Adaptec MaxIQ™ SSD Cache Performance Solution

for Web Server Environments Analysis

AppLabs

no doubt about it

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Introduction

Adaptec has partnered with AppLabs to evaluate 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. AppLabs has successfully completed this performance benchmark testing in a Web Server environment. 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

As part of this engagement, AppLabs conducted tests with the following requirements for the Web Server environment:

- 1,500 user load with 8,300 websites hosted on 1 web server.
- Obtained performance metrics with MaxIQ SSD cache disabled followed by identical testing with MaxIQ SSD cache enabled.
- Captured the web server statistics of first 30 websites and other server performance metrics.
- 90 minutes test run

High Level Summary

AppLabs analyzed the performance of the Adaptec MaxIQ Cache Performance Solution. The Adaptec RAID 5445Z controller may be equipped with up to four MaxIQ solid state drives that serve as cache directly attached to the controller. In this engagement one solid state drive was configured for the Web Server analysis.

AppLabs found that when MaxIQ SSD cache was engaged with a single MaxIQ SSD:

- Web Server throughput increased by 3.6 times
- Time to First Byte improved by 5 times
- Average web server response times under load decreased by 10.3 times
- User response rate increased by 6 times
- Number of users increased by almost 2 times for the same response time.

Software

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

| Device	Software
Web Server	RedHat 5.3
	Apache2 Web Server
Test Management Console	Windows 2003 Server – Standard Edition
	WebLoad 8.3
Load Generators	Windows XP, SP3 with WebLoad 8.3

Hardware

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

| Device	Hardware
Web Server	Xeon – Quad Processor Quad Core 7400 at 2.9 GHz (16 Logical CPUs)
	2 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 17508] Controller Memory: 512MB
	RAID 5 with 3 SATA drives Model: WDC WD10EADS-00M Firmware: 01.00AA01
WebLoad Server (Test Management Console)	2+ GHz Processor, 2 GB memory
3 Load Generators	2+ GHz Processor, 512 MB memory

Topology

The following is a diagram of the Web Server Environment:

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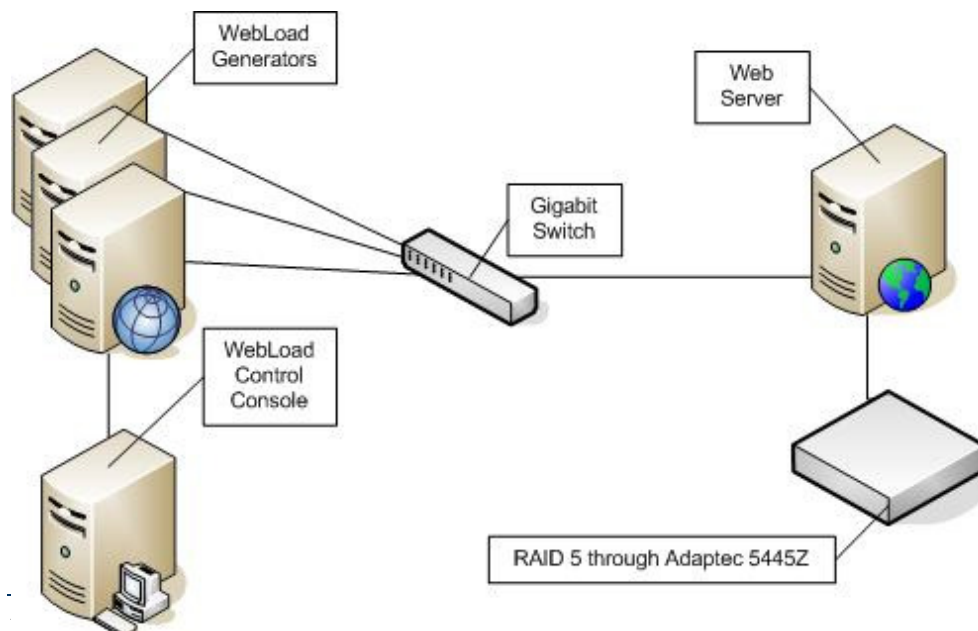
Comparison Test Results for the Web Server

The Adaptec MaxIQ SSD Cache Performance Solution was tested with MaxIQ cache enabled compared, and then again with MaxIQ cache disabled. In all cases the Web Server and load generators were monitored to ensure the only bottlenecks were the storage controller.   CPU, RAM, network, Apache and other devices were monitored to ensure that they were not causing the environment to perform slowly.

