



# Proliant GEN9 Blade Servers for Data Center

**Sowmyashree K K**

M.Tech in CSE

Dept. of Computer Science and Engineering,  
SJCE, Mysore, Karnataka, India

**M A Anasuya**

Associate Professor in

Dept. of Computer Science and Engineering,  
SJCE, Mysore, Karnataka, India

## Abstract

*Data Center is a facility used to house computer system and associated components, such as telecommunications and storage systems. It generally includes backup power supplies, data communication connections, environmental controls (e.g., air conditioning, fire suspensions) and security devices. A blade server is a stripped-down server computer with a modular design optimized to minimize the use of physical space and energy. Blade systems represent a new approach to infrastructure that can accelerate the integration and transformation of your data center. Blade servers are currently the most efficient computer devices and are often used by modern businesses as the backbone of the office computer system.*

*Keywords—Data Center; Blade Server;*

## INTRODUCTION

Unlike a rack mount server, which is entirely self-contained, blade servers lack certain key components, such as cooling fans and power supplies. These missing components, which contribute to a blade server's small size and lower cost, are instead contained in a dedicated blade server chassis. The chassis is a modular unit that contains blade servers and other modules. In addition to the servers, a blade server chassis might contain modular power supplies, storage modules, cooling modules (i.e., fans) and management modules.

Blade chassis design is proprietary and often specific to a provider's modules. As such, you cannot install a Hewlett-

Packard (HP) Co. server in a Dell Inc. chassis, or vice versa. Furthermore, blade server chassis won't necessarily accommodate all blade server models that a manufacturer offers.

Information Technology (IT) organizations face increasing demands on their infrastructure in order to support business growth. In September of 2014, HP introduced its new line of HP ProLiant BladeSystem Gen9 Server Blades with the goal of improving the price/performance ratio of datacenter

computing to empower the data-driven enterprise. These new servers take advantage of the new Intel Xeon E5-2600 v3 processors, DDR4 Smart Memory, and improved Virtual Connect Flex Fabric 20 GB. This allows HP to deliver an infrastructure that meets IT needs for a more service driven platform. The HP ProLiant BladeSystem Gen9 Server Blades are purpose-built for enterprise workloads such as virtualization and cloud computing, delivering lower cost, faster time, and higher value of service delivery. These next generation blades are specifically focused on ensuring that there is a close match between the application being run, the environment in which it is running, and the business outputs being sought.

When IT Managers consider upgrading older generation HP hardware or purchasing new hardware to help manage the increased demands of their datacenters, they want to know that the next generation offers solid, measurable performance to drive business improvements.

With this in mind, HP commissioned Demartekto compare Gen8 and Gen9 performance of their HP ProLiant BL460c Server Blades using a Data Warehousing workload. The workload was chosen to provide comparative information as a decision support vehicle. It consists of a suite of business oriented ad-hoc queries and concurrent data modifications.

The queries and the data populating the database have been chosen to have broad industry-wide relevance. This workload illustrates decision support systems that examine large volumes of data, execute queries with a high degree of complexity and give answers to critical business questions. Two variations of data warehousing workloads were run: a single sequence of queries and then a set of streamed multiple query sequences concurrently.

### 1. LITERATURE REVIEW

Rack Enclosure is a standardized frame or enclosure for mounting multiple equipment modules. Each module has a front panel that is 19 inches (482.6 mm) wide, including edges or ears that protrude on each side which allow the module to be fastened to the rack frame with screws.

It is often preferred by the companies where:

- The need of some extra space is realized especially in terms of centralized data center.
- Flexibility is required to create a match between servers and applications.
- Large dedicate storage is required which is internal to the server.

ProLiant is a brand of server computers that was originally developed and marketed by Compaq. After Compaq merged with Hewlett-Packard (HP), HP retired its former 'Net server' brand in favor of the ProLiant brand. The brand is currently marketed by Hewlett Packard Enterprise. HPE ProLiant systems lead the x86 server market in terms of units and revenue during first quarter of 2010.

ProLiant servers are separated into four main product lines - ML, DL, BL, and SL - which generally denote form factor. The ProLiant ML line comprises tower-based servers (convertible to rack mount) with capacity for internal expansion of disks and interconnects, while the DL line comprises general purpose rack mount servers. The BL line comprises blade servers which fit within the HP BladeSystem, and the SL line comprises dense rack mount servers for scale out environments. The MicroServer product line addresses small and home businesses.

