Demartek

Accelerating SQL Server 2016 with Dell PowerEdge R830 and QLogic Fibre Channel

16GFC provides performance boost for SQL Server 2016 data warehousing workloads compared to older versions.

Executive Summary

Large enterprises choose modern four-socket servers to power their most demanding workloads, including big data analytics and dense virtualization deployments. The latest Dell PowerEdge R830 four-socket server leverages the current Intel® Xeon® E5 v4 processor family to deliver the highest levels of performance.

Frequently, datacenters consider refreshing their compute platforms as certain software applications reach the end of support. Microsoft recently released SQL Server 2016 and declared the end of extended support for SQL Server 2005 SP4.

Dell commissioned Demartek to evaluate the benefits of moving to a data warehousing solution powered by the latest generation of hardware and software. We compared the Dell PowerEdge R830 server running Microsoft SQL Server 2016 connected to an all-flash storage array using 16 Gb Fibre Channel (FC) adapters from QLogic and the older solution consisting of a Dell PowerEdge R820 server running Microsoft SQL Server 2005 SP4 using legacy 8 Gb Fibre Channel technology. We tested both the performance of the Fibre Channel infrastructure and the performance of the servers.

We found that the data warehousing solution using the Dell PowerEdge R830 server, all-flash array and QLogic 16GFC HBAs provided significantly better performance than the solution using the older hardware and software for both storage performance and server performance.

Key Findings

> The Dell PowerEdge R830 with QLogic QLE2692 16GFC adapter connected to the all-flash array completed the SQL Server 2016 decision support workload in 47% less time than with Dell PowerEdge R820 and the legacy 8GFC adapter running SQL Server 2005 SP4.

> The Dell PowerEdge R830 with 1.5 TB RAM completed the SQL Server 2016 decision support workload in 69% less time than with Dell PowerEdge R820 with 256 GB RAM running SQL Server 2005 SP4.

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Dell PowerEdge R830 Server

The PowerEdge R830 with Microsoft SQL Server 2016, as well as its built-in high performing data warehouse, has the processing power required for virtualization and memory-intensive application workloads for databases. In order to scale performance to meet the demands of almost any workload, the PowerEdge R830 supports:

- Intel® Xeon® E5 v4 processor family with up to 22 cores per processor, totaling 88 processing cores with all four processors
- 48 DDR4 2400 MHz DIMM slots with up to 3 TB of available memory, or a lower total if lower-cost, smaller DIMMs are deployed
- QPI up to 9.6 GT/s
- Chipset: Intel C612
- Up to 7 PCIe 3.0 slots, including up to 2 x16 slots
- Up to 16 2.5-inch drive bays
- Single or dual 80PLUS Platinum power supplies, either 750W or 1600W each

QLogic 16 Gb Fibre Channel Adapter Models

The QLogic QLE2692 Fibre Channel host bus adapter (HBA) supports Enhanced Gen 5 Fibre Channel with up to 650K IOPS per-port and lower power consumption than their original Gen 5 FC HBA.

The QLogic Enhanced Gen 5 FC HBAs include the QLogic StorFusion technology that includes advanced management and diagnostic features when deployed with supported Brocade FC switches.

Supported Speeds

The QLogic QLE2692 adapters support 16GFC, 8GFC and 4GFC link speeds, automatically negotiated.

The QLogic QLE2562 adapters support 8GFC, 4GFC and 2GFC link speeds, automatically negotiated.

SQL Server 2016

The total cost of ownership (TCO) advantages of Microsoft SQL Server 2016 include a number of built-in features that cost extra with other commercial database products. These built-in features include in-memory databases, end-to-end security, advanced analytics and complete mobile business intelligence.

The integrated, in-memory persistent Columnstore features of SQL Server 2016 reduce the storage footprint while delivering significantly higher analytics performance.

Always Encrypted is a feature designed to protect sensitive data in SQL Server databases. Data is protected transparently by automatically encrypting and decrypting sensitive data in the client application, limiting data access only to data owners, not system administrators.

