WHITE PAPER: LACIE FASTKEY USB 3.0 SSD

Technical Brief

This white paper discusses the advantages of solid-state drives over traditional hard disk drives, focusing on LaCie's first implementation of this emerging technology, the FastKey USB 3.0.

To illustrate the benefits of SSD, benchmark tests comparing the FastKey with other LaCie products were conducted.

WHAT IS AN SSD?

SSD means Solid State Drive. An SSD has no moving parts and is essentially an HDD emulator based on flash memory. It is comprised of a printed circuit board, a set of NAND flash memory chips, SDRAM cache, a memory controller, an interface controller, and an interface connector such as IDE, SATA, SAS, USB, or even fiber channel.

In addition to the performance and energy advantages of SSD, the lack of moving parts means that the drives can withstand high vibration and shock. In fact, some SSDs can withstand shock up to 1500G, the equivalent of a drop from 26 feet.

Basic specifications of Solid State Drives are:

MTBF	1,000,000 hours
Data Integrity	10 years
Shock (operating)	1500G, 3 axes
Vibration (operating)	16G, each axis
Operating Temperature	0°C to 70°C

The LaCie FastKey is an SSD USB 3.0-connected device. The FastKey uses MLC NAND flash memory chips and two main chipsets:

- Indylinx barefoot: SSD controller
- Symwave 6316: USB 3.0 controller

MLC OR SLC, WHAT IS THE DIFFERENCE?

Single-level cell (SLC) and multi-level cell (MLC) Flash memory are similar in their design. MLC Flash devices usually cost less and allow for higher storage density. SLC Flash devices provide faster write performance and greater reliability, even at high industrial temperatures above the operating range of MLC Flash devices. Speed performances between SLC and MLC are comparable.

The endurance of SLC Flash is around five times that of MLC Flash. The endurance of MLC Flash decreases during the product's life. This is a main reason why SLC Flash is considered industrial-grade Flash and MLC Flash is considered consumer-grade Flash. MLC lifetime is limited to 1,000,000 "Programmed / Erased" cycles (10,000 cycles per cell).

HARD DRIVE DISK OR SOLID STATE DISK?

Advantages of SSD over HDD

- Faster start-up because no spin-up is required.
- Fast random access because there is no "seeking" motion as is required with rotating disk platters and the read/write head and head-actuator mechanism
- Low read latency times for RAM drives. In applications where hard disk seeks are the limiting factor, this results in faster boot and application launch times.
- Consistent read performance because physical location of data is irrelevant for SSDs.
- File fragmentation has negligible effect because data access degradation due to fragmentation is primarily due to much greater disk head seek activity, as data reads or writes are spread across many different locations on the disk; SSDs have no heads and thus no delays due to head motion (seeking).
- Silent operation due to the lack of moving parts.
- SSDs typically have lower power consumption than HDDs.
- High mechanical reliability, as the lack of moving parts almost eliminates the risk of mechanical failure.
- Ability to endure extreme shock, high altitude, vibration, and extremes of temperature.
- Immune to magnets.
- For low-capacity SSDs (like the LaCie FastKey), lower weight and size: although size and weight per unit storage are still better for traditional hard drives.
- Failures occur less frequently while writing/erasing data, which means there is a lower chance of irrecoverable data damage.
- SSDs are random access by nature and can perform parallel reads on multiple sections of the drive (as opposed to a HDD, which requires seek time for each fragment, assuming a single head assembly).
- Can also be configured to smaller form factors and reduced weight.

DISADVANTAGES OF SSD COMPARED TO HDD:

- Flash-memory drives have limited lifetimes and will often wear out after 1,000,000 P/E cycles (10,000 per cell) for MLC, and up to 5,000,000 P/E cycles (100,000 per cell) for SLC.
- SSDs using wear leveling cannot be defragmented in order to provide maximum sequential read speed. Optimizations do not work efficiently if files are fragmented (access time of flash-based SSDs is about 0.1 ms).
- Wear leveling used by most SSDs intrinsically induces fragmentation. Moreover, defragmenting a SSD by a defragmenter is harmful since it adds wear to the SSD for no benefit.
- As of 4Q 2010, SSDs are still much more expensive per gigabyte than hard drives. Whereas hard drives are around US$0.10 per gigabyte for 3.5", or US$0.20 for 2.5", a typical flash drive is closer to US$3 per gigabyte in 2010
- The maximum capacity of SSDs is currently lower than that of hard drives.
- SSD write performance is significantly impacted by the availability of free, programmable blocks. Previously written data blocks that are no longer in use can be reclaimed by TRIM; however, even with TRIM, fewer free, programmable blocks translate into reduced performance.
- As a result of wear leveling and write combining, the performance of SSDs degrades with use. However, most modern SSDs now support the TRIM command and thus return the SSD back to its factory performance when using OSes that support it like Windows 7, Windows Server, 2008 and Linux.

WHAT IS USB 3.0?

The Universal Serial Bus (USB) 3.0 specification is a new industry-standard peripheral connection technology, developed by USB Implementors forum, for connecting peripherals to PCs and laptops.

The USB 3.0 specification draws from the same architecture of the wired USB specification and therefore is a backward-compatible standard with the same ease-of-use and plug-and-play capabilities of previous USB technologies, but with a 10 times performance increase and lower power consumption. The USB 3.0 specification uses two additional high-speed differential pairs for SuperSpeed mode, which boosts its bandwidth to 5 GB/s.

For end-users of the USB 3.0 specification, the goals of connecting peripherals with PCs or laptops are still the same as the Hi-Speed (USB 2.0) specification, but with significantly increased speed and reduced power consumption.

