

# Better Business Intelligence

## Micron® 5100 ECO SSDs: 14X More Queries per Hour on Highly Loaded Platforms

Data growth has exploded. Users and systems generate more data than ever before. What used to be silos have grown to lakes, lakes have grown to oceans – and those oceans are getting ever larger. Finding valuable, actionable data in the morass has never been more challenging. Nor more critical.

Global competition across scores of commercial enterprises means management has to make better, more informed decisions. And it has to make them faster.

Business intelligence (BI) systems are more critical now than ever before. These systems have to support faster, more precise decisions from larger pools of data – with maximum efficiency to minimize their environmental footprint.

Faster results under heavy loading provides more value to the agile enterprises that need to analyze enormous data collections and answer critical questions quickly and efficiently.

In this technical brief we compare two BI platform configurations: The first built with eight Micron 5100 ECO enterprise-grade SSDs and the second with eight 10K RPM hard disk drives (HDDs).

We found that the configuration with Micron 5100 ECO SSDs supported 14X more queries per hour and had 11X better storage throughput when both systems were heavily loaded.

### 5100 ECO SSDs vs HDDs: Business Intelligence



When heavily loaded, the 5100 ECO SSD configuration showed:  
14X More Queries per Hour  
11X Higher Storage Throughput



Business intelligence systems are more critical now than ever before. These systems have to support faster, more precise decisions from larger pools of data. Enterprise SSDs like the Micron 5100 ECO drive better BI systems for better results.

## Standardized Tests, Compelling Results

We used HammerDB’s OLAP implementation for all-query performance tests<sup>1</sup>. This free, standardized measurement tool is based on the TPC-H benchmark. It uses a series of business-oriented, ad-hoc queries and concurrent data modifications to gauge platform capability. To ensure test results matched real-world use, we set the two exit conditions below. The first condition ensures that results are available in a reasonable time frame. The second reflects the common practice of adding load until reaching maximal queries per hour. When the test met either condition, we stopped the test:

- Run time: The test run time exceeded 12 hours (longer run times decrease the usefulness of the results)
- Loading: Additional loading resulted in lower queries completed per hour<sup>2</sup>.

We were forced to limit the HDD stream count to one; if we added more streams, the test took longer than 12 hours (making its results less useful in the real world). A single stream test using Max DoP=7<sup>3,4</sup> took about 12 hours to complete. Because total run time and Max DoP have a roughly linear relationship, we fixed the HDD configuration stream count to one and did not test additional stream counts on the HDD configuration. The 5100 ECO configuration supported all tested stream counts.

## 5100 ECO SSDs: 14X More Queries per Hour

We set Max DoP=7 (the HDD optimal value as shown above) and measured its single stream query completion time. We then set Max DoP=7 and tested the 5100 ECO SSD configuration query completion time across a broad range of stream counts. Because users would typically adjust the stream count to provide the lowest completion time, we selected the 5100 ECO stream count=8 and used the results to compare queries per hour<sup>2</sup> (QPH) for each configuration.

Figure 1 shows the results (additional detail in Table 1). Note that the HDD configuration (using 1 stream) took longer than the 5100 ECO configuration did at any tested stream count. The HDD configuration completed 2.1 QPH (1 stream; the only supported stream count).

The 5100 ECO configuration reached 28.9 QPH (8 streams) for a difference of 14X.

Note: The entry “---” in Table 1 indicates an unsupported and untested configuration.

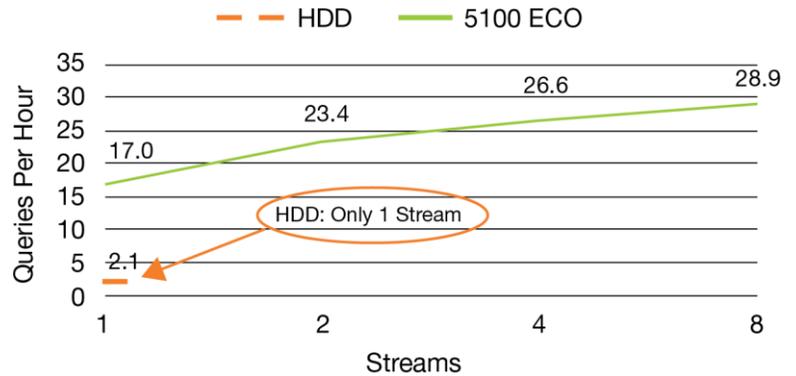


Figure 1: QPH vs. Streams

Streams	Completion Time (seconds)		Queries Per Hour (QPH)	
	HDD	5100 ECO	HDD	5100 ECO
1	38,563	4650	2.1	17.0
2	---	6756	---	23.4
4	---	11,889	---	26.6
8	---	21,887	---	28.9

Table 1: Number of Streams, Completion Time and Queries per Hour

1. For additional details on HammerDB and Decision Support testing, see: [http://www.hammerdb.com/hammerdb\\_dssintro.pdf](http://www.hammerdb.com/hammerdb_dssintro.pdf)  
 2. Queries per hour = (streams)\*(22 queries)/total run time  
 3. Max DoP is an adjustable parameter that tells the SQL Server Planner how many parallel operations it can use for a given query  
 4. We tested a wide variety of Max DoP values and found that Max DoP=7 showed optimum results for the HDD configuration

## 5100 ECO SSDs: 11X Better Storage Throughput

To better understand the QPH results, we also compared the storage throughput of both configurations using Max DoP=7.

We tested the HDD configuration with one stream (the maximum supported) and the 5100 ECO configuration at multiple stream counts. Figure 2 shows the results (with additional detail in Table 2). Note that the HDD configuration shows much lower throughput than the 5100 ECO at any stream count.

