# Microsemi Adaptec HBA 1000 Series

# Technical Brief

# 12 Gbps PCIe Gen3 SAS/SATA Host Bus Adapters

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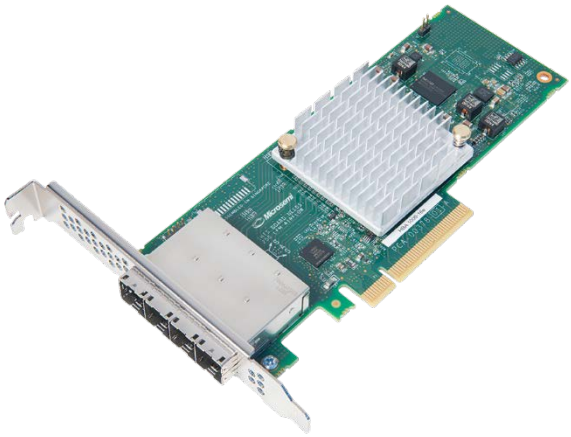
# HBA 1000 Series 12 Gbps SAS Host Bus Adapters

## Introduction

The Microsemi Adaptec HBA 1000 Series of host bus adapters (HBA) is the first in a broad family of Microsemi Smart Storage Solutions to leverage industry-leading silicon, board, and storage stack expertise in a single, unified solution. By incorporating the latest standards, high port counts, low power consumption, and a small form factor, the HBA 1000 product family is the preferred storage solution for data centers and enterprises concerned about system resilience, efficiency, and ease of use.

**Figure 1 Microsemi Adaptec HBA 1000 Series**



### What is a Host Bus Adapter?

The PCIe interface has become the universal I/O connectivity standard in host systems or servers. The most popular PCIe interface today is a slot with eight lanes of the latest PCIe Gen 3.0 standard implementation, which yields a combined theoretical maximum bandwidth of nearly 8 GB/s.

Microsemi Adaptec pioneered the development of HBA. The primary function of an HBA is to bridge the host system PCIe with storage devices to help accomplish the server's intended application.

The standard interface for storage has become the Serial Attached SCSI, or SAS interface. The latest SAS interface has a theoretical maximum bandwidth of 12 Gbps per lane. Having that higher standard interface speed is advantageous, but most peripheral devices cannot utilize all of it. A major part of the HBA's job is to aggregate performance in the most efficient manner possible without getting in the way.

### The HBA 1000 Series

Microsemi's latest HBA 1000 Series products use five different configurations to seamlessly aggregate performance. All have the 8-lane PCIe Gen 3.0 host interface, compact MD2 form factor, low-power Microsemi ASIC technology, a common set of drivers, and user-friendly management tools. For maximum system flexibility, the models vary in the number and location of the SAS connections, or ports, they provide—models are available with 8 internal ports, 8 external ports, 16 internal ports, 16 external ports, and 8 internal and 8 external ports.

In addition to superior scalability and performance, the 16-port models of the HBA 1000 Series consume 60% less power on average than competing HBAs, thanks to the power-efficient Microsemi SmartIOC. The HBA 1000 Series 16-port models consumed only 11.45 W, compared to the competitor's 16-port HBA models at 27.8 W.

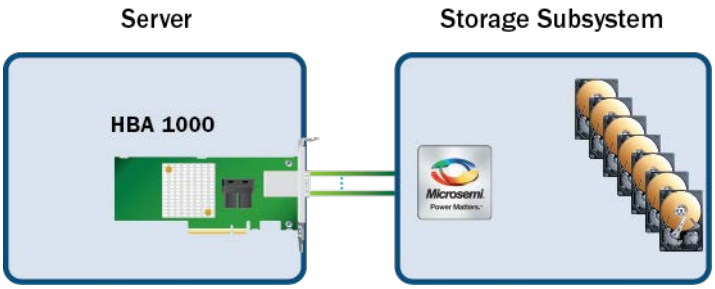
## HBA 1000 Series Use Cases

With five different models available, resilient solutions to large number of applications are possible. Three popular basic configurations are discussed below.

### Point-to-Point Communication Between Computers

While the SAS interface is the most widely adopted standard storage connection for servers, its derivation from the Small Computer System Interface (SCSI) makes it appropriate for connections between processors as well. The most common example of this is the connection between a server's powerful CPU(s) and a storage subsystem, Storage Area Network (SAN), or Network Attached Storage (NAS), as shown in the following illustration. All of these external systems have embedded computers (with a range of CPUs) that are involved in managing, virtualizing, or otherwise manipulating the storage they control. Higher-cost fibre channel connections may also be used, especially when distances greater than a few meters are involved. The latest 12 Gbps SAS standard now supports optical cables, which extend the distance supported by SAS and the HBA 1000's external ports to several hundred meters.