The SuperSpeed USB specification, therefore, is not simply an upgrade to earlier versions of the USB 2.0 specification. Due to the broad deployment of USB 2.0 devices in the market, SuperSpeed USB devices need to be backward-compatible, but the backward-compatibility portion of the SuperSpeed USB specification targets only the device drivers and connector architecture. The higher speed and reduced power consumption for the USB 3.0 specification uses advanced mechanisms and techniques similar to ones that were used for other high bandwidth interfaces, such as the PCI Express (PCIe) specification. As a result, the SuperSpeed USB specification has many differences compared to earlier generations of USB specifications (1.1/2.0/OTG).

DIFFERENCES BETWEEN SUPERSPEED USB 3.0 AND HI-SPEED USB 2.0

The SuperSpeed USB specification is similar to earlier USB versions in terms of the connector and device drivers. The end-user and device driver engineer may find SuperSpeed USB similar to earlier versions, but it is significantly different to implementors of SuperSpeed USB host and devices.

At a mechanical level, the SuperSpeed USB specification supports dual-bus architecture for backward compatibility to a USB 2.0 device.

This means that the SuperSpeed USB cable needs to support eight primary wires, two wires for USB 2.0 connectors, two shared between the USB 2.0 and SuperSpeed USB specifications (PWR and GND), and four for SuperSpeed USB dual-simplex differential signals.

Many changes were required in the existing USB 2.0 data flow to maximize the advantages of the SuperSpeed USB bi-directional dual-simplex data interface. Though the SuperSpeed USB specification is still a host-directed protocol and preserves the concepts of endpoints, pipes transfer types, etc., the traffic flow has changed to asynchronous as opposed to polling traffic flow in previous USB specifications. In addition, there are many fundamental differences at the Protocol level as shown in the inset table.

SuperSpeed USB 3.0 also manages power consumption more efficiently, which results in some differences at the Protocol level:

1. SuperSpeed supports link-level power management, which means either a host or a device can initiate link power management. In USB 2.0, it is always initiated by the host.
2. SuperSpeed USB allows isochronous devices to enter in the low power link states between service intervals. This mechanism is not supported in USB 2.0.
3. SuperSpeed USB allows devices to inform the host of their latency tolerance using the Latency Tolerance Messaging mechanism.

This allows the host to enter in low power states for better power performance.

SuperSpeed USB 3.0	Hi-Speed USB 2.0
Dual-simplex, unicast protocol	Half-duplex, broadcast protocol
Uses asynchronous notification (NRDY, ERDY)	Uses polling mechanism
Supports streaming for bulk transfers	Does not support streaming
Supports continuous bursting	Does not support bursting
For OUT, token is integrated into data	OUT is three separate parts (Token, Data, and Handshake)
For IN, token is replaced by Handshake	IN is three separate parts (Token, Data, and Handshake)
Split error protection, recovery, and flow control functionality between protocol layer and link layer	Protocol layer manages error detection, recovery, and flow control functionality

The SuperSpeed USB specification supports a dual-simplex data interface with four differential wires for simultaneous data flow in both directions. It should be noted that adding a bi-directional data interface was necessary to support the SuperSpeed USB specification's target speed because the halfduplex, two wire differential signals of USB 2.0 and unidirectional data flow were not enough to support the SuperSpeed USB specification's high bandwidth.

THE WEAR LEVELING FUNCTION FOR SSD

MLC lifetime is limited to 1,000,000 "Programmed / Erased" cycles. LaCie Fastkey uses special static wear levelling in order to mitigate this problem by spreading writes over the entire device (and not always on the same memory blocks).

Static wear levelling uses a map to link the Logical Block Addresses (LBAs) from the Operating System to physical memory addresses. Each time the OS writes replacement data, the map is updated so the original physical block is marked as invalid data, and a new block is linked to that map entry. Each time a block of data is re-written to the Flash memory it is written to a new location. This "rotational" effect enables the SSD to operate until most of the blocks are near their end of life.

512KB blocks. This is important because this is the smallest structure that can be erased. You can read and write at a page level, but you can only erase an entire 512KB block. This means that you can read 4KB at a time and write 4KB at a time to an empty space, but you can't overwrite a page. You must first erase the content.

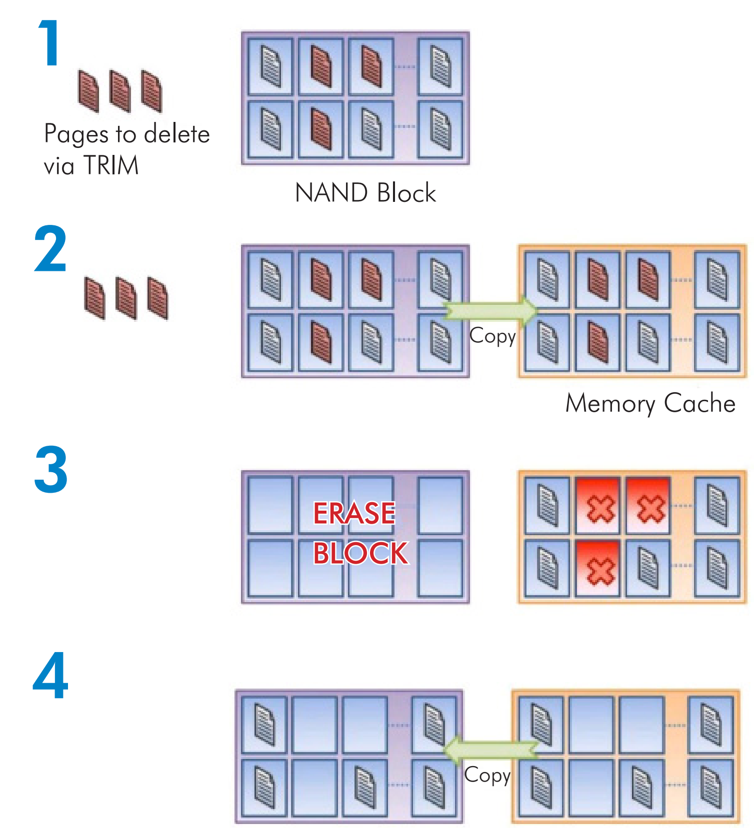
Windows 7 and Windows Server 2008 R2 support the TRIM function, which they use when they detect that a file is being deleted from an SSD. When the OS deletes a file on an SSD, it updates the file system but also tells the SSD via the TRIM command which pages should be deleted. At the time of the delete, the SSD can read the block into memory, erase the block, and write back only pages with data in them, as illustrated below. The delete is slower, but you get better performance for future writes because the pages are already empty, and write performance is generally considered the most important factor.