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Test Results

The primary workload used for these tests was a data warehousing application workload running on SQL Server 2016. This read-intensive data warehousing workload is also known as a decision support application because it gives answers to critical business questions. It consists of a fixed set of queries of relatively high complexity presented to a large database that examines large volumes of data.

Because this is a fixed set of work, any improvements in infrastructure such as faster Fibre Channel host bus adapters (HBAs) or larger amounts of memory allocated to SQL Server will result in completion of the work in a smaller amount of time.

The business benefit of this is demonstrated in a faster time to extract business insights from the decision support application.

We compared the performance of this data warehousing workload with two QLogic adapters.

> QLogic QLE2562 – 8GFC
> QLogic QLE2692 – 16GFC

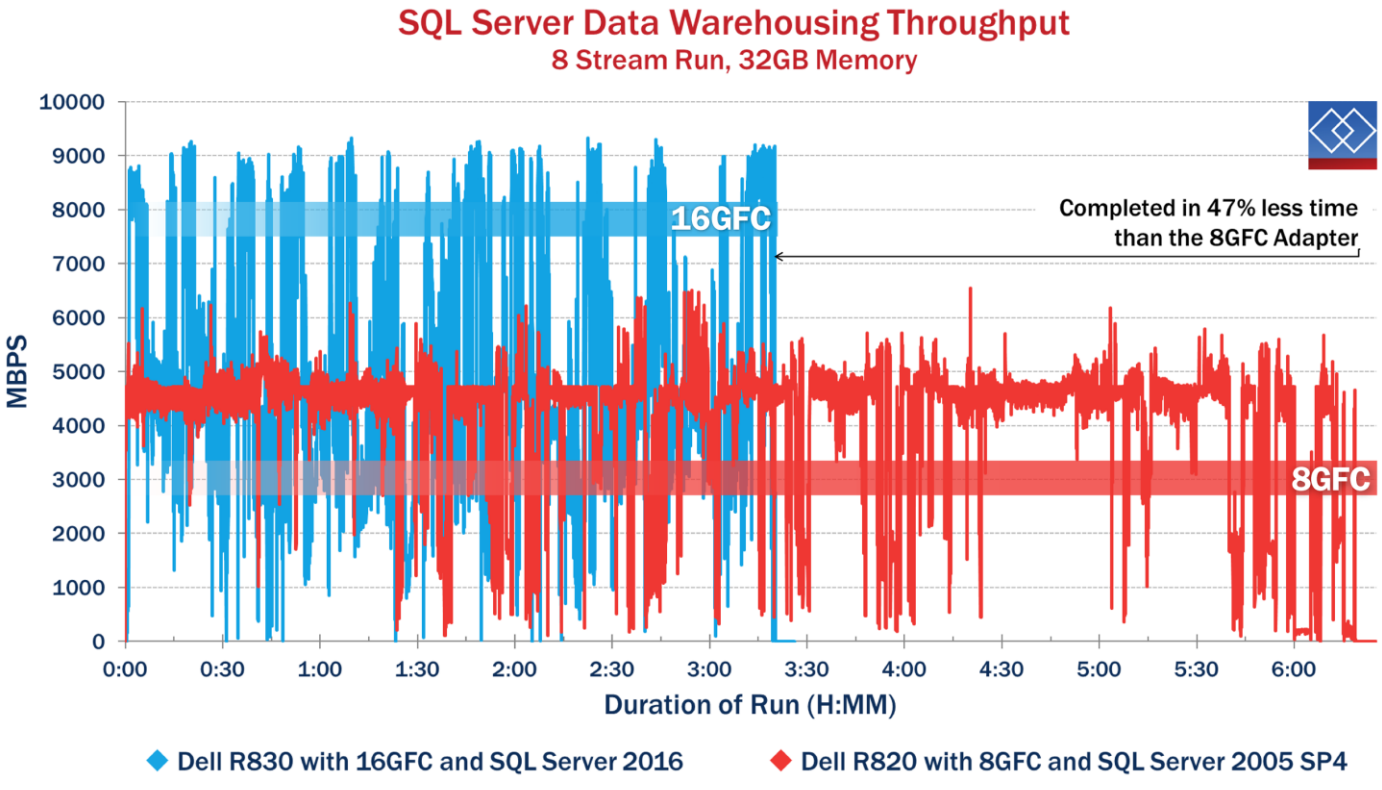
We had to modify our data warehousing workload to remove some of the queries that were not supported with SQL Server 2005 SP4. We ran the same, somewhat reduced set of queries with both versions of SQL Server.

