Technical Report

Using Flash Cache for Exchange 2010

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EXECUTIVE SUMMARY

This technical report describes the benefits of the Flash Cache (formerly PAM II) for a Microsoft® Exchange Server 2010 workload. In all cases Flash Cache will show improvement; however, the percentage of improvement will depend upon the particular configuration. In this configuration, a 256GB Flash Cache card in a FAS3140 controller doubled total achieved I/O per second (IOPS), increased Exchange 2010 mailboxes supported by 67%, and increased storage use by 67%. A capacity-bound configuration would not have an increase in user count, but it would show lower disk response times.

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1 INTRODUCTION

Microsoft Exchange 2010 includes several improvements to support larger mailboxes at lower cost. For example, a typical Exchange 2010 mailbox size is expected to be greater than 1GB, while generating ~0.10 input/output operations per second (IOPS). These decreased I/O operations, compared to Exchange Server 2007, present the option to use low-cost SATA disks[1].

NetApp® Flash Cache (formerly PAM II) reduces costs for storage, power, and rack space by optimizing the performance of random read-intensive workloads such as file services, messaging, virtual infrastructure, and OLTP databases[2].

The purpose of this technical report is to quantify the benefits of Flash Cache for Exchange 2010 by running Jetstress 2010 tests on a NetApp FAS3140 storage system with SATA disks.

2 TEST CONFIGURATION

The test bed was configured with two IBM x3650 servers (4 processors @ 2.66GHz, 18GB RAM) and a NetApp FAS3140 storage system. The servers and FAS3140 were connected using 4Gbps Fibre Channel links (2 per server) by way of a pair of Brocade switches.

Jetstress 2010 was used to simulate Exchange 2010 mailboxes and test the performance of storage subsystems. The software versions used by the two IBM servers are:

- Windows Server® 2008 Enterprise SP2
- Jetstress version: 14.01.0043.000
- ESE.dll version: 14.00.0639.019

2.1 SIMULATED EXCHANGE CONFIGURATION

Table 1 summarizes the simulated Exchange 2010 configurations for both Flash Cache enabled and disabled. The mailbox size, 2000MB, was kept the same whether Flash Cache was enabled or disabled. With Flash Cached enabled, more IOPS per mailbox can be supported, and a higher number of threads per database (6 instead of 5) was used to drive more load on the FAS3140. The number of simulated mailboxes was also higher when Flash Cache was enabled than when it was disabled. This parameter was mainly determined by trying to simulate as many mailboxes as possible, while maintaining the database read and write latencies below 20msec, as required by Microsoft. Section 3, "Results and Analysis," describes the details. In all tests, the background database maintenance was enabled 24x7, in keeping with the Microsoft recommendation.

Table 1) Summary of simulated Exchange 2010 configurations.

Parameters	Flash Cache Disabled	Flash Cache Enabled
Simulated mailbox size (MB)	2,000	2,000
Number of IOPS simulated per mailbox	0.12	0.15
Number of threads per database	5	6
Background database maintenance	24x7	24x7
Number of servers under test	2	2

2.2 FAS3140 CONFIGURATION

The FAS3140 storage system is simple to deploy and to manage. It ships with a wealth of integrated data protection and management software based on Data ONTAP® to help increase storage use and the efficiency[3]. For the tests described in this technical report, the FAS3140 was running Data ONTAP 7.3.2. Standard NetApp features such as Snapshot™, FlexVol® flexible volumes, and RAID-DP® were used.

RAID-DP is a high-performance implementation of RAID 6 that provides double parity across the disk subsystem and protects against the failure of up to two disks per RAID group. Calculations have shown that double-parity RAID offers over 160 times the protection against data loss than RAID 10 and almost 4,000 times the protection against data loss than RAID 5[4]. The test results described in this report were obtained with RAID-DP in action.

Table 2 summarizes the FAS3140 configuration common to tests with Flash Cache enabled and disabled. Section 5, "Appendix: FAS3140 Configuration," contains FAS3140 configuration details.

Table 1) Summary of FAS3140 configuration.

Parameters	FAS3140 Configuration
Data ONTAP version	7.3.2
Hard disk drive (HDD) type	SATA, 1TB, 7.2K RPM
Number of HDDs	64
RAID level	RAID-DP

The FAS3140 had one Flash Cache (256GB) module installed. Except for the following settings, the default Flash Cache settings were used:

- Without Flash Cache: `flexscale.enable off`
- With Flash Cache: `flexscale.enable on`

The Jetstress performance test was run first without Flash Cache to establish the baseline. Then, the same test was run again with Flash Cache enabled.