TRIM FUNCTION FOR SSD (TO RESIST WRITE PERFORMANCE DECLINE)

TRIM is a useful command for Linux 2.6.33, Windows 7, and Windows Server 2008. The LaCie FastKey supports TRIM which improves performance when you delete files to prepare the space for future writing. If you overwrite an existing file, TRIM doesn't help and you'll get the same write performance as without TRIM.

SSDs behave very differently from traditional mechanical, platter-based hard disks. SSDs are made up of cells. These cells are organized into pages, the smallest readable/writable unit in most SSDs, and are normally 4KB.

These pages are then organized into blocks, traditionally 128 pages per block, for a block size of



PERFORMANCE

Definitions of Performance Measurements

There are many different ways to measure the performance of a storage device. Key parameters used in this paper are defined here for reference.

Access Time - The time a program or device takes to locate a single piece of information and make it available to the computer for processing. Access time is typically measured in milliseconds (ms).

Sequential Transfer Rate - The amount of data that the device can read or write to adjacent sectors of the storage media in one second. Sequential transfer rate is typically measured in megabytes per second (MB/s).

Random Transfer Rate - The amount of data that the device can read or write to non-adjacent sectors of the storage media in one second. Random transfer rate is typically measured in megabytes per second (MB/s).

Access Time: FastKey (SSD) versus d2 USB 3.0, Minimus USB 3.0 and 2Big USB 3.0 (HDDs)

An HDD contains one or more platters of magnetic media and a read/write head that moves on an actuator from inside to outside diameters on the platter surface. To locate and read a particular piece of data, the heads must find and move to the correct location and then wait for the spinning platter to present the physical data. This typically takes 10 ms or more. Some faster HDD models are capable of 7 or 8 ms access time.

Due to its solid state components and the ability to address any sector of the NAND memory directly (instead of seeking it), an SSD can access the data in about 0.1 ms or about 100 times faster than an HDD. When this is done tens of thousand or hundreds of thousand of times to complete an operation such as boot up, the user easily recognizes a significant delay in minutes caused by the HDD. The table below shows an access time comparison between LaCie FastKey and a variety of LaCie USB 3.0 HDDs (shorter bar is faster).

		Access Time (ms)	HDD
HDD	Minimus	15.2	Seagate ST32000542AS 2TB
	d2	13.8	Hitachi HDS 721010CLA 332 1TB
	2big	13.3	HITACHI HDS 721010CLA 332 1TB
	Rikiki	18.8	Toshiba MK1059GSM 1TB 5400RPM
SSD	iamaKey	0.5	N/A
	FastKey	0.1	N/A

(Axis: 0 5 10 15 20)

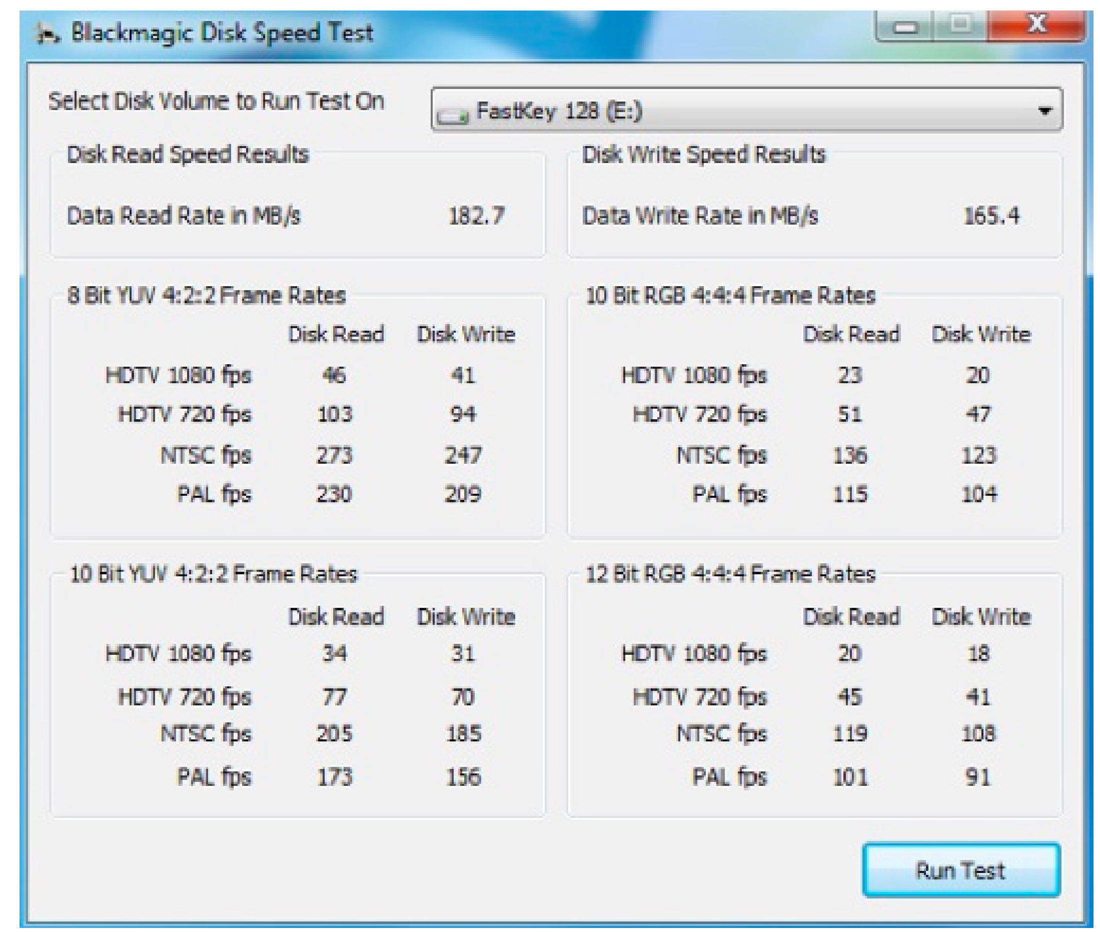
Transfer Rates: FastKey (SSD) vs. d2 USB 3.0, Minimus USB 3.0, 2Big USB 3.0, Rikiki USB 3.0 (HDDs)