Throughput via Fibre Channel

When using real database workloads, the I/O rate varies as the workload progresses because the application is not only issuing I/O requests but is also consuming varying amounts of host CPU and memory resources.

The increased speed of the QLogic QLE2692 FC adapter allowed the workload to be completed in approximately half the time of the legacy 8GFC HBA.

Memory allocated to SQL Server was limited to 32 GB.



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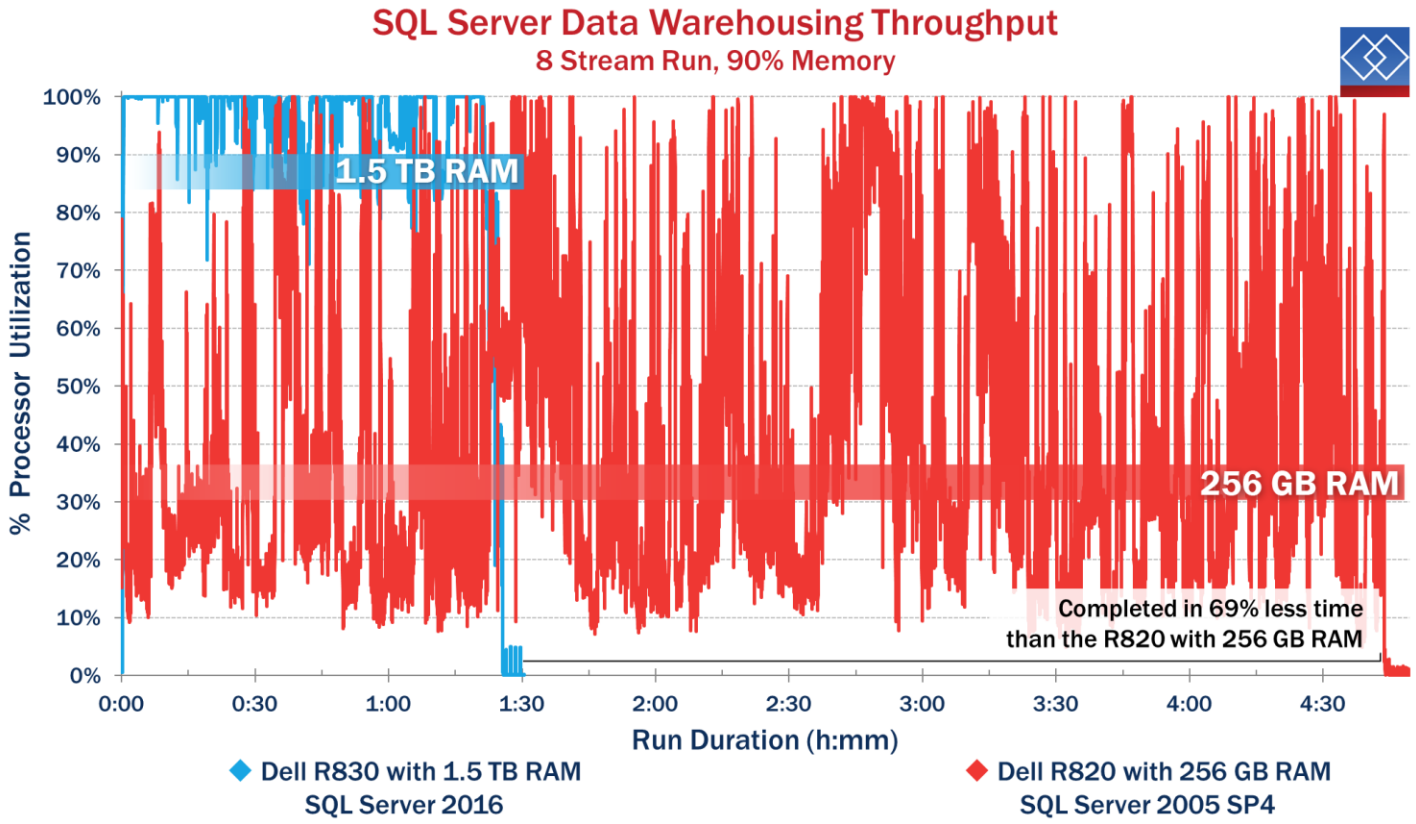
Throughput via Large Memory

