

Intel® RAID: SSD Cache with FastPath* I/O

Significantly improve your storage performance with an Intel RAID Premium Feature Key and one or more SSD



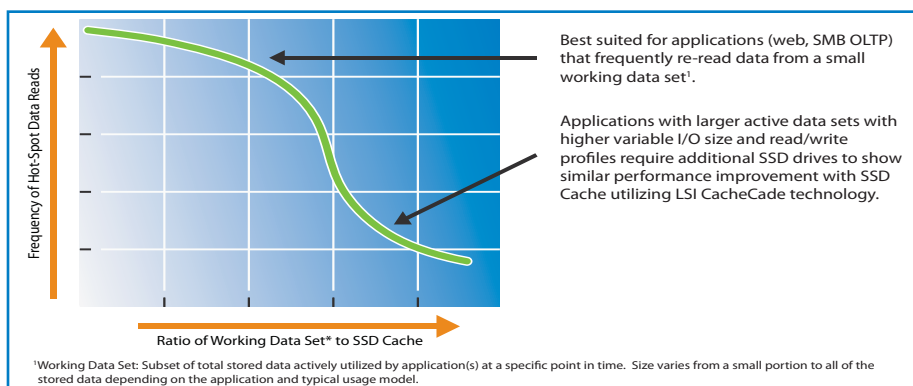
SSD Cache with Fastpath I/O, an Intel® RAID Premium Feature, allows users to take advantage of significant performance enhancements while generating a higher ROI for SSDs. This feature offers two distinct usage models for server systems with one or more Solid State Drives (SSD). The first usage model is to use SSDs as extended cache for an array of conventional hard drives. The second usage module is to utilize Fastpath* I/O which accelerates I/O performance of a complete SSD array through the enablement of algorithms optimized for flash-based storage.

Why SSDs?

SSDs are growing rapidly in popularity because they provide read performance and power advantages. Individual SSDs can reach up to 45,000 read IOPs compared to the fastest enterprise hard disk drives that can only reach up to 400 IOPs. Also, power consumption per IOP in SSDs is a fraction of that required for hard disk drives.

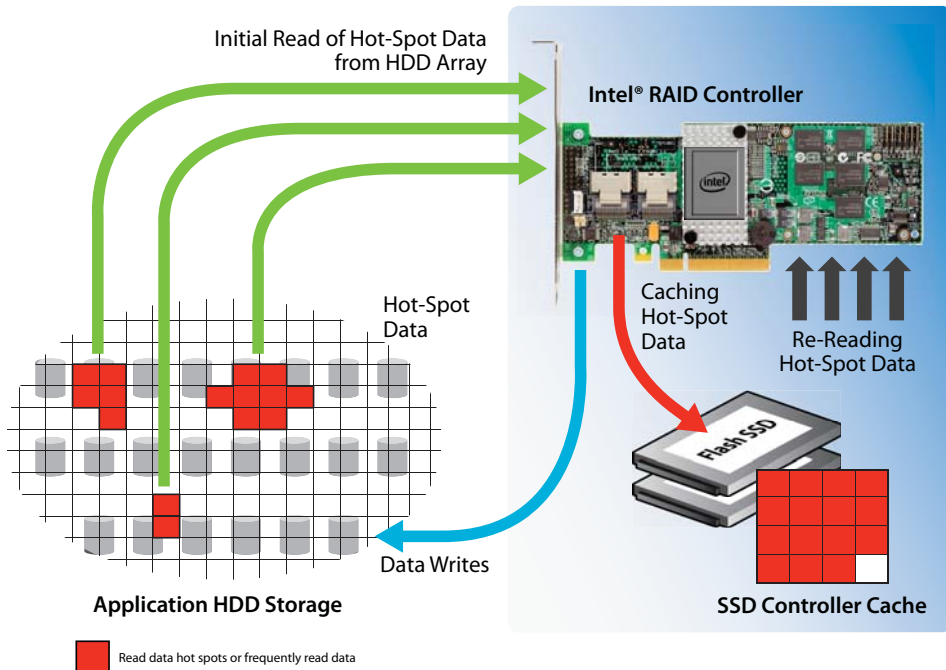
SSD Cache

Despite the drastic performance advantage, SSDs have price-per-GB and max capacity disadvantages when compared to hard disk drives. The SSD Cache Premium Feature Key allows for capitalizing on the performance advantages of SSDs as well as the cost and capacity advantages of traditional SATA and SAS drives. Through the integration of SSD Cache software, a SSD can be added to a conventional drive volume and assigned as a secondary tier of cache to assist the RAID card in maximizing random read performance.