Sequential Speed: Sequential speed is required to open, save a new or modified file to non-volatile storage such as an HDD or SSD. Any data file such as a document, spreadsheet, presentation, picture, or any other data file the user creates will take a finite amount of time to save. The screenshots below show a comparison of the write and read sequential transfer rates of FastKey (with and without specific Symstor driver) and HDD devices.

Symstor Driver / Turbo USB Drivers: LaCie FastKey features a specific USB 3.0 driver developed by Symwave. This driver allows better performances on Windows-based computers. This driver can only increase performance of LaCie FastKey and LaCie 2Big USB 3.0. More information here: http://www.lacie.com/us/support/drivers/driver.htm?id=10211

USB 3.0 Drivers for Mac: LaCie has recently released an exclusive driver for Mac OS 10.6. This driver allows compatibility between LaCie's USB 3.0 products and Apple computers and at USB 3.0 speed. You must use LaCie USB 3.0 Cards and LaCie devices in order to benefit from these features. More information here: www.lacie.com/usb3mac

Tests and Comparison with Blackmagic Disk Speed



LaCie FastKey 120GB – Without Symstor Driver

Select Disk Volume to Run Test On: FastKey 128 (E:)

Disk Read Speed Results — Data Read Rate in MB/s: 230.6

Disk Write Speed Results — Data Write Rate in MB/s: 201.8

8 Bit YUV 4:2:2 Frame Rates

	Disk Read	Disk Write
HDTV 1080 fps	58	51
HDTV 720 fps	131	114
NTSC fps	345	302
PAL fps	291	255

10 Bit RGB 4:4:4 Frame Rates

	Disk Read	Disk Write
HDTV 1080 fps	29	25
HDTV 720 fps	65	57
NTSC fps	172	151
PAL fps	145	127

10 Bit YUV 4:2:2 Frame Rates

	Disk Read	Disk Write
HDTV 1080 fps	43	38
HDTV 720 fps	98	86
NTSC fps	259	226
PAL fps	218	191

12 Bit RGB 4:4:4 Frame Rates

	Disk Read	Disk Write
HDTV 1080 fps	25	22
HDTV 720 fps	57	50
NTSC fps	151	132
PAL fps	127	111

LaCie FastKey 120GB – With Symstor Driver

Select Disk Volume to Run Test On: New Volume (G:)

Disk Read Speed Results — Data Read Rate in MB/s: 95.4

Disk Write Speed Results — Data Write Rate in MB/s: 124.2

8 Bit YUV 4:2:2 Frame Rates

	Disk Read	Disk Write
HDTV 1080 fps	24	31
HDTV 720 fps	54	70
NTSC fps	142	186
PAL fps	120	156

10 Bit RGB 4:4:4 Frame Rates

	Disk Read	Disk Write
HDTV 1080 fps	12	15
HDTV 720 fps	27	35
NTSC fps	71	93
PAL fps	60	78

10 Bit YUV 4:2:2 Frame Rates

	Disk Read	Disk Write
HDTV 1080 fps	18	23
HDTV 720 fps	40	52
NTSC fps	107	139
PAL fps	90	117

12 Bit RGB 4:4:4 Frame Rates

	Disk Read	Disk Write
HDTV 1080 fps	10	13
HDTV 720 fps	23	30
NTSC fps	62	81
PAL fps	52	68

d2 USB 3.0 with Hitachi HDS 721010CLA 332 1TB

Select Disk Volume to Run Test On: 2BigUSB3-1 (E:)

Disk Read Speed Results — Data Read Rate in MB/s: 239.7

Disk Write Speed Results — Data Write Rate in MB/s: 200.4

8 Bit YUV 4:2:2 Frame Rates

	Disk Read	Disk Write
HDTV 1080 fps	60	50
HDTV 720 fps	136	114
NTSC fps	359	300
PAL fps	303	253

10 Bit RGB 4:4:4 Frame Rates

	Disk Read	Disk Write
HDTV 1080 fps	30	25
HDTV 720 fps	68	57
NTSC fps	179	150
PAL fps	151	126

10 Bit YUV 4:2:2 Frame Rates

	Disk Read	Disk Write
HDTV 1080 fps	45	38
HDTV 720 fps	102	85
NTSC fps	269	225
PAL fps	227	190

12 Bit RGB 4:4:4 Frame Rates

	Disk Read	Disk Write
HDTV 1080 fps	26	22
HDTV 720 fps	59	49
NTSC fps	157	131
PAL fps	132	110

2 Big USB 3.0 with 2x Hitachi HDS 721010CLA 332 1TB (with Symstor Driver + RAID 0 mode)

Select Disk Volume to Run Test On: New Volume (E:)

Disk Read Speed Results — Data Read Rate in MB/s: 115.1

Disk Write Speed Results — Data Write Rate in MB/s: 113.6

8 Bit YUV 4:2:2 Frame Rates

	Disk Read	Disk Write
HDTV 1080 fps	29	28
HDTV 720 fps	65	64
NTSC fps	172	170
PAL fps	145	143