### 2. NEW FEATURES

The improved Gen9Server Blade hardware innovations from Gen8 Server Blades include the following:

- DDR4 memory with increased memory speeds, increased bandwidth, decreased latency, and improved error correction.

- The Intel Xeon Processor E5-2600 v3 product family with increased cores, increased cache, and Quick path Interconnect (QPI).

The following server and server option prices were quoted by HP as the Hardware Internet List Price .It did not include the Microsoft SQL Server 2014 license cost as we were testing for performance to see if more processor cores helped or if the processor frequency was the determining factor when running this load test. For the overall system wanted a fast storage subsystem hence the use of Virtual Connect (VC) FlexFabric interconnects that could provide the 10GbE uplinks to the Top of Rack HP 5900 Series Switch and then connect via 40GbE to the iSCSI SSD Storage Array. This provided the high bandwidth pipes that would be needed to provide data to the servers during these tests.

### 3. TOTAL COST OF OWNERSHIP

Prices for our configured test servers:

	Gen8		Gen9	
Blade	BL460c	\$1,961	BL460c	\$2,011
CPU (2 sockets)	Intel® Xeon® E5-2680 2.70 GHz, 8-core	\$5,198	Intel® Xeon® E5-2670 v3 2.30GHz, 12-core	\$4,458
Processor cache size	L1: (8 x 32 KB) x 2 L2: 8 x 256 KB L3: 20 MB		L1: (12 x 32 KB) x 2 L2: 12 x 256 KB L3: 30 MB	
DIMM	512 GB, DDR3 1333MHz	\$15,984	512 GB, DDR4 2133MHz	\$14,384
Total Cost (without adapters)		\$23,143		\$20,853

Figure 1: Cost of Owership

### 4. KEY FINDINGS

- The BL460c Gen9 Server Blades outperformed the BL460c Gen8 Server Blades in all tests, despite the BL460c Gen9 Server Blade processor having a slower clock speed than the BL460Gen8 (2.7 GHz vs. 2.3 GHz).

- The largest performance improvement was shown when multiple streams of database workload queries were performed. The Gen9 blades performed the streamed database workload queries an average of 31% faster and the single sequence of database workload queries an average of 10% faster.
- While executing the database workload queries, the Gen9 Server Blade had more processor headroom available to handle other processes or other workload applications.
- When comparing like configurations of the blades used for these tests, the cost for Gen9 Server Blade hardware was 10% lower than the cost for the Gen8 Server Blade (using HP Internet List Price). It did not include the price for the network adapters, as they were the same 20 GB CNA model and quantity for both servers.
- An important consideration when evaluating servers for a data center environment is the trade-off involving acquisition costs vs. lifecycle Total Cost of Ownership (TCO). In this database application example, run headlong into the world of server hardware costs plus software application licensing vs. increased performance, lower operational costs, and business needs over the lifecycle of the solution.
  - Performance considerations –You will find that a higher Performance system that involves more processor cores, larger on-chip cache size and the ability to effectively use those cores can produce significant business benefits in faster execution times, earlier access to information, and the potential of increased business agility and service delivery. You will see those performance numbers in this report. That does come with a significant per processor core license cost when using Microsoft SQL Server 2014 with Intel E5-2600 v3 processors that have up to 18 cores per processor.
  - Acquisition cost considerations –The other consideration for the data center decision-makers is balancing the overall acquisition costs that include application software licensing with the performance needed by business for immediate requirements and to support future growth, competitive issues, new services that may be deployed and overall internal and customer satisfaction. Each company will have to evaluate the

trade-offs between performance and the overall system costs necessary to meet business goals. In this report we concentrated primarily on attaining and evaluating performance of the Gen8 and Gen9 Server Blades. Realize that the entire system of servers, storage, and networking contribute to the performance of a system. Just as the processor speed and cores come into play, so too does the SSD drives we used in the iSCSI storage array and the VC FlexFabric components that provided 20 Gb FlexibleLOMs between the servers and the VC FlexFabric modules along with 40 GbE uplinks to the HP 5900 Series Switch which connected to an iSCSI SSD array.

## 5. TEST SETUP

For the tests, each HP ProLiant BL460cServer Blade was equipped with a FlexFabric 20GB 2-port 630FLB adapter and two FlexFabric 20GB 2-port 630M adapters.