By allowing frequently-read data (hot-spot) to be copied from a traditional hard drive to second tier SSD cache, information can be retrieved much faster when it is time for it to be re-read. This affords the possibility of dramatic performance improvements as high as 50 times for read-intensive applications such as web, file, SQL, and other transactional server applications.*

How SSD Cache Works

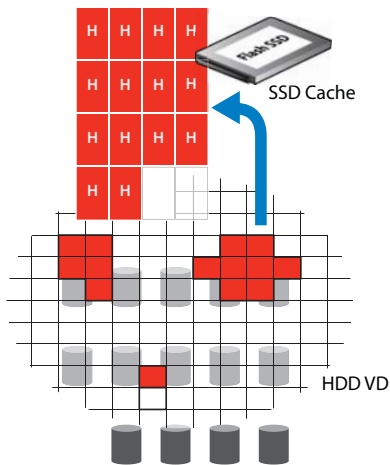


SSD Cache Software

- Frequently accessed data sets are copied from HDDs to lower latency Flash SSDs to improve system performance in subsequent read requests
- 50x Increase on Re-Reads of Hot-Spot Data

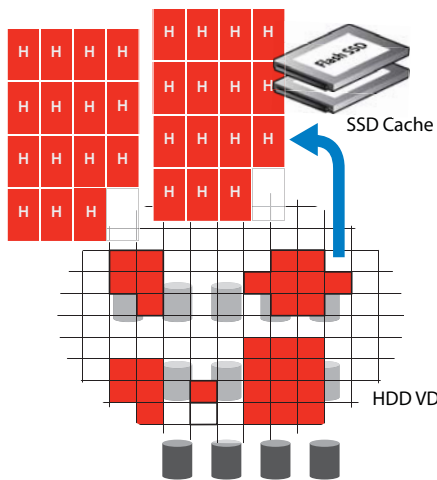
Single Cache SSD

- Best suited for small working data set apps (examples: Web Server or Blackberry email server type applications)
- Data is frequently re-read from a relatively small working data set
- Max SSD Cache performance boost achieved when working data set fits in SSD cache



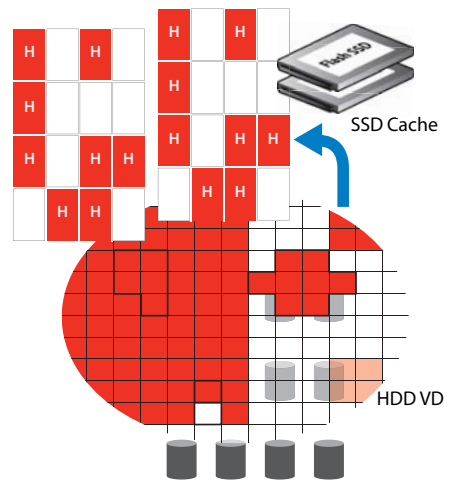
Multiple Cache SSDs

- Transactional database (OLTP, SQL) and some email applications have larger working data sets that require more SSD Cache to scale performance



Multiple Cache SSDs

- Applications with larger active data sets with much wider IO access ranges show less improvement with SSD Cache
- Cache hit rates are lower due to heavy percentage of write requests as compared to read requests



FastPath* I/O

FastPath* I/O increases standard transactional performance or application workloads by up to 200% as it operates as a high-performance IO accelerator for Solid State Drive (SSD) arrays connected to an Intel RAID controller. This advanced software can dramatically boost storage subsystem and overall application performance — particularly those that demonstrate high random read/write operation workloads — when deployed with a 6Gb/s Intel RAID controller connected to SSDs. Application workloads that will benefit most, from FastPath* I/O with SSD volumes, are those with small and random IO patterns requiring high transactional throughput, such as OLTP.

RAID 0 Random Workload Performance

With FastPath software enabled, SSD configurations tuned for small, random block-size IO activity — typical of transactional database applications — can sustain over 150,000 IO reads per second in RAID 0 configurations. This is two times the transactional performance of identical configurations when the FastPath software is disabled. This is particularly evident in 4K random reads and random writes; as well as 4K and 8K OLTP transaction-oriented benchmarks.