10 Bit RGB 4:4:4 Frame Rates

	Disk Read	Disk Write
HDTV 1080 fps	14	14
HDTV 720 fps	32	32
NTSC fps	86	85
PAL fps	72	71

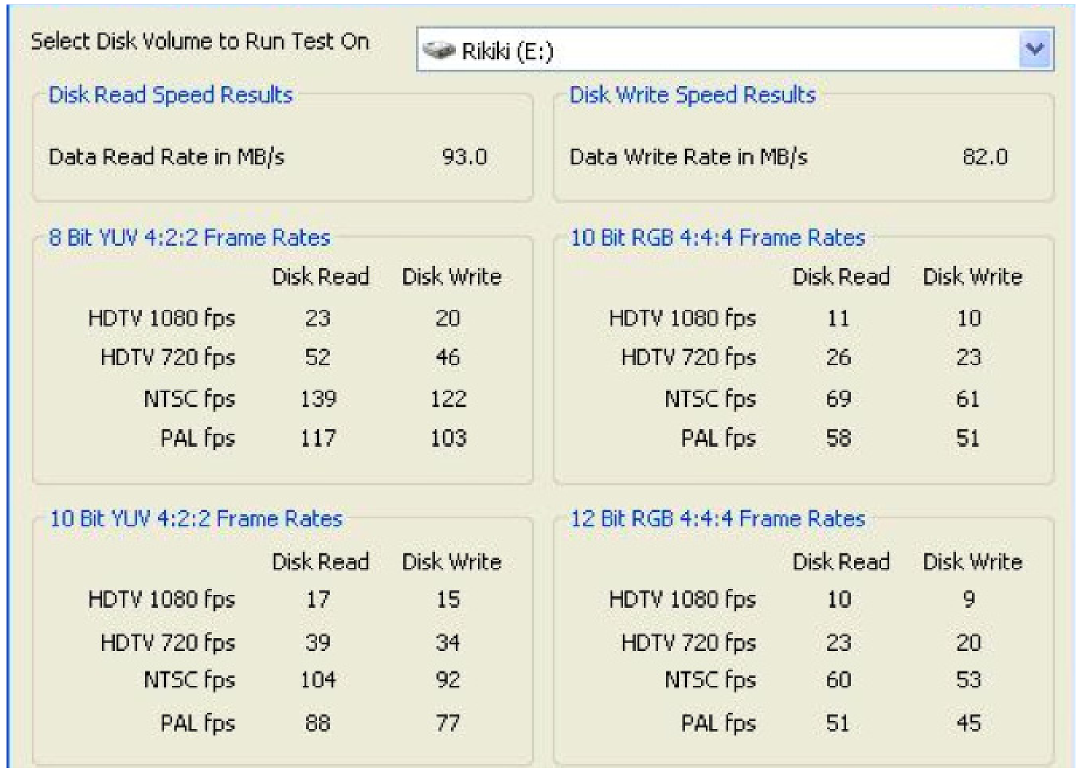
10 Bit YUV 4:2:2 Frame Rates

	Disk Read	Disk Write
HDTV 1080 fps	21	21
HDTV 720 fps	49	48
NTSC fps	129	127
PAL fps	109	107

12 Bit RGB 4:4:4 Frame Rates

	Disk Read	Disk Write
HDTV 1080 fps	12	12
HDTV 720 fps	28	28
NTSC fps	75	74
PAL fps	63	62

Minimus USB 3.0 with Seagate ST32000542AS 2TB



Select Disk Volume to Run Test On: Rikiki (E:)

Disk Read Speed Results — Data Read Rate in MB/s: 93.0

Disk Write Speed Results — Data Write Rate in MB/s: 82.0

8 Bit YUV 4:2:2 Frame Rates

	Disk Read	Disk Write
HDTV 1080 fps	23	20
HDTV 720 fps	52	46
NTSC fps	139	122
PAL fps	117	103

10 Bit RGB 4:4:4 Frame Rates

	Disk Read	Disk Write
HDTV 1080 fps	11	10
HDTV 720 fps	26	23
NTSC fps	69	61
PAL fps	58	51

10 Bit YUV 4:2:2 Frame Rates

	Disk Read	Disk Write
HDTV 1080 fps	17	15
HDTV 720 fps	39	34
NTSC fps	104	92
PAL fps	88	77

12 Bit RGB 4:4:4 Frame Rates

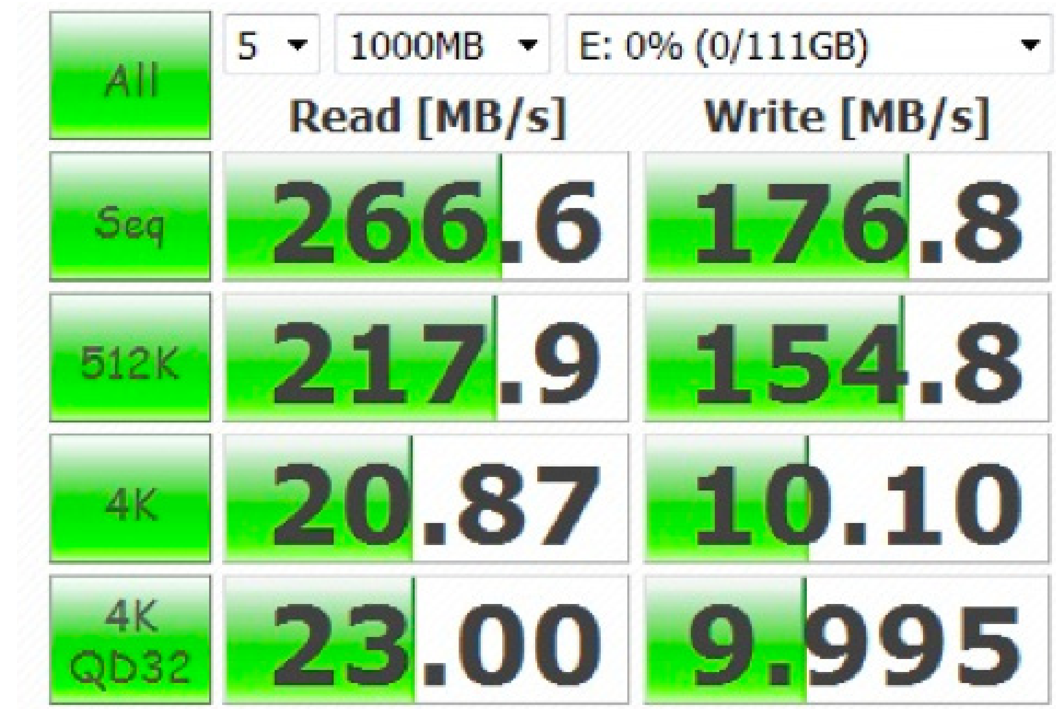
	Disk Read	Disk Write
HDTV 1080 fps	10	9
HDTV 720 fps	23	20
NTSC fps	60	53
PAL fps	51	45

