

# HP SN1000 16 Gb Host Bus Adapters

Technical white paper

## Table of contents

Introduction.....	2
16 GFC technology .....	2
The 16 GFC ecosystem .....	3
Application and hardware use cases .....	4
Virtualization.....	4
Multicore processors .....	4
SSDs .....	4
Improvements/Enhancements over 8 GFC .....	6
Customer use cases.....	7
8 GFC infrastructure—need higher performance.....	7
Configure long server life.....	7
Boost server performance with 4 GFC HBA.....	7
Conclusion.....	8



# Introduction

16 Gb/s Fibre Channel (GFC) technology is now available and HP is at the forefront of delivering next-generation storage area network (SAN) connectivity with the HP SN1000 16 Gb Host Bus Adapter (HBA) family. The first product in this family, the HP SN1000E 16 Gb FC HBA, is currently available in single-channel and dual-channel configurations. With 16 Gb link speed coupled with high-performance technologies and reductions in capital expense (CAPEX) and operational expense (OPEX), there is a strong business case for deploying the HP SN1000 16 Gb HBAs in data centers. This white paper explores 16 GFC and the many benefits 16 GFC HBAs bring to SAN fabrics, even those with an 8 Gb backbone.

SANs have evolved with faster and faster performance throughout the fabric. A key piece is the connectivity provided through the HBA. Beginning with 1 GFC HBAs, data centers worldwide connected their storage to their servers in their Fibre Channel SANs.

Less than 15 years after the first 1 GFC HBA was shipped, 16 GFC HBAs are now shipping. Newly available, 16 GFC HBAs are designed to meet the connectivity needs of the most demanding data centers. This white paper explores 16 GFC technology and the many benefits it delivers.

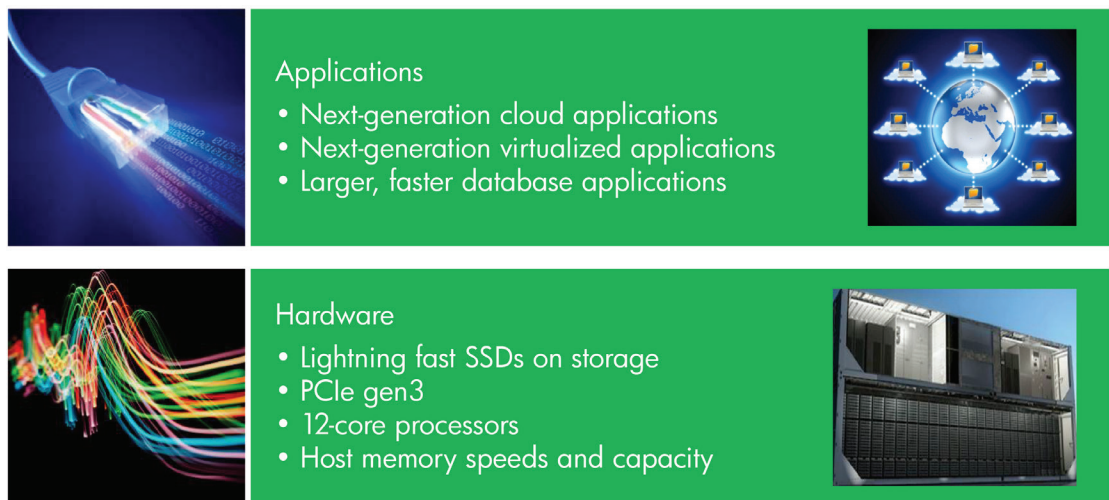
The HP SN1000E 16 Gb Host Bus Adapter single-port and dual-port HBAs meet the needs of both virtualized business-critical applications and the cloud, while also supporting high-performance solid-state disk (SSD) drive requirements and advanced storage arrays. These products represent the next generation of HBAs, delivering over 1 million IOPS through one port, 1,024 MSI-X, 8,192 logins/open exchanges, in addition to half the latency of its 8 GFC predecessor.

This white paper also takes a close look at the HP SN1000E 16 Gb FC HBA, the features it offers in addition to fast performance and the improvements over the 8 GFC HBA in both performance and lowering operational expenses.