The blade enclosure included a pair of HP Virtual Connect(VC) FlexFabric-20/40 F8 Modules in interconnect bays 1 and 2, and two pairs of HP VC FlexFabric 10Gb/24-Port Modules in bays 3 and 4, 5 and 6.

HP OneView was used to provision 4x10Gbps uplinks from the blade chassis to thump 5900 Series Switch JG838A. The switch had 2X40Gbps uplinks to iSCSI flash storage.

A Data Warehousing database and TempDB database were stored on the flash storage targets for use in the Microsoft SQL Server Database Warehousing workload.

Two diagrams are shown below. The physical diagram provides the major hardware components and connections. The logical diagram shows the individual logical uplink connections and information for the database storage.

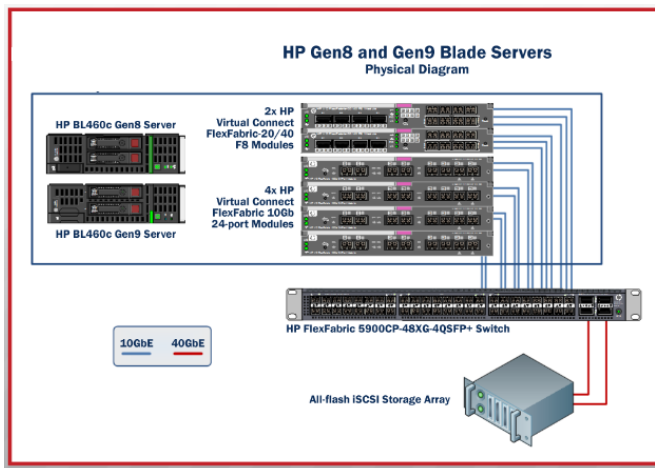


Figure 2: Physical diagram

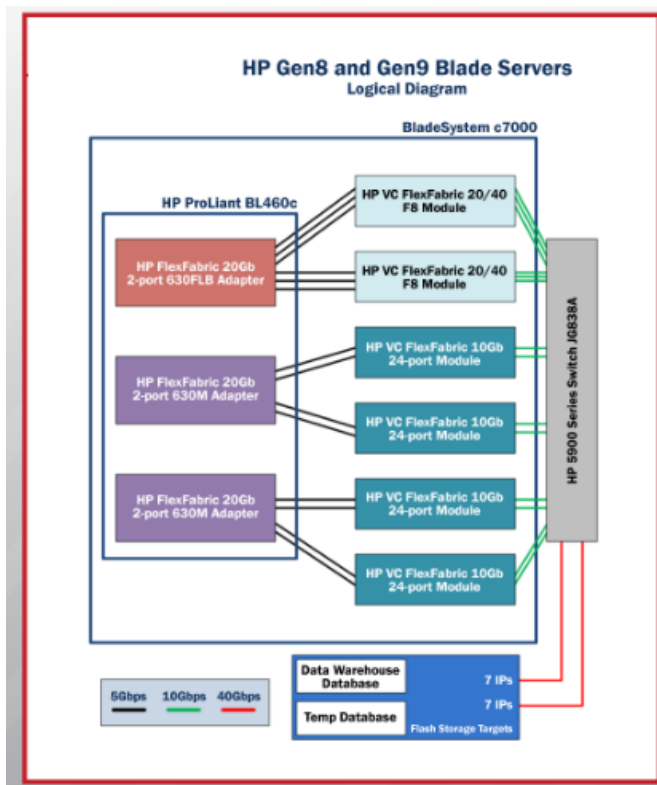


Figure 3: Logical diagram

Two different types of VC modules were used in this setup. This impacted the available bandwidth. Each FlexFabric 20GB adapter has 2 ports of 20 GB. The top adapter, colored red, connects those ports to the 20 GB ports on the HP VC FlexFabric 20/40 F8 module, so it has 20 GB of throughput available on each port. However, the bottom two adapters, colored purple, connect their 20Gb ports to 10Gb ports on the HP VC FlexFabric 10Gb 24 port Modules. While the server blade has 20 GB available on each port, the VC Modules have only 10 GB, so only 10 GB of links were used on each of

these ports. In order to ensure that the uplinks and networks were not adversely impacting performance, two measures were taken:

