cache per CPU Operating System - HP-UX 11i version 2.0 of September 2004 (B.11.23).
Card Tested		AB465A 2-Port 2 Gigabit Fibre Channel and 2-Port Gigabit Ethernet card • PCI-X (64-bit, 133 MHz, 3.3v) • GigE LAN Driver version – GigEther-01 B.11.23.05 • Fibre Channel Driver version -- FibrChanl-01 B.11.23.01

Table 1 Products Used in the Performance Measurement Tests (Continued)

Clients generating the test load for Gigabit Ethernet		Four rx2600 servers • 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
HP StorageWorks DS2405 Fibre Channel Disk Systems		Four DS2405 2Gb/s FC disk systems with a mix of drives for Fibre Channel tests.
Benchmark software for Gigabit Ethernet tests		Netperf 2.2pl4+ is the benchmarking software suite that generated LAN traffic for the Gigabit Ethernet performance tests. For more information about netperf or to get a free copy, go to http://www.netperf.org
Benchmark software for Fibre Channel tests		Diskbench (db) is the benchmark suite that generated disk read and write traffic for the FC tests.

Features and Benefits of the AB465A

Features and benefits of the AB465A 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.
- The Gigabit Ethernet ports support Jumbo Frames with a maximum transmission unit (MTU) of 9000 bytes. Jumbo frames achieve much higher throughput than the standard 1500 MTU before reaching optimum CPU utilization.
- 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.
- Supports Virtual Partitions (vPars 3.02 or higher) on specified HP 9000 (PA-RISC-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.

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.

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

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