## 16 GFC technology

16 GFC accelerates high-density virtualization by doubling the number of ports that can be virtualized and reducing the number of physical ports and cables required by half. In fact, 16 GFC is required for a properly balanced solution stack combining the latest multi-core processors, expanded memory and high-speed storage, such as SSDs.

Figure 1. Drivers of 16 GFC



The need for 16 GFC SAN technology was driven by high-bandwidth applications and devices. Figure 1 shows the main application and hardware drivers for 16 GFC. On the application side, 16 GFC is being driven by fundamentally new demands of the next generation of cloud and virtualized business-critical applications as well as larger and faster database application demands. On the hardware side, a 16 GFC low-latency fabric is essential to meeting the performance needs of new 12-core processors, Intel® QuickPath Interconnect memory speeds on the hosts, and to matching the lightning-fast SSDs on the storage side.

## The 16 GFC ecosystem

As a result of the application and hardware drivers shown in figure 1, the 16 GFC ecosystem is developing very quickly. 16 GFC “pipes” allow users to maximize their investments in the latest server and SAN products by improving I/O performance across the fabric.

Figure 2 shows the 16 GFC ecosystem, consisting of switches, HBAs arrays, OSs, applications, and virtualization support. While the ecosystem is rapidly developing due to application and hardware demands, today there are a limited number of switches, HBAs, and OSs available, with array, application, and virtualization support quickly emerging in 2012.

**Figure 2.** 16 GFC ecosystem

16 GFC switches	16 GFC HBAs	16 GFC arrays	OS, apps, virtualization
			
<ul style="list-style-type: none"> <li>• Available today</li> </ul>	<ul style="list-style-type: none"> <li>• Available today</li> </ul>	<ul style="list-style-type: none"> <li>• Mid-2012</li> </ul>	<ul style="list-style-type: none"> <li>• Linux, Windows® available now</li> <li>• VMware early 2012 (using Emulex as the 16 GFC reference design)</li> <li>• More coming soon</li> </ul>

The HP SN1000E 16 Gb FC HBA is currently available and certified with the major switch vendors, with support for a broad range of OSs. The HP SN1000E 16 Gb FC HBA delivers performance improvements, while operating on an 8 Gb/s infrastructure, protecting past investments, while future proofing I/O performance as 16 GFC is fully deployed.

# Application and hardware use cases

As mentioned previously, 16 GFC adoption will be driven by server virtualization, processor and host memory advancements, SSDs, and storage array advancements. This section provides an overview of how these drivers benefit from 16 GFC.

## Virtualization

Attaching virtual machines (VMs) to Fibre Channel SANs is continuing to increase.

As many data centers take the next steps in virtualizing big I/O applications, like databases, and move to more scalable private clouds, storage networking has become the primary bottleneck for quality of service (QoS) and scalability. The HP SN1000E 16 Gb FC HBA fixes that bottleneck, enabling the best QoS for the highest VM density, with the fewest ports and cables and the lowest power footprint.

In terms of scalability, the HP SN1000E 16 Gb FC HBA supports up to 255 virtual functions (VFs), 1,024 Message Signal Interrupts (MSI-X) and 8,192 concurrent logins and open exchanges, enabling support for more VMs than ever before and making the HP SN1000E 16 Gb FC HBA the adapter of choice for data centers looking to increase VM densities. Moreover, the entire SAN fabric benefits from higher availability and reduced power requirements with the faster HBA.

## Multicore processors

Next-generation multicore processors consume bandwidth at a phenomenal rate. For example Intel® Core™ i7 Processor Extreme edition, rated at 159 KMi/s, generates about 3.2 M I/Os, which means that at 4 KB per I/O, performance is around 12 Gb/s. Data centers can take advantage of this fast performance for traditional data protection solutions, such as time-honored backup and recovery, which no longer meet the most pressing needs of diverse data center ecosystems. Storage array advancements offer alternatives, such as high-speed data migration, but existing SAN deployments require upgrades. They need to be faster, more secure and to support ever-increasing numbers of VMs as well as larger cloud deployments and mission-critical applications. With the 16 GFC higher link speed, data centers can achieve faster data backup, replication, and migration.