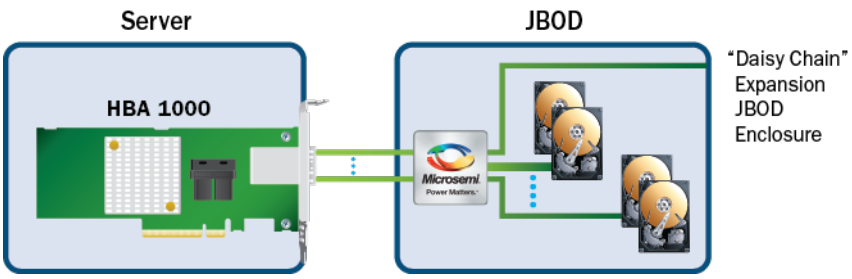
**Figure 2 Communication Between Computers**




### Connection Between Server and JBOD(s)

Many data centers and other applications have replaced expensive storage subsystems with less expensive JBODs (Just a Bunch of Disks). These JBODs replace the expense and complexity of a SAN with one or more less-expensive SAS expander chips offered by Microsemi, or the Microsemi Adaptec AEC-82885T SAS Expander Card, as shown by the following illustration.

**Figure 3 Connection Between Server and JBOD(s)**



Adding JBODs to the architecture provides an easy way to scale the attached storage to the server, and the HBA 1000's external ports provide efficient, low-cost connectivity to the JBOD. Traditionally, most external SAS connectivity is provided in a four-lane cable. In this configuration, the same SAS address is associated with all four lanes connected to the JBOD, making it a 6 GB/s connection [(4 lanes x 12 Gbps) divided by 8 bits/Byte]. Another cable and SAS address could be used to increase the connection's performance limit to 12 GB/s or beyond with the higher port counts available from the HBA 1000-16e.

Because many storage subsystems cannot support this level of performance, a more typical use of the external high port count is to add JBODs to the system architecture, which allows for an increased number of individual storage devices. This provides additional scalability of both capacity and overall performance—up to the limits of the host's eight-lane PCIe interface.

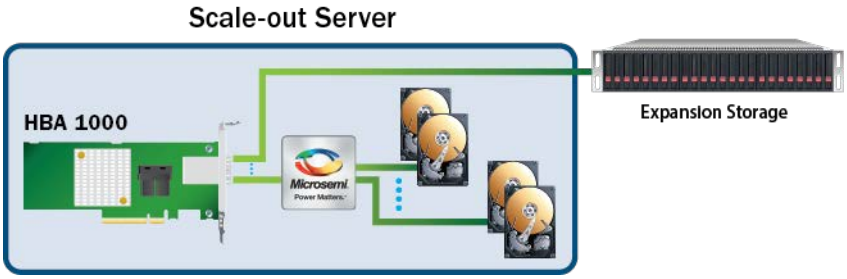
Another common benefit of multiple external ports is in applications for high availability, where the number of JBODs and their corresponding server connections are doubled to provide redundant, high-performance storage with redundant SAS cabling. System limitations on these architectures are most likely to come from the total number of devices. Matching the system capacity, scaled performance, and reliability to the requirements of the application are the ultimate criteria for choosing one configuration over another.

## Connection Within Server

Some applications are limited to just one large scale-out enclosure. The HBA 1000 models with internal connectivity and the SAS architecture allow the same principles to be applied within a single chassis, as shown by the following illustration. Scale-out chassis benefit from the same HBA 1000/SAS expander architectures as previously described. System limits are more likely to come from physical size, power supplies, and cooling constraints than from the HBA 1000.

Even without an expander, the HBA 1000-16i can provide connection for up to 16 individual storage devices. These applications can also often justify higher-performance devices like SSDs. Often with these newer devices, their aggregated performance levels reach a PCIe-imposed limit between 12 and 16 units, making the HBA 1000-16i the ideal connection.

**Figure 4 Daisy Chain Expansion**




Finally, for applications with severe physical constraints on internal devices and no expander, there still may be a requirement for external connectivity to support future scalability or reliability. Without an expander, those missing ports become problematic. With the HBA 1000-8i8e, however, the necessary internal device connectivity is easily maintained and the missing expander's external connectivity is replaced with the external ports of the HBA 1000-8i8e.

## Conclusion

The HBA 1000 incorporates the latest PCIe 3.0 and SAS 12 Gbps standards, high port count with both internal and external connectivity, low power, and small form factor in five models. By supporting all popular use cases, the HBA 1000 product family becomes an easy-to-choose controller for server-based storage solutions, data centers, enterprises, and other applications requiring high efficiency and resiliency.

For further information about the HBA 1000 and Microsemi's Adaptec products, visit www.microsemi.com.

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