- To ensure there was enough uplink bandwidth, more uplinks were allocated than what was necessary to support the server. The server blade has a total of  $2 \times 20\text{GB} + 4 \times 10\text{GB} = 80\text{GB}$  of bandwidth available.  $14 \times 10\text{GB}$  uplinks made 140 GB of throughput available to the server blade.
- In an effort to ensure packets used all available uplinks to reach the top of rack switch, each uplink was assigned a different HP OneView network. As there were more uplinks than server blade ports, the ports were split into 5 GB logical links in HP OneView. Each link was on a separate network with a separate uplink. With this setup, each 5 GB logical server blade port had a different, dedicated 10 GB uplink available to it. Configuring Multi-Path IO (MPIO) on the server blade ensured that all server blade ports and all their corresponding uplinks were used.

## 6. TESTING RESULTS

### Gen8 and Gen9 Server Blades with Multiple Concurrent Queries

Three database workload tests were run where 7 concurrent streams of 22 queries were run. A total of 154 queries are completed in the test, with seven queries running at any one time.

All cores were utilized to a greater extent on both servers. Again the Gen8 server maxed out the processor compute power more frequently than the Gen9 server.

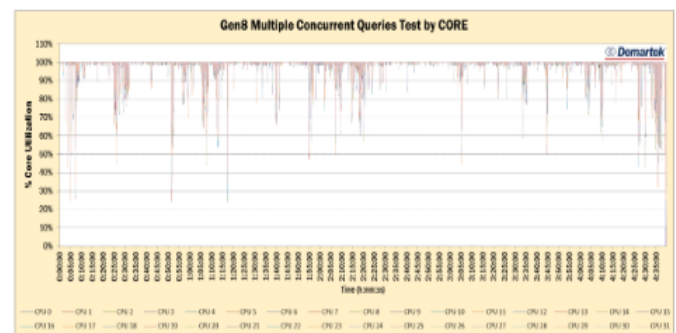


Figure 4: Gen 8 multiple concurrent queries test by core

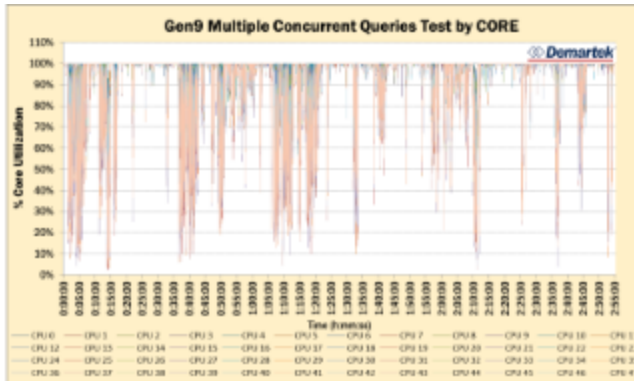


Figure 5: Gen 9 multiple concurrent queries test by core

Running 7queries concurrently ensures that there should be several processor-intensive queries available to take advantage of CPU resource sat any point during the test.

The tests were run 3 times on each system and the Gen9server was consistently faster, by an average of 1 hour and 25 minutes, or approximately 31%. This is most likely due to the increased number of cores available on the Gen9system that enable the server to complete more tasks in parallel.

Completion Times	Gen8	Gen9
Test 1	4:40:41	3:17:40
Test 2	4:39:55	3:12:32
Test 3	4:41:17	3:15:47

Figure 6: Completion time taken by Gen8 and Gen9

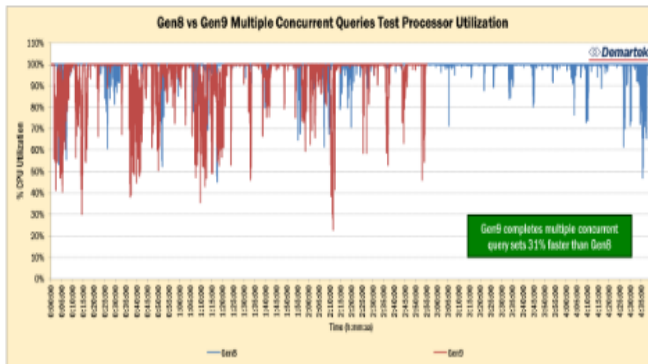


Figure 7: Processor utilization by Gen8 and Gen9

The average processor use over the entire test run was 99.5% for the Gen8server and 94.6% for the Gen9server. The Gen9server still had more processor capability that could be used for other workloads. We see the same patterns for memory, throughput and IOPS as we did in the single query set tests.