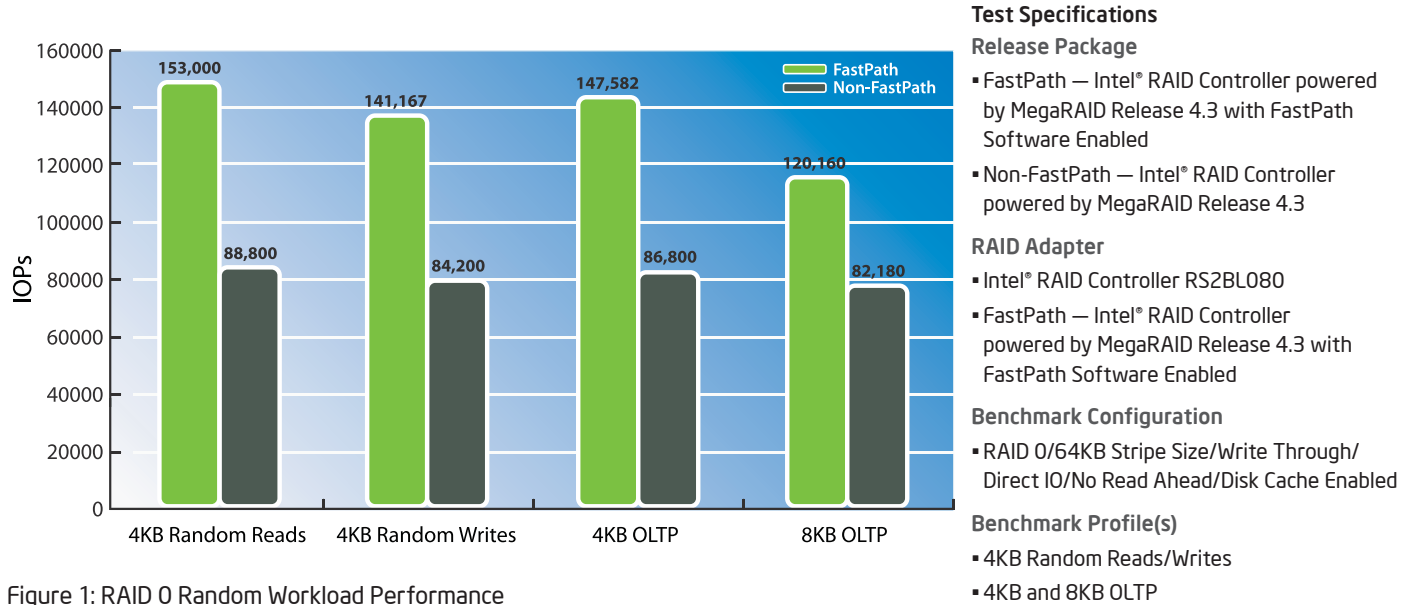


Figure 1: RAID 0 Random Workload Performance

In Figure 1, note that in the standard mode where FastPath software is not enabled, arrays are able to reach more than 80,000 IOPs. This is due to additional performance tuning optimizations over previous 6Gb/s Intel RAID controller generations. However, with the FastPath software enabled, users can experience more than 70% increase in IOPs throughput.

RAID 5 Random Workload Performance

In Figure 2, read performance in RAID 5 configurations demonstrate similar IOPs performance as RAID 0. When comparing RAID 5 write performance, FastPath software demonstrates 2.5 times the IOPs performance over an identical configuration with this feature disabled shown in Figure 3.

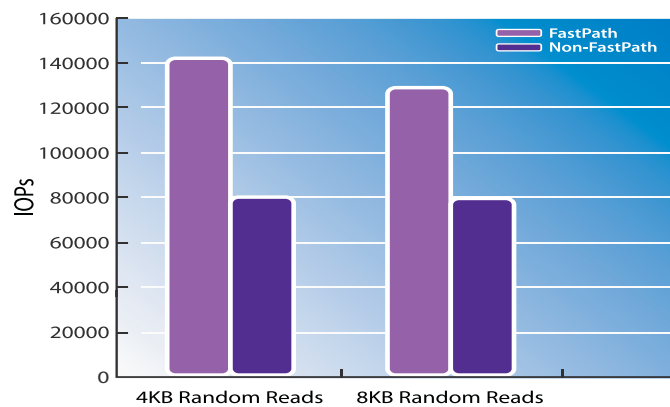


Figure 2: Read Performance in RAID 5 Configurations

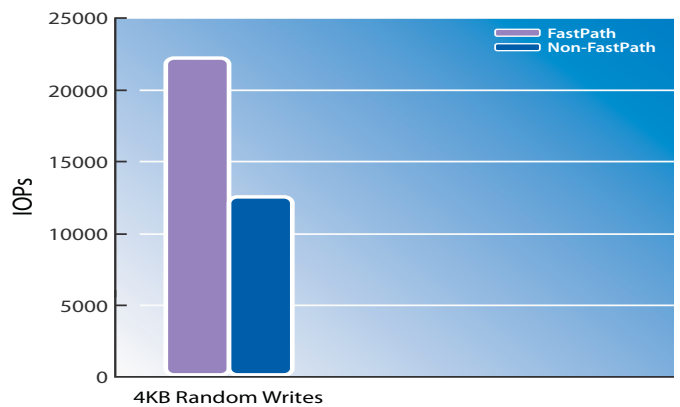


Figure 3: Write Performance in RAID 5 Configurations

Test Specifications

Release Package

- FastPath — Intel® RAID Controller powered by MegaRAID Release 4.3 with FastPath Software Enabled
- Non-FastPath — Intel® RAID Controller powered by MegaRAID Release 4.3

SSDs

- Eight Intel X25E SSD Drives

Benchmark Profile(s)

- 4KB Random Reads/Writes
- 8KB Random Reads/Writes

RAID 0 Real Workload Performance

FastPath software significantly boosts server application performance levels for real-world workloads as well. Intel controllers with FastPath software disabled are limited to 80,000 IOPs, while application performance improves by up to 45% with FastPath software enabled.