In a separate test, we ran the data warehousing workload allowing SQL Server to use 90% of all available memory for database caching, rather than a smaller, fixed amount of memory used in the previous test in order to force more I/O requests. The older PowerEdge R820 server running SQL Server 2005 SP4 had 256 MB of RAM, while the newer PowerEdge R830 server running SQL Server 2016 had 1.5 TB (1536 MB) of RAM.

SQL Server, like most databases, will take advantage of RAM for caching to either decrease the amount of I/O required or to increase the effective throughput.

The larger memory deployed in the newer PowerEdge R830 server allowed more of the processing to occur in-memory, reducing the time to complete the workload by more than 2/3 compared to the smaller memory, older processors and older version of SQL Server used with the older PowerEdge R820 server.

Today's servers have the processing power and increased memory to significantly reduce analytics workloads. This same processing power and memory capacity can also be harnessed for virtualized server environments.



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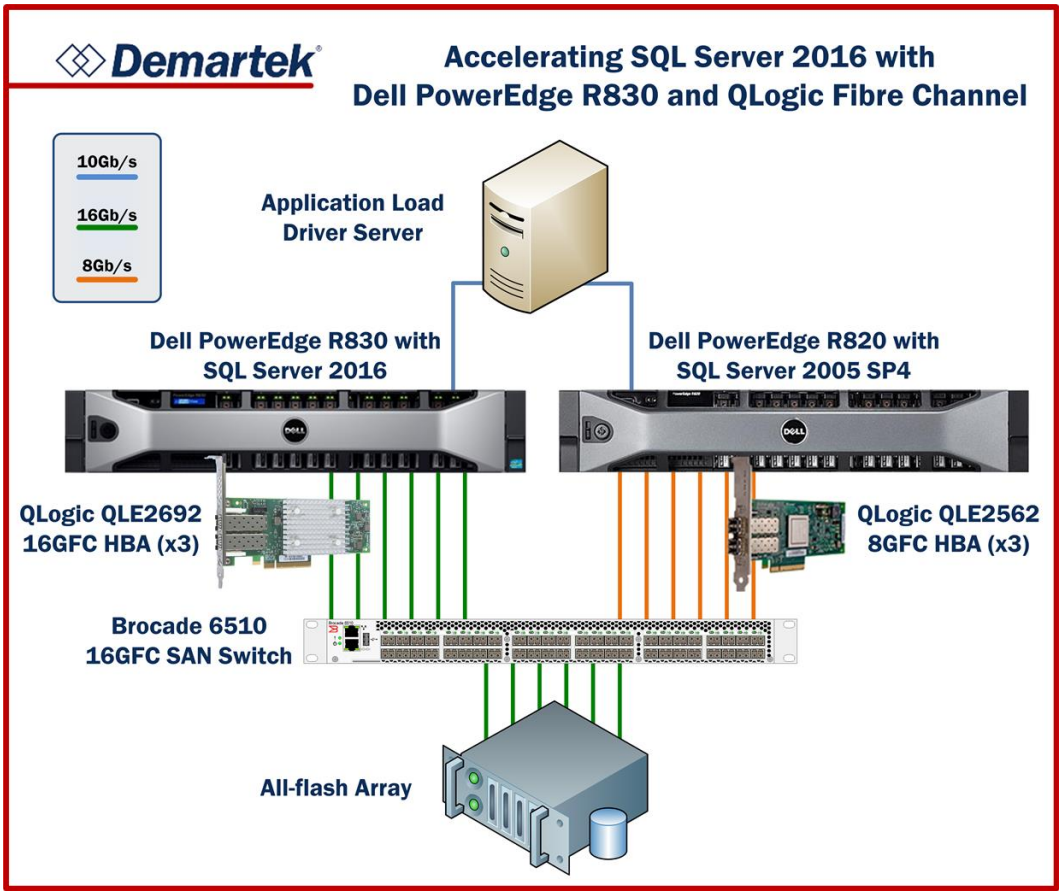
Test Environment