Throughput
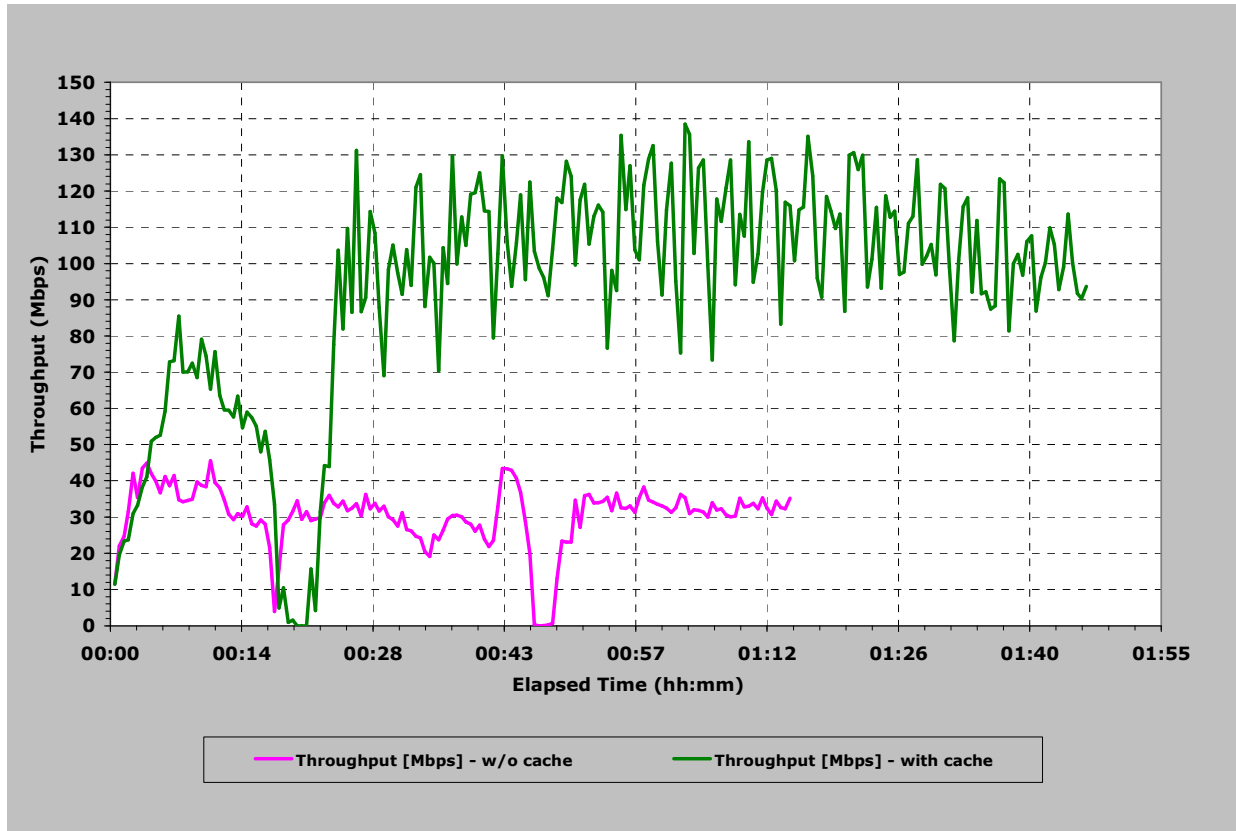
Throughput is measured in mega bits per second through the Adaptec 5445Z controller. The web server content resided on a RAID 5 partition controlled by the Adaptec 5445Z.

The green line is with MaxIQ SSD cache enabled on the Adaptec 5445Z, and shows that when the WebLoad user count reached 1500 users the throughput stabilized at about 110 mega bits per second.

The pink line is with MaxIQ SSD cache disabled on the Adaptec 5445Z, and shows that when the WebLoad user count reached 1500 users the throughput stabilized at about 30 megabits per second.

Enabling the Adaptec Cache improved the throughput by 3.6 times over non-cache.