3 RESULTS AND ANALYSIS

This section describes the test results in terms of total achieved database IOPS, number of mailboxes supported, and storage capacity use. All of the test results described here satisfy Microsoft's latency requirement, that is, less than 20msec for both read and write average latencies[5].

3.1 TOTAL ACHIEVED DB IOPS

Figure 1 shows the total achieved database IOPS, including both transactional database reads and writes. The total achieved database IOPS is 929 with Flash Cache disabled and 1,964 with Flash Cache enabled. The total achieved database IOPS is 111% higher when Flash Cache was enabled. This improvement had two sources:

- Increased number of IOPS per mailbox was increased
- Increased number of supported mailboxes (see Section 3.2)

Figure 1) Total achieved database IOPS (higher is better).
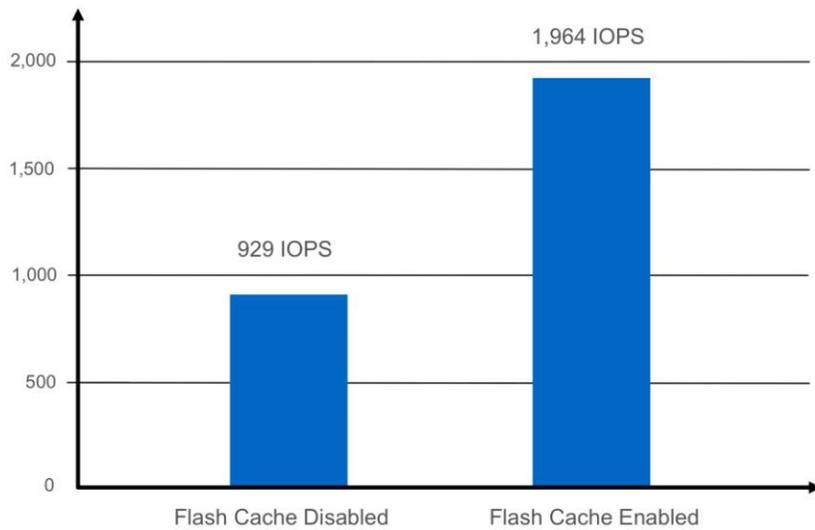
3.2   NUMBER OF MAILBOXES SUPPORTED

Figure 2 shows the number of mailboxes supported:

- 7,200 when Flash Cache was disabled
- 12,000 when Flash Cache was enabled

With the same number of hard disk drives, 67% more mailboxes were supported due to Flash Cache.

Figure 2) Number of mailboxes supported (higher is better).
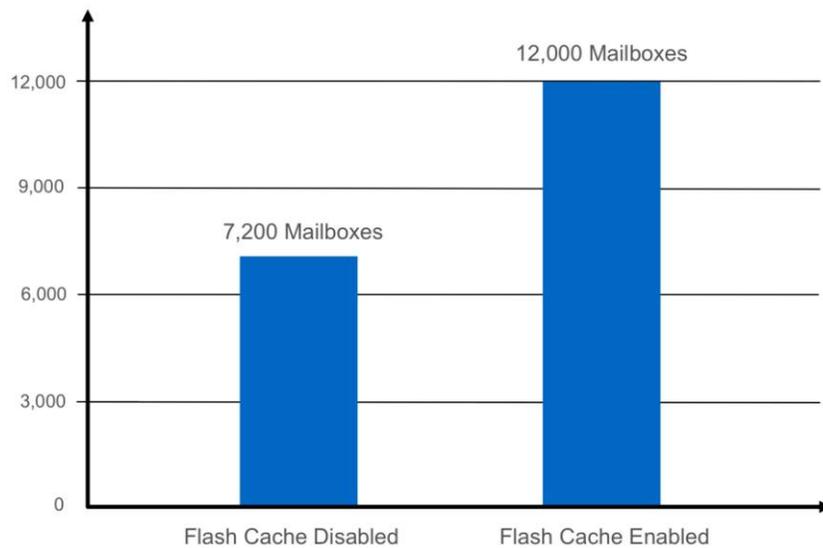
3.3   STORAGE USE COMPARISON

Storage capacity use, or storage use, measures the percentage of available storage capacity that contains user data. The same set of hard disk drives was used for both tests with Flash Cache disabled and enabled; therefore, a valid comparison can be drawn using the total database sizes in both tests, as shown in Figure 3.