Rikiki USB 3.0 with 15mm Toshiba MK1059GSM 1TB 5400RPM

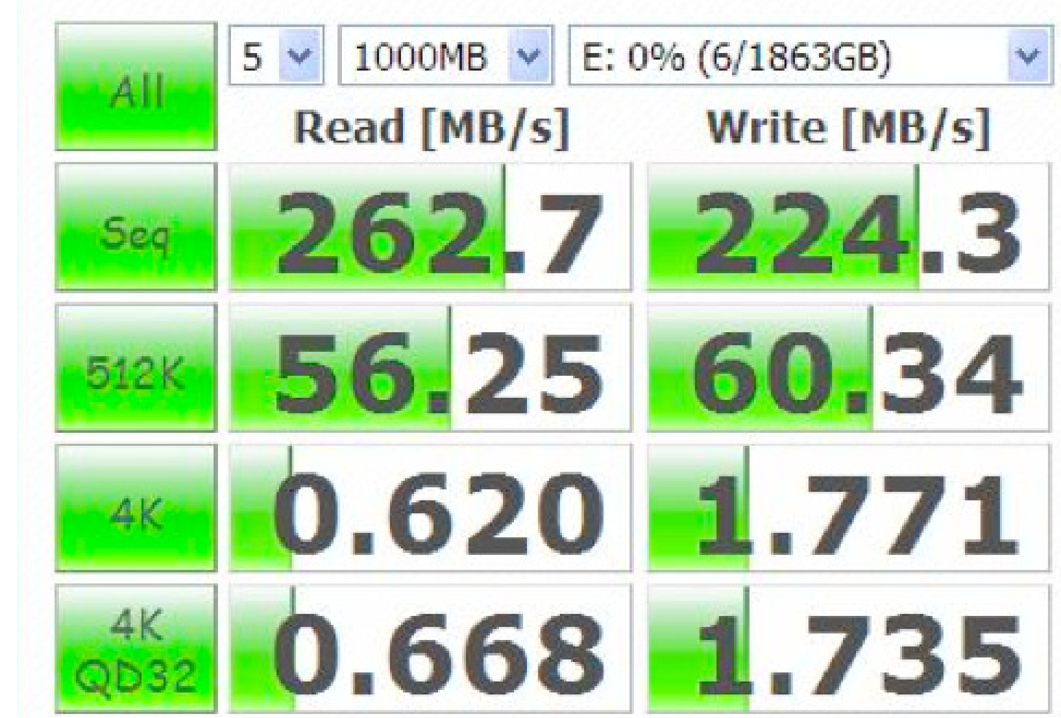
Benchmark Conclusion

LaCie FastKey is **at minimum two times faster** than d2, Minimus, or Rikiki USB 3.0 HDDs. When compared with the LaCie 2Big, thanks to increased speeds due to RAID configuration, the comparison is slightly more complicated. However, speed results are similar.

More Transfer Speed Benchmarks: LaCie FastKey vs 2Big USB 3.0: Tests with CrystalMark 3.0



LaCie FastKey 120GB – With Symstor Driver



2 Big USB 3.0 with 2x Hitachi HDS 721010CLA 332 1TB (with Symstor Driver + RAID 0 mode)

ADVANTAGES OF DRAM CACHE BUFFER FOR SMALL FILES

The LaCie FastKey SSD includes DRAM Cache (64MB). This Dynamic Random Access Memory (DRAM) buffer boosts LaCie's FastKey performance and significantly increases the random and sequential read and write transfer rates for small files. The DRAM acts as a buffer, increasing reliability and lessening the possibility for "bottlenecks" within data transfers. It can also offer major improvements to write performance because it coalesces many smaller files or updates into fewer block writes. Normal memory sticks or hard drives are dramatically slower than the LaCie FastKey.

Benchmark Conclusion

- FastKey is up to 1.5 times faster (in Write mode) than the 2Big USB 3.0 with 512K files.
- FastKey is up to 4.7 times faster (in Write mode) than the 2Big USB 3.0 with small (4K) files.