Web Page time to First Byte
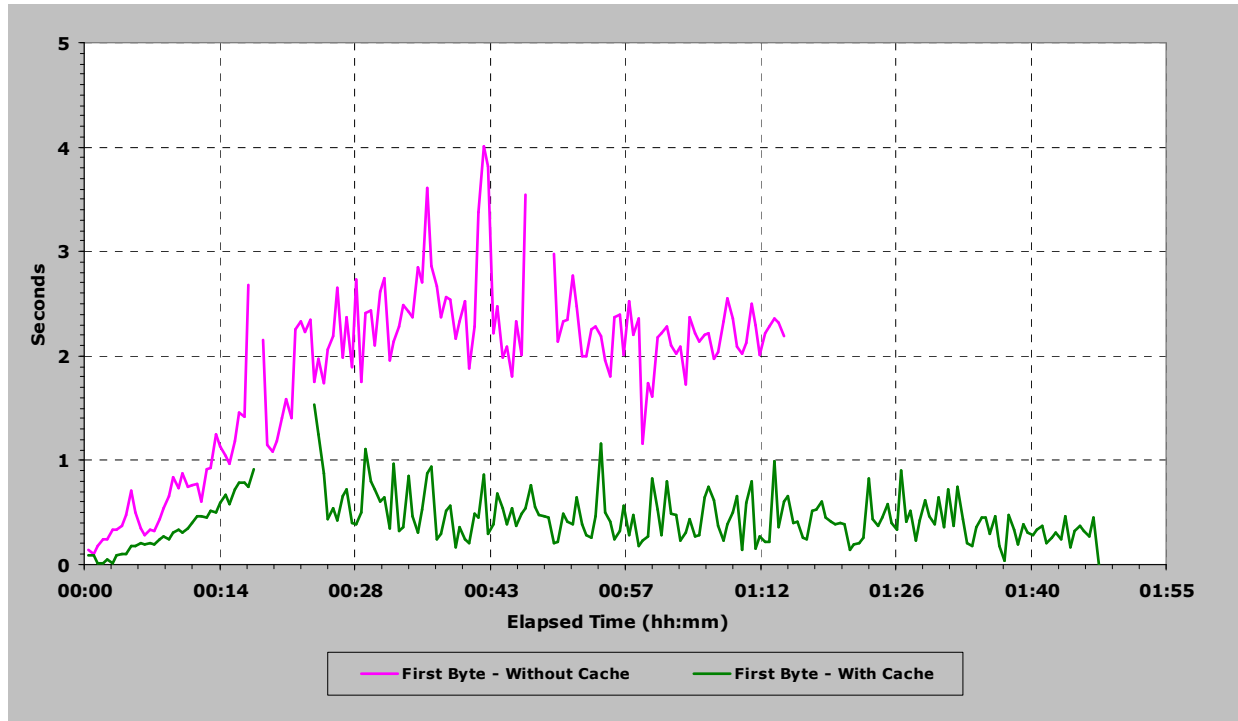
Time to First byte is the amount of time it takes for a web browser like Internet Explorer to initiate a request from a web server, and for the web server to respond with data back to the web browser. The starting time of the metric is the instant when the web browser initiates a request. The instant when the first byte of data from the web server makes it to the web browser is ending time of the metric.

The green line is with MaxIQ SSD cache enabled on the Adaptec 5445Z, and shows that when the WebLoad user count reached 1500 users the Time to First Byte stabilized at about 0.5 seconds.

The pink line is with MaxIQ SSD cache disabled on the Adaptec 5445Z, and shows that when the WebLoad user count reached 1500 users the throughput stabilized at about 2.5 second.

Enabling the MaxIQ cache improved the time to first byte performance by 5 times over non-cache.

Web Page Response Times

The test environment was comprised of 8300 web pages. Each web page was hit randomly by three load generators (web browser clients).   The response time is how many seconds it takes for the web server to return data to the browser. The units are seconds.

Enabling the Adaptec MaxIQ SSD Cache Performance Solution improved the web page response time performance by 10.3 times over non-cache. The following data was collected from 30 web pages:

Average of Columns			
	Min	Avg	Max
Without Cache	1.41	42.2	134.43
With Cache	0.08	4.1	20.56
Improvement	16.8	**10.3**	6.5

User Response Rates

The test environment was configured for a comparative analysis of users versus web server response rates. As WebLoad users were added, the response rate of the web server was measured. The following table lists the response rates in seconds for user counts:

No. of Users	Response Time W/o Cache (secs)	Response Time With Cache
500	0.3	0.2
1000	0.8	0.5
1500	2.4	1.0
2000	3.8	1.8
2500	15.7	2.6

Enabling the Adaptec cache improved the user response rate by 6 times over non-cache

Conclusion

The following items provide an overview of the tests comparing Adaptec MaxIQ SSD Cache Performance Solution performance used in a Web Server environment:

- Throughput in mega bits per second (Mbps) went from 29.4 Mbps with SSD cache disabled to 107.0 Mbps with SSD cache enabled for a performance gain of 3.6 times the non-cached environment.
- The "Time to First Byte" with 1500 WebLoad users went from 2.5 seconds with SSD cache disabled to 0.5 seconds with SSD cache enabled for a performance gain of 5 times the non-cached environment.
- Average response times with 1500 WebLoad users for pages to be served went from 42.2 seconds with SSD cache disabled to 4.1 seconds with SSD cache enabled for a performance gain of 10.3 times the non-cached environment .
- The response rate with SSD cache improved by 6 times the non-cached environment.
- Number of users increased by almost 2 times for the same response time.
- 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.