## SSDs

With advanced SSD technology and the declining cost of SSDs, the use of SSDs in a tiered storage environment is becoming more widespread. This technology allows a company to better align its storage needs with its business objectives. The 16 GFC HBA delivers the high performance required for SSDs and 12-core server processors to handle larger workloads while cutting down on power consumption. With the highly reliable, scalable, and centrally managed HP 16 GFC HBAs, SSDs, and servers can operate at their peak performance.

## Features and benefits of the HP SN1000E 16 Gb FC HBA

Exceptional price/performance, advanced management functionality that can shave days off installing and managing adapters, coupled with up to three times better IOPS performance per watt, make the HP SN1000E 16 Gb FC HBA the clear choice for the toughest virtualized, cloud, and mission-critical deployments. The HP SN1000E 16 Gb FC single-port and dual-port HBAs feature backward compatibility with 4 GFC and 8 GFC HBAs and SAN components.

Table 1 shows the many features and benefits of the HP SN1000E 16 Gb FC HBA for the most demanding data centers.

HP SN1000E 16 GFC HBA feature	Data center benefit
<b>Performance</b>	<b>High performance:</b> Performance and scalability supports 255 VFs, 1,024 MSI-X and 8,192 logins/open exchanges for maximum VM density—four times more than other adapters.
<b>Return on investment (ROI)</b>	<b>Increased ROI:</b> CPU offload lowers CPU burden on host server, enabling support for more VMs.
<b>Reduced latency</b>	<b>High performance:</b> As most high transaction processing is not a constant stream of data, but rather bursty segments of data, the computer is actually doing multiple things. It's trying to process data, moving data in and out of memory, and it's trying to update data to and from the storage devices. By reducing the time it takes to get data in and out of the storage device, the HP SN1000E 16 Gb FC HBAs help the computer spend more time on processing the data, thus helping the overall transactions per second just due to lower latency of the length of storage. With HP SN1000E 16 Gb FC HBAs, virtualization environments users can move typical high transaction bursty data much more quickly.
<b>Power efficiency</b>	<b>High availability and reliability:</b> There is a direct correlation between heat and device longevity. Overheated parts generally exhibit a shorter lifespan and lower system performance. The HP SN1000E 16 Gb FC HBA enables low-power breakthroughs, allowing selective dynamic hibernation, advanced thermal and power instrumentation, and a configuration around 3 watts per port. <b>Reduced OPEX:</b> Cooling costs are reduced.
<b>Scalable</b>	<b>Investment protection:</b> SAN, virtualization, and cloud environments are dynamic. To that end, HP SN1000E 16 Gb FC HBAs, management tools, device drivers, and firmware are designed to provide a great degree of scalability and flexibility. Increases in the numbers of virtual HBAs and simultaneous transaction contexts Extensible Resource Identifier (XRI) provide a safe growth environment for organic growth and cloud transition.
<b>Single management console</b>	<b>Reduced OPEX:</b> Comprehensive control of the HP SN1000E Fibre Channel HBA within a centralized, cross-platform framework, combining flexible remote-management options with secure access control can be achieved with Emulex OneCommand Manager. Through a single console, SAN administrators can manage all HP SN1000E HBAs, leveraging either in-band or out-of-band (over the LAN) options and a host of automation features that reduce deployment and management costs significantly over other HBAs.
<b>Fast deployment</b>	<b>Reduced OPEX:</b> Historical testing on the 8 GFC HBAs show that administrators can get twice the adapter management functionality, deploying HBAs in half the time compared to other management solutions. In an enterprise setting with hundreds, or even thousands, of adapters, this productivity advantage is significant.
<b>Reduced cabling</b>	<b>Increased ROI:</b> Enables more applications and VMs to run on a single server and Fibre Channel port.
<b>SSD support</b>	<b>High performance:</b> For SSDs attached to a SAN, HP delivers reliable and high-performance connectivity to enable fast and reliable storage tiering and burst caching with the HP SN1000E 16 GFC HBA.
<b>Certified stack</b>	<b>Investment protection:</b> With certification with leading virtualization vendors, data center managers are assured of a no-risk, high-availability, and supported solution.

