
Adaptec MaxiQ™ SSD Cache Performance Solution for MySQL Analysis

September 22, 2009

Introduction

Adaptec has requested an evaluation of the performance of the Adaptec MaxIQ™ SSD Cache Performance Solution, used with the Adaptec 5445Z storage controller. Adaptec supports MaxIQ on all of their Series 5 controllers. In our testing, the Adaptec RAID 5445Z controller is equipped with MaxIQ solid state drives that serve as cache directly attached to the controller. The end goal of this engagement is to capture the performance statistics on the controller with SSD cache enabled and then with SSD cache disabled for a comparative analysis.

Test Objectives

Tests were conducted with the following requirements for the MySQL Server environment:

- ▶ MySQL Server with 82,000 records hosted on 1 MySQL server.
- ▶ Obtain performance metrics with MaxIQ SSD cache on the Adaptec 5445Z host bus adapter disabled, followed by identical testing with MaxIQ SSD cache enabled which include MySQL server statistics and other server operating system performance metrics.
- ▶ Executed each test run for 60 minutes.

High Level Summary

The Adaptec RAID 5445Z controller may be equipped with up to four MaxIQ SSD solid state drives that serve as cache directly attached to the adapter. In this engagement one solid state drive was configured for the MySQL analysis.

A MySQL database was designed to emulate an E-Commerce solution that displays images of products, requests information from a database and adds data to the database. The database was 80GB in size with typical content like user contact information, account information, company information, product information and the like. The test database was designed with multi-table selects, joins, inserts, updates, deletes, and indexing that any MySQL solution might employ. The test scripts employed a 95% read (select statements) 5% write (insert, delete, update statements) strategy to simulate databases where the vast majority of database queries are reads, with a few writes. Write intensive databases where new data is added might include inventory, accounting, engineering, education, medical, etc.

When MaxIQ SSD cache was engaged with a single MaxIQ SSD in a read/write test run:

- ▶ MySQL read and write (selects, inserts, updates and deletes) throughput increased by 8.0 times
- ▶ MySQL transactions per second increased by 6.9 times

Other types of databases might employ a strictly read only strategy. There are various good reasons for this: security, increased performance, business model, etc. For example, databases might be set up for archiving information such as bank records that cannot change due to regulatory constraints. A part tracking database might have very few changes, but frequent reads.

Software

The following table describes the software that was used for testing the MySQL Server environment:

Device	Software
MySQL Server	SuSE Linux Enterprise Server 10.2 MySQL 5.0.26
Test Management Console	Windows XP, SP3

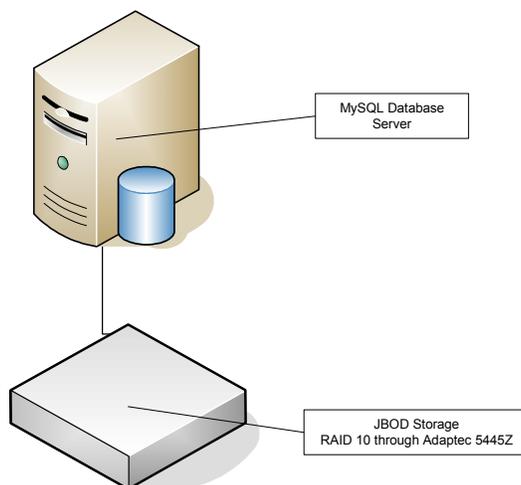
Hardware

The following table describes the hardware that was used for testing the MySQL Server environment:

Device	Hardware
MySQL Server	16 Intel(R) Xeon(R) CPU L5520 @ 2.27GHz
	12 GB RAM, 300GB HDD
	Intel 82575EB Gigabit Network
	Adaptec AAC-RAID (aacraid v1.1-5[2468]) MaxIQ Solid state drive for cache: one drive Model: SSDSA2SH032G1GN, firmware: 045C8790 BIOS: v5.2-0 [Build 17517] Controller Memory: 512MB
	DataON DNS-1400 JBOD with RAID 10 (16 SATA drives) Model: Seagate ST3146356S