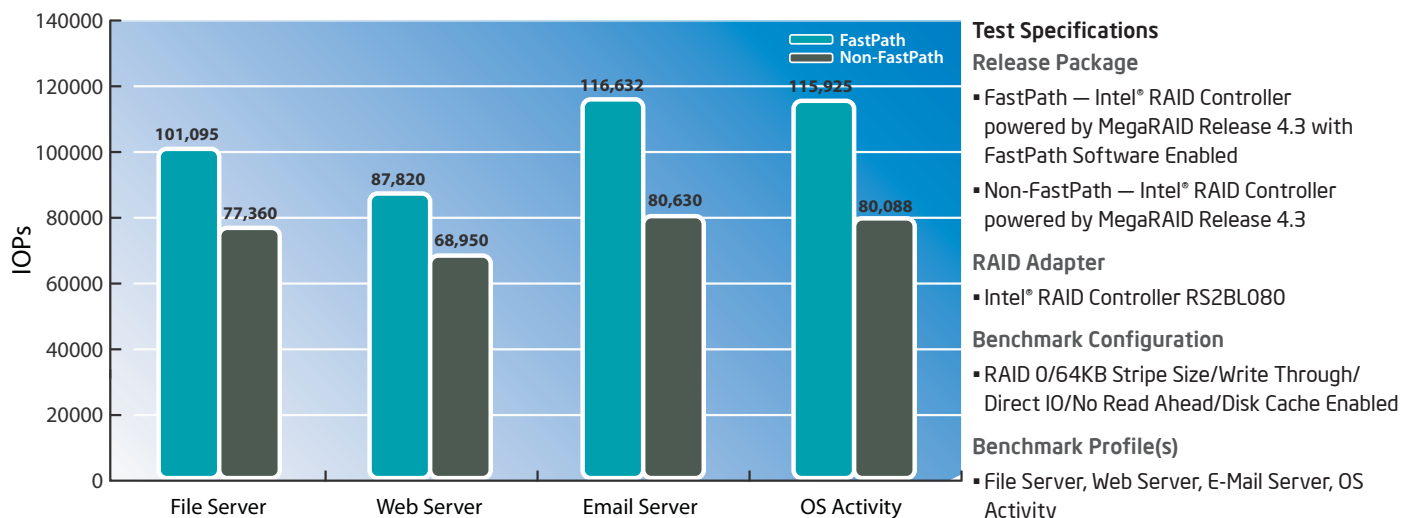


Figure 4: FastPath vs. Non-FastPath Real Work Performance

Ordering Information:

Physical Key Order Code	AXXRPFKSSD
Supported RAID Controllers and Modules	<ul style="list-style-type: none"> Intel RAID Controller RS2BL040 Intel RAID Controller RS2BL080 Intel RAID Controller RS2PI008 (August '10) Intel RAID Controller RS2MB044 Intel RAID Controller RS2WG160 (August '10) Intel RAID Controller RS2SG244 (August '10) Intel Integrated RAID Module RMS2MH080 (July '10)
Supported Operating Systems	All supported operating systems
Supported SSDs	Please visit support.intel.com resources for a complete list of tested SSDs.
Max. Number of SSD Disks in a CacheCade Cache Pool	32 SSDs
Max. Number of SSC VD Supported in a Controller	Up to 64 (The total number of HDD VDs plus SSD Cache VDs must not exceed 64 as this is the maximum number of VDs supported by the RAID Controller.)
Max. SSD Cache Capacity per Controller	512GB

For more information on the Intel® RAID Premium Features, visit www.intel.com/go/RAID

For more information on how to make the Intel® RAID products part of your server environment, please contact an Intel® Channel Partner Program participant.

*A 14GB volume on a two drive RAID 1 array was used to simulate web server re-read hot spot activity. Using IOMeter version 2006.07.27, an Intel RAID Controller RS2PI008 with configuration settings: No Read Ahead, Write Back Cache, 64KB Stripe Size and Direct IO, using firmware version 2.60.03-0778, reached 14,896 IOPs per second with CacheCade enabled, compared to 273 IOPs per second with CacheCade disabled. This represents an increase of approximately 50x.

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