## Improvements/Enhancements over 8 GFC

With 16 GFC, there are fewer links, cables, ports, and less power consumption for the same equivalent performance with 8 GFC. 16 GFC offers twice the link speed as 8 GFC. The faster speed translates to a reduction of tens or even hundreds of ports from a comparable 8 GFC fabric in a typical deployment, in addition to a reduced CAPEX, such as cables. The cost savings can be significant (up to \$300 USD per port).

With fewer pieces of equipment, data centers also see a reduction in power consumption. Power efficiency is an integral part of the HP SN1000E 16 Gb FC HBA design. With the HP SN1000E 16 Gb FC HBA, data center managers see up to three times improvement in application throughput per watt (IOPS/W). Moreover, 16 GFC reduces the number of switch ports required, which can also reduce the overall fabric size for greater power savings.

A comparison of the 16 GFC HBA with the 8 GFC HBA reveals that 16 GFC HBAs deliver the following benefits:

- Greater IOPS
- Twice the data throughput
- Cuts the response time in half
- Greater IOPS for typical 4 KB I/O block database applications
- Greater IOPS for typical 8 KB I/O block database applications
- Significantly better IOPS performance per watt

Table 2 summarizes the main differences between 16 GFC and 8 GFC HBAs based on Emulex lab reports

**Table 2.** 16 GFC HBA vs. 8 GFC HBA

Feature	16 GFC	8 GFC
<b>Performance: more IOPS</b>	>1,000,000	>400,000
<b>MSI-X vectors</b>	1,024	32
<b>VFs</b>	255	0
<b>Improved latency</b>	Cuts response time in half	-
<b>Greater throughput</b>	3200 MB/s	1600 MB/s
<b>Concurrent logins and open exchanges</b>	8,192	4,096

The performance and feature improvements over 8 GFC are significant. Coupled with the reduction in OPEX and CAPEX, 16 GFC HBAs make a very good business case.

## Customer use cases

We've already discussed the types of applications and hardware that can benefit from 16 GFC technology. This section discusses the users who are likely to move to 16 GFC HBAs in the near-term and the benefit they achieve.

### 8 GFC infrastructure—need higher performance

Many data centers with an 8 Gb/s backbone are at the leading edge of performance, requiring ever-increasing levels of I/O. For a newly acquired server, or even an existing one, when faced with an HBA purchasing decision, it makes the most sense to buy 16 GFC HBAs, even with an 8 Gb/s network. Using the new HP SN1000E 16 Gb FC HBAs can provide a performance and latency boost even when running in 8 Gb mode in an 8 Gb environment. When the time comes for the server to be upgraded to 16 Gb/s switches and arrays, the adapter is ready to go.

### Configure long server life

All data centers want to extend the life of their server; however, there are some servers, such as a newly acquired multi-processor server that can host mission-critical applications, which require an especially long life. As the HP SN1000E 16 Gb FC HBA boards are newer, they will be supported on future revisions of Windows®/Linux and hypervisor software for a considerable period of time after support for the 8 Gb boards is frozen. By purchasing the newer 16 GFC boards, users get the greatest amount of investment protection.

### Boost server performance with 4 GFC HBA

Many data center managers have discovered they can boost the performance of multiple servers with the purchase of a 16 GFC HBA. That is, they purchase a 16 GFC adapter and install it into a server currently running an 8 GFC adapter. They then take that 8 GFC adapter and place it in a server running a 4 GFC adapter. In this way, one purchase can actually result in the performance upgrade of two or more servers, greatly boosting the ROI for the purchase of the new 16 GFC HBA.

## Conclusion

16 GFC technology delivers many benefits to data centers and will be used worldwide as SANs are upgraded to meet the needs of the new wave of virtualization and cloud architectures. The HP SN1000E 16 Gb FC HBA continues HP's tradition of delivering reliable, high-performance, and scalable connectivity for SANs. As data centers migrate business-critical applications, like databases, into virtualized environments, the HP SN1000 16 Gb HBA family can help ensure maximum performance and QoS. With improved power efficiency and through the use of Emulex OneCommand Manager, OPEX is significantly reduced, while a single-driver stack ensures investment protection for all HBAs in the data center.



**Two needs, one great solution:** HP SN1000 16 Gb HBAs meet the needs of both virtualized business-critical applications and cloud environments. Visit [www.hp.com/go/SN1000HBA](http://www.hp.com/go/SN1000HBA).



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