Note: the entry “---” in Table 2 indicates an unsupported and, therefore, untested configuration.

### Summary

Data is everywhere and more is created every day. With this unparalleled growth comes incredible complexity – finding the information we need is becoming much harder. Finding it in a timely manner, even more so.

Competition on a global scale is helping drive the need for better, more informed decisions faster. BI systems are vital to success.

Enterprise SSDs — like Micron’s 5100 ECO SSD — drive better BI systems for better results.

In testing a 5100 ECO BI platform against an all-HDD BI platform, we found that the 5100 ECO configuration completed 14X more queries per hour with 11X the storage throughput, making the 5100 ECO the clear choice for better BI platforms.

Contact your Micron representative or visit [micron.com](http://micron.com) to explore the opportunities awaiting your BI systems with Micron 5100 ECO SSDs.

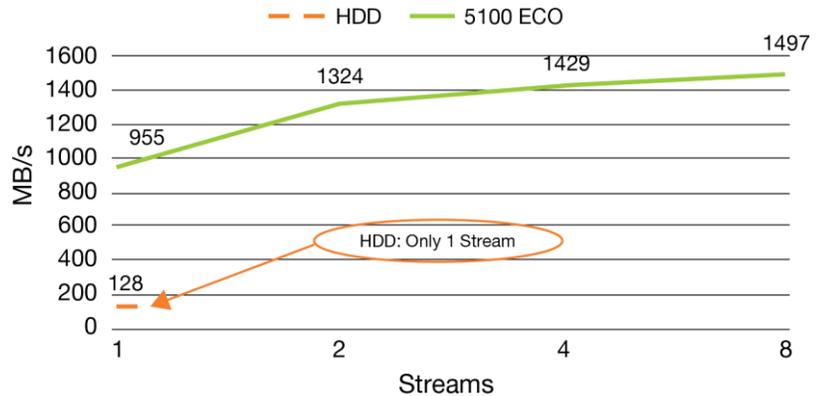


Figure 2: Throughput vs. Streams

Throughput (MB/s, Max DoP=7)			
Streams	HDD	5100 ECO	Multiplier
1	128	955	7.4X
2	---	1324	10.3X
4	---	1429	11.1X
8	---	1497	11.7X

Table 2: Throughput and Streams (Detail)

## How We Tested

To ensure we had optimal results for the HDD configuration, we varied the maximum degree of parallelism (Max DoP)<sup>1</sup> and measured the resulting QPH (tuning for best QPH is a common practice).

Figure 3 shows that Max DoP=7 results in the highest QPH for the HDD configuration. When Max DoP is set to 7, the HDD configuration completed 2.1 QPH.

The 5100 ECO configuration supports multiple streams (the HDD configuration supported only one).

We tested the 5100 ECO configuration with a range of Max DoP and stream counts (to explore its additional capability), varying both to determine its optimal tuning. For these tests we used DoP values 2, 4, 7, 14, and 28 (28 is the maximum number of threads in a single server node) and stream count = 1, 2, 4 and 8.

Figure 4 shows that the 5100 ECO configuration completes the highest QPH (28.9) when Max DoP=7 and stream count = 8.

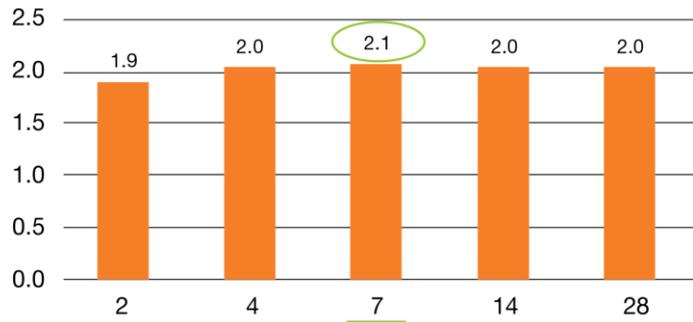


Figure 3: QPH vs. Max DoP (HDD Configuration)

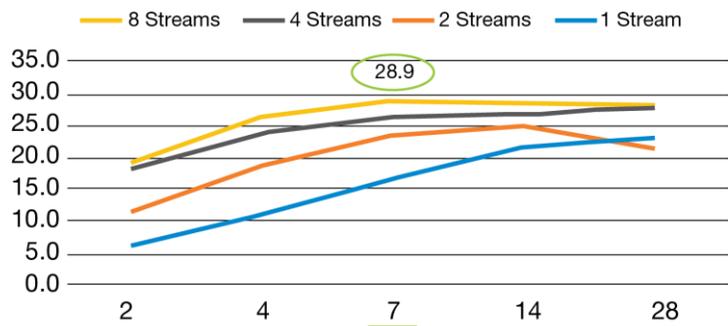


Figure 4: QPH vs. Max DoP and Stream Count (5100 ECO)

1. Max DoP is an adjustable parameter that tells the SQL Server Planner how many parallel operations it can use for a given query

Products are warranted only to meet Micron's production data sheet specifications. Products, programs and specifications are subject to change without notice. Dates are estimates only. This technical marketing brief is published by Micron and has not been authorized, sponsored, or otherwise approved by Red Hat or NVM Express. ©2017 Micron Technology, Inc. All rights reserved. All information herein is provided on an "AS IS" basis without warranties of any kind. Micron, the Micron logo, and all other Micron trademarks are the property of Micron Technology, Inc. All other trademarks are property of their respective owners. Rev. A 5/17 CCMMD-676576390-10721