Model	Capacity	File Size	Performances			
			Read MB/s)	Write (MB/s)	Speed Difference	
FastKey	120GB	Seq	266.60	176.80	1.48%	-21.18%
		512Kb	217.90	154.80	287.38%	156.55%
		4Kb	20.87	10.10	3266.13%	470.30%
		4Kb QD32	23.00	9.99	3343.11%	475.79%
2Big USB 3.0	2TB	Seq	262.70	224.30		
		512Kb	56.25	60.34		
		4Kb	0.62	1.77		
		4Kb QD32	0.67	1.74		

LaCie FastKey vs Typical USB 2.0 Key (Flash vs Flash)

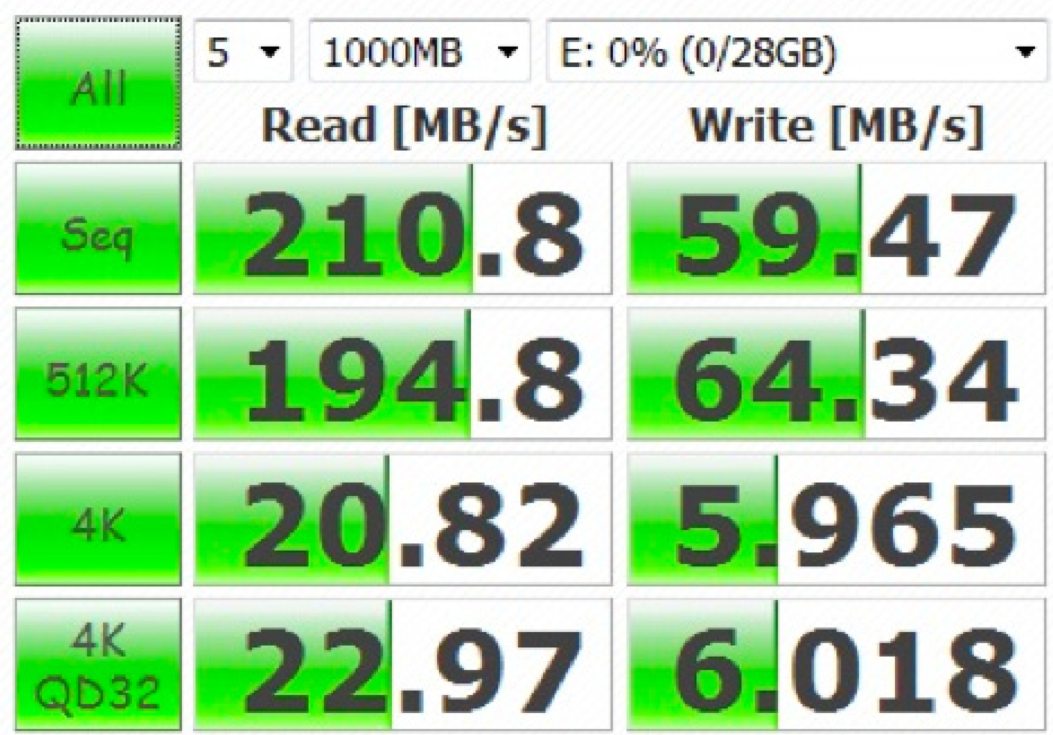
Model	Capacity	File Size	Performances			
			Read MB/s)	Write (MB/s)	Speed Difference	
FastKey	120GB	Seq	266.60	176.80	855.03%	1969.69%
		512Kb	217.90	154.80	700.64%	11665.41%
		4Kb	20.87	10.10	399.57%	91818.18%
		4Kb QD32	23.00	9.99	3343.11%	90818.18%
Typical USB 2.0 Key	16GB	Seq	31.18	8.976		
		512Kb	31.10	1.327		
		4Kb	5.223	0.011		
		4Kb QD32	7.050	7.050		

Benchmark Conclusion

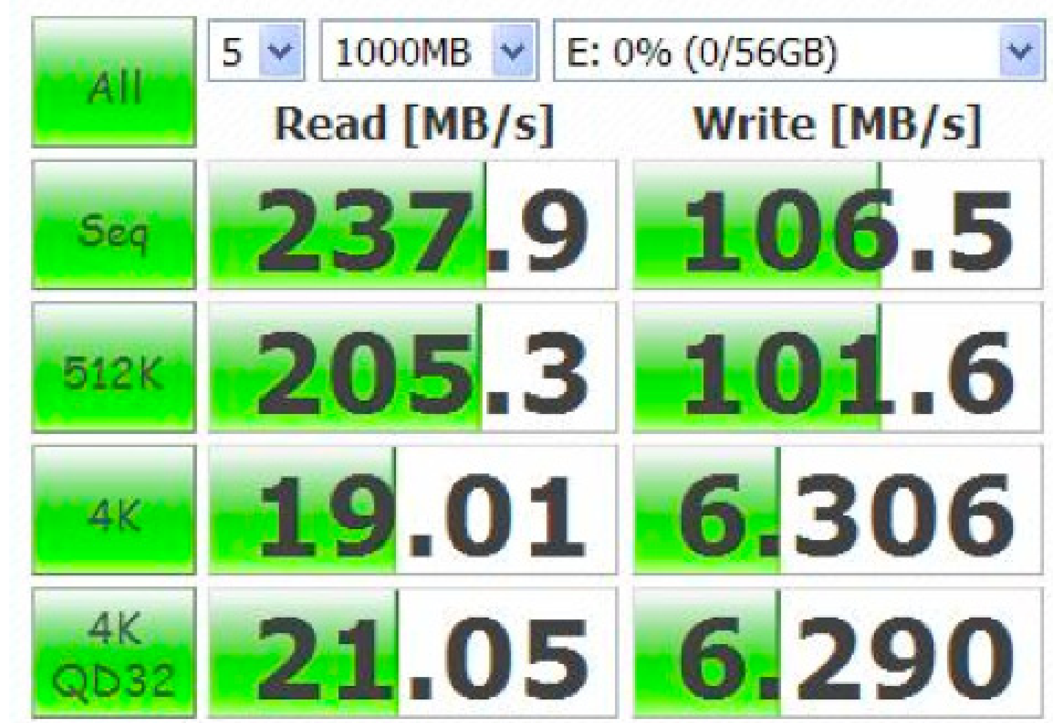
- FastKey is up to 117 times faster than a typical 16GB key with 512K files.
- FastKey is up to 919 times faster than a typical 16GB Key with small (4K) files, up to 300 times quicker than a USB 3.0 HDD.