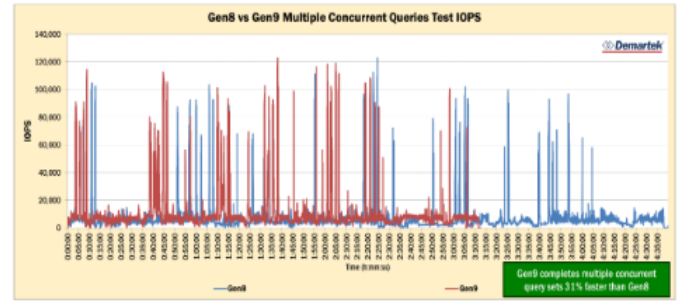


Figure 8: Test of IOPS

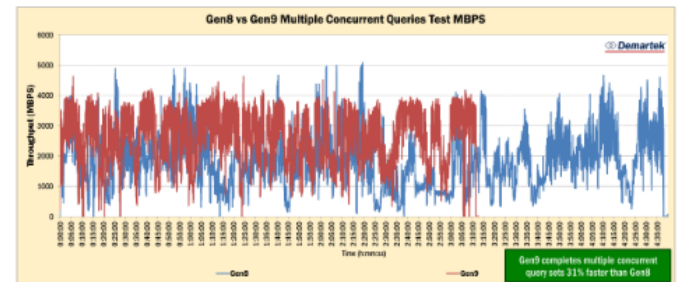


Figure 9: Test of MDPS

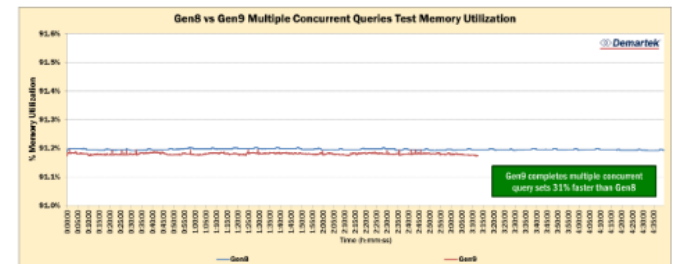


Figure 10: Memory utilization by Gen8 and Gen9

## 7. SUMMARY AND CONCLUSION

The HP ProLiant BL460c Gen9Server Blades outperformed the HP ProLiant BL460c Gen8Server Blades, especially in multi-threaded database throughput tests. Should an IT manager need to purchase more servers to handle an increased database workload, the Gen9servers would be a smarter choice. The Gen9Server Blade comparative configuration hardware costs 10% less and offers a 31% increase in performance.

Performance improvements drive more savings. If we quadrupled our workload to include 28 streams and 616 total queries, it would take four HP ProLiant BL460c Gen8 Server Blades to complete the workload while it would take 25% fewer (3) HP ProLiant BL460c Gen9 Server Blades to complete the same task. In short, three Gen9 Server Blades could do the same job as four Gen8 Server Blades while saving \$30,003 (33% reduction) in pure capital acquisition costs. We would also anticipate data center savings in power and cooling, space, and maintenance operational costs.

## 8. REFERENCES

[1] [http://h20564.www2.hp.com/hpsc/doc/public/display?docId=emr\\_na-c04534754&sp4ts.oid=7252820](http://h20564.www2.hp.com/hpsc/doc/public/display?docId=emr_na-c04534754&sp4ts.oid=7252820) *Communication*, November 1999.

[2] Gartner, "Data Center Power and Cooling Challenge," 2007.

[3] Gartner, "The Data Center Power and Cooling Challenge," David Cappuccio and Lynne Craver, November 2007.

[4] Niccolai, James. "Data Centers Turn to Outsourcing to Meet Capacity Needs," CIO.com, May 10, 2011

[5] James Glanz (September 22, 2012). "Power, Pollution and the Internet". *The New York Times*. Retrieved 2012-09-25.

[6] Morgan, Timothy Prickett. (April 29, 2013). "HP mashes up ProLiant, Integrity, BladeSystem, and Moonshot server business," *The Register.com*.

[7] HPE ProLiant rack and tower servers *The right compute for the right workload at the right economics*

[8] Technical white paper *HP FlexFabric Reference Architecture: Data Center Trends*

[9] <http://www.slideshare.net/KingofServers/gen8vgen9>