Server – Dell PowerEdge R830

> 4x Intel Xeon E5-4669 v4, 2.2GHz, 88 total cores, 176 total threads
> 1536 GB RAM, DDR4, 2400 MHz
> Windows Server 2012 R2
> SQL Server 2016

Server – Dell PowerEdge R820

> 4x Intel Xeon E5-4650, 2.7GHz, 32 total cores, 64 total threads
> 256 GB RAM, DDR3, 1866 MHz
> Windows Server 2008 R2
> SQL Server 2005 SP4

Fibre Channel Switch

> Brocade 6510 16GFC Switch

Fibre Channel Adapters

> QLogic QLE2562 (8GFC)
> QLogic QLE2692 (16GFC)

Storage System

> All-flash array
> 6x 16GFC target ports

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Summary and Conclusion

Combining the new Dell PowerEdge R830 server, the all-flash array and the 16GFC adapters from QLogic provides a powerful solution for today's demanding enterprise workloads such as data warehousing with Microsoft SQL Server 2016.

> The Dell PowerEdge R830 with QLogic QLE2692 16GFC adapter connected to the all-flash array completed the SQL Server 2016 decision support workload in 47% less time than with Dell PowerEdge R820 and the legacy 8GFC adapter running SQL Server 2005 SP4.

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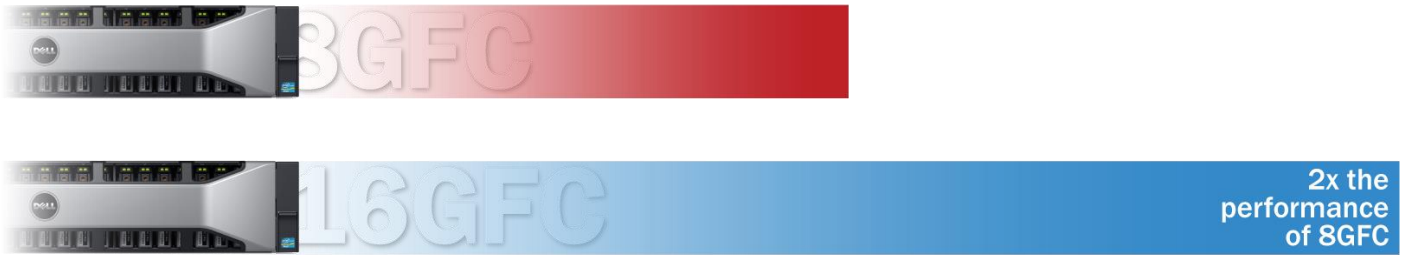

The most current version of this report is available at http://www.demartek.com/Demartek_Dell_R830_QLogic_16GFC_SQL_Server_2016_Evaluation_2016-06.html on the Demartek website.