Topology

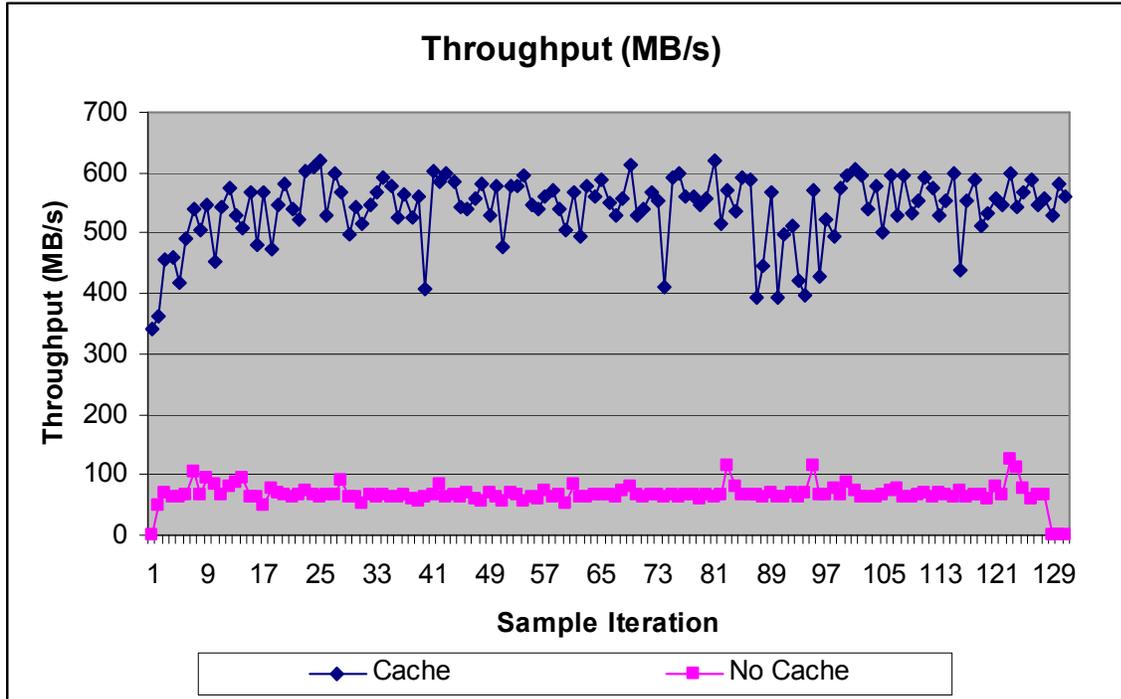
The following is a diagram of the MySQL Server Environment:



Test Results for the MySQL Server

These are the test results of the Adaptec MaxIQ SSD Cache Performance Solution with MaxIQ cache enabled compared to being disabled. In all cases the MySQL Server was monitored to ensure the only bottleneck was the storage controller. CPU, RAM, network, MySQL and other devices were monitored to ensure that they were not causing the environment to perform slowly.

Throughput with 95% Reads and 5% Writes

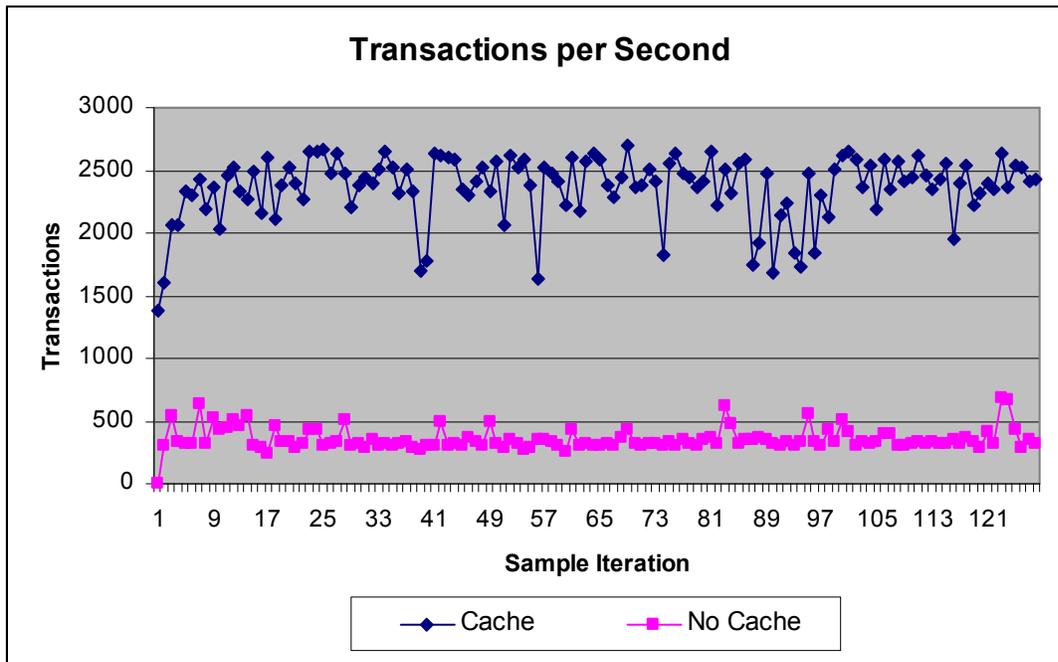


The blue line is with MaxIQ SSD cache enabled on the Adaptec 5445Z, and shows that the MySQL throughput stabilized at 542.3 MB second.

The pink line is with MaxIQ SSD cache disabled on the Adaptec 5445Z, and shows that the MySQL throughput stabilized at 67.6 MB per second.

This test run showed a performance increase of 8.0x with cache over no cache.