Figure 3) Total database sizes (higher is better).
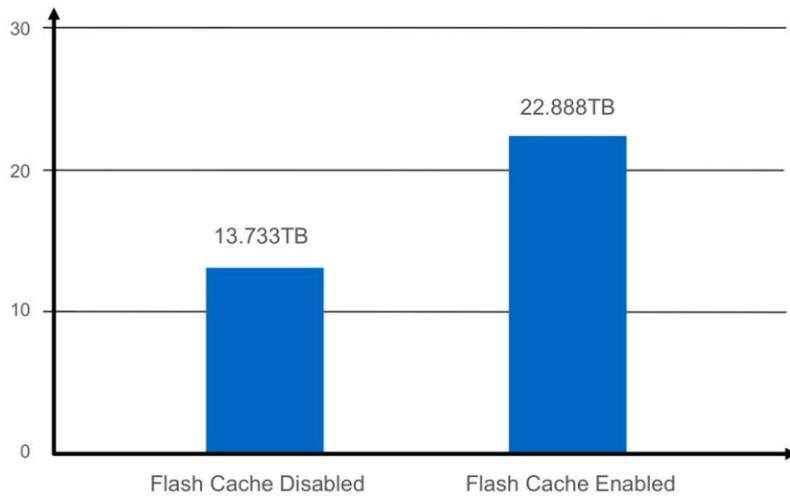
The total database sizes are:

- 13.733TB with Flash Cache disabled
- 22.888TB with Flash Cache enabled

The increase in total database size is due to the number of additional mailboxes supported with Flash Cache. Given the same raw disk capacity, this translated to 67% higher storage utilization when Flash Cache was enabled on this configuration.

4 CONCLUSIONS

The test results show that Flash Cache (formerly PAM II) can benefit Exchange 2010 significantly. In summary, without adding more hard disk drives, Flash Cache can:

- Increase the number of mailboxes supported when not in a capacity-bound configuration
- Increase storage use by increasing efficiency when performance bound
- Increase the number of achieved IOPS

The actual IOPS increase will depend on the ratio of Flash Cache to total database size.

This study demonstrates the benefits of Flash Cache to Exchange 2010 on a NetApp FAS3140 storage system. The detailed results might vary with different user profiles, database sizes, Flash Cache sizes, and storage system models. At the same time, the benefits of Flash Cache to Exchange 2010 will likely carry over to other Exchange 2010 configurations on other NetApp storage systems.

5 APPENDIX: FAS3140 CONFIGURATION

One FAS3140 controller and 64 1TB SATA drives were used for the tests described in this technical report. A Flash Cache (formerly PAM II) module with 256GB cache was installed in the FAS3140. Table 2 contains the FAS3140 configuration details for both Flash Cache enabled and disabled.

Table 2) FAS3140 configuration details.

Parameters	Flash Cache Disabled	Flash Cache Enabled
Data ONTAP version	7.3.2	7.3.2
Hard disk drive (HDD) type	SATA, 1TB, 7.2K RPM	SATA, 1TB, 7.2K RPM
Number of HDDs	64	64
RAID level	RAID-DP	RAID-DP
Number of disks per aggregate	16 (14+2)	16 (14+2)
Number of aggregates	4	4
Number of flexible volumes per aggregate	2 for Exchange databases 1 for Exchange logs	3 for Exchange databases 1 for Exchange logs
Number of LUNs per flexible volumes	1	1
LUN sizes	2.08TB per LUN for database 100GB per LUN for logs	2.08TB per LUN for database 100GB per LUN for logs
Number of databases per LUN	1	1
Total number of databases	8	12
Number of mailboxes per database	900	1,000

6 REFERENCES

[1]Exchange 2010 storage: *www.microsoft.com/exchange/2010/en/my/storage.aspx*

[2]Flash Cache: *www.netapp.com/us/products/storage-systems/flash-cache/*

[3]FAS3100 series: *www.netapp.com/us/products/storage-systems/fas3100/*

[4]TR-3574 "Using NetApp RAID-DP in Exchange Server 2007 Storage Designs":
http://media.netapp.com/documents/tr-3574.pdf

[5]Microsoft Exchange Server Jetstress 2010:
http://technet.microsoft.com/en-us/library/ff706601(EXCHG.141).aspx

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