LaCie FastKey: Three Capacities, Three Levels of Performance

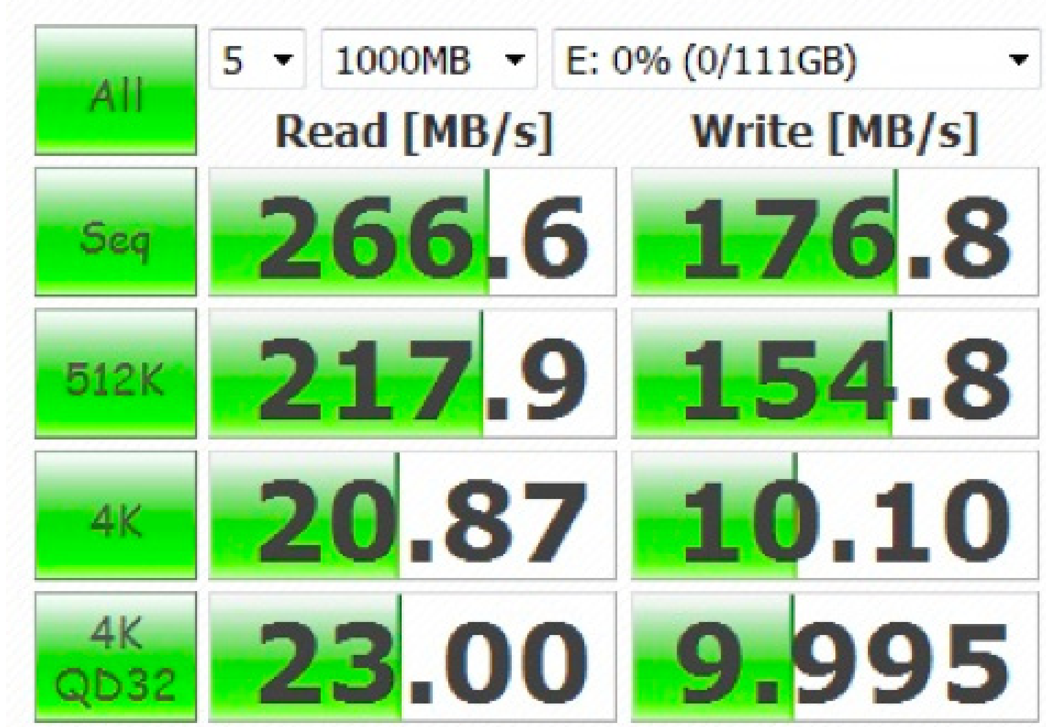
Due to its internal architecture and number of flash modules, performance between FastKey 30GB, 60GB, or 120GB is slightly different. This is expected due to differences in the number of dies and the interleave process.



LaCie FastKey 30GB



LaCie FastKey 60GB



LaCie FastKey 120GB

POWER CONSUMPTION

The LaCie FastKey requires much less power than a typical HDD. Lower power requirements also mean less heat generated, which indirectly impacts electricity usage by reducing the energy needed for cooling.

The following table compares the power usage of the FastKey and a high-performance HDD, the LaCie d2 USB 3.0 with Hitachi HDS 721010CLA 332 1TB drive:

	d2 (HDD)	FastKey
Idle Approx.	15% of the HDS 721010CLA 332	
Peak Operation	Approx. 30% of the HDS 721010CLA 332	
Power draw	130 kWh/year @ 15 watts	22 kWh/year @ 2.5 watts
Cost/year*	€19.50	€ 3.30

* Assuming €0.15 / kWh)

HEAT DISSIPATION

Most SSD products featuring USB 3.0 interface suffer from thermal problems. This issue is due to the large number of components constrained within a small casing and due to the very high speed information transfer into the SSD's flash cells. To prevent this problem, the LaCie FastKey's casing is made from a single piece of solid aluminium for optimal heat dissipation, and features low heat-emission components.

MAXIMIZING PERFORMANCE WITH LACIE FASTKEY USB 3.0

Overall performance is always limited by the slowest component in the system. As a result, make sure that your computer and your USB 3.0 motherboard or USB 3.0 card is correctly installed and configured.

Some tips:

- Make sure that you have correctly configured the motherboard's BIOS and don't allow, for example, performance sharing between USB 3.0 and SATA II ports.
- Please make sure that your motherboard supports PCI Express "revision 2" cards.
- Please note that you never can achieve USB 3.0's maximum performance if you are using a USB 3.0 ExpressCard34. ExpressCard slots are not fast enough (due to limited bandwidth) to support the full USB 3.0 speed.

NOTES ON BENCHMARKS

All our tests and benchmarks have been performed with the following configuration:

Motherboard	ASUS P5Q3
Processor	Intel Quad Core Q8200 2.34GHz
RAM	4GB DDR3
OS	Windows 7 32bits
Benchmark tools	Crystal Disk Mark 3.0 Blackmagic disk Speed

ABOUT LACIE

Through a combination of cutting-edge engineering and a rich history of unique design aesthetics, LaCie has earned an excellent reputation for producing products that are the perfect synthesis of form and function. Our hard disks and SSDs, network and RAID solutions, optical drives, displays, and accessories are created to enhance and expand your computing environment, no matter its platform or configuration.

Featuring the exclusive styles of world-renowned designers such as Neil Poulton, Philippe Starck, Karim Rashid and Sam Hecht, LaCie's award-winning products look stunning and perform with unparalleled reliability and versatility. LaCie is a global leader in manufacturing top-of-the-line tools that are often first-to-market, constantly raising the bar and re-establishing industry standards.

Please visit our website: www.lacie.com, for up-to-date product specifications—available in multiple languages for worldwide accessibility. Use it to purchase items online, contact our excellent technical support or locate the sales office or reseller nearest you.

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