Transaction Performance with 95% Reads, 5% Writes



The blue line is with MaxIQ SSD cache enabled on the Adaptec 5445Z, and shows that the MySQL transactions stabilized at about 2374 transactions per second.

The pink line is with MaxIQ SSD cache disabled on the Adaptec 5445Z, and shows that when the MySQL stabilized at about 346 transactions per second.

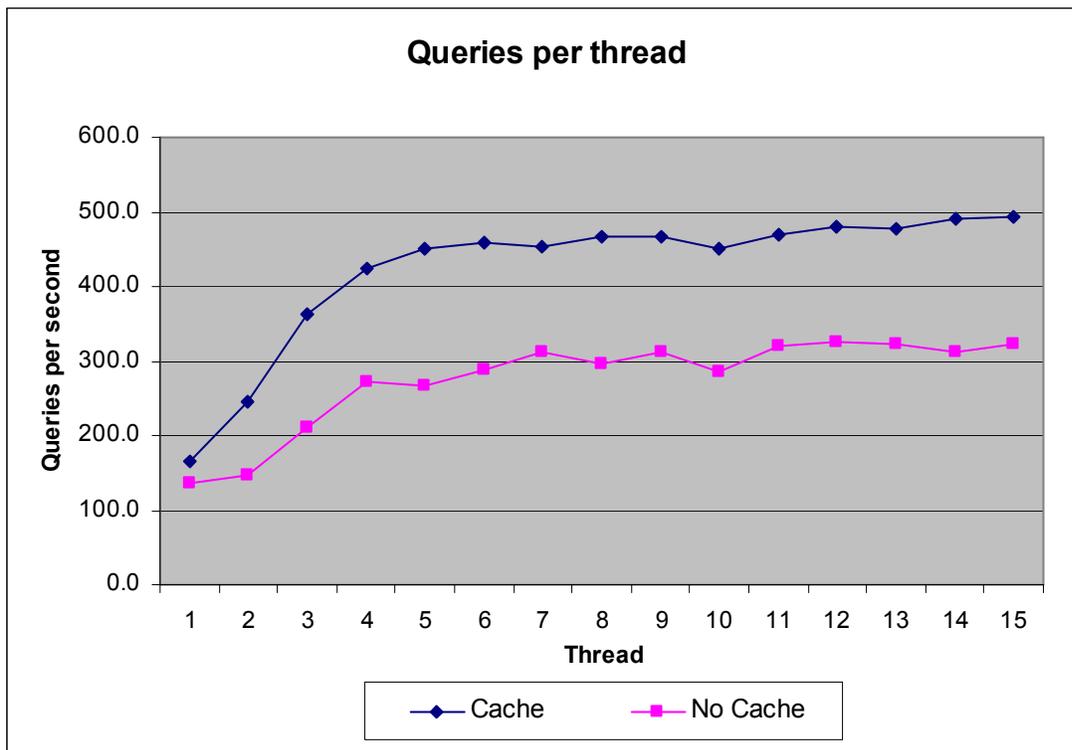
This test run showed a performance increase of 6.9x with cache over no cache.

A total of 1.6 million transactions were executed for each test run.

Queries per Thread

The MySQL server was monitored for the number of queries per second that it could sustain given an increasing workload. The workload was generated from worker threads. Worker threads generated SQL queries in high quantities with no delays between SQL queries. Each worker thread count was allowed to run for a short period of time until the MySQL Queries per Second rate stabilized. The chart below summarized the effect that enabling SSD cache has compared to not enabling cache. Without SSD cache the Queries per Thread level off at about 300 queries per second. With SSD cache the Queries per Thread level off at about 490 queries per second.

A typical user will execute a single request to a database, consider the data for a few minutes and then perhaps ask for another query on the database. This metric is intended to show the response rate of the system in terms of queries per second that are sustainable. Since the intended audiences and their core usage are very different for all databases, it is up to the database developer to determine what their database must be able to sustain for a query load.



Conclusion

The following items provide an overview of the tests comparing the Adaptec MaxIQ SSD Cache Performance Solution within a MySQL Server environment:

- ▶ Read/Write test run with 95% select statements and 5% insert/delete/update statements.
 - Throughput in mega bytes per second (Mbps) went from 67.6 Mbps with SSD cache disabled to 542.3 Mbps with SSD cache enabled for a performance gain of 8.0 times the non-cached environment.
 - Transactions per second went from 346 transactions per second with SSD cache disabled to 2374 transactions per second with SSD cache enabled for a performance gain of 6.9 times the non-cached environment.
- ▶ The test environment was designed so that CPU utilization, network traffic and memory were not bottlenecks, and disk I/O through the Adaptec RAID 5445Z was heavily loaded to exercise the 5445Z's cache.

Installing, configuring and managing the controller and SSD cache is a trivial, quick and intuitive experience. Managing the MaxIQ cache only requires half a dozen mouse clicks from launching to exiting the GUI interface.