



Backup Device Speed Testing



WHITEPAPER

BackupAssist Version 5

www.BackupAssist.com

Cortex I.T.

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1. Introduction

1.1 Overview

This whitepaper is perhaps the most comprehensive series of tests of backup devices ever conducted. Its aim is to help I.T. consultants decide what backup devices to use, and what speeds can be expected.

1.2 Results summary

This table provides an average speed in GB/Hr for each device.

Device class	Specifics	Approximate Price (USD)	Imaging speed (GB/hr)	Avg. File Copy speed (GB/hr)
3.5" eSATA External Drive	Server HDD (7200RPM / 32MB) in Astone case	\$155.00	280	192
	Server HDD (7200RPM / 32MB) in Channel+ case	\$150.00	290	191
	WorkStation HDD 1 (7200RPM / 8MB) in Astone case	\$85.00	163	136
	WorkStation HDD 1 (7200RPM / 8MB) in Channel+ case	\$80.00	163	140
3.5" USB External Drive	Server HDD (7200RPM / 32MB) in Astone case	\$155.00	101	90
	Server HDD (7200RPM / 32MB) in Channel+ case	\$150.00	101	90
	WorkStation HDD 1 (7200RPM / 8MB) in Astone case	\$85.00	102	90
	WorkStation HDD 1 (7200RPM / 8MB) in Channel+ case	\$80.00	100	90
2.5" USB Portable HDD	Lacie Little disk (250GB)	\$70.00	96	88
	Seagate Freeagent GO	\$56.00	91	85
RDX drives	Tandberg rdx Quikstor SATA	\$147.00*	108**	129
	Tandberg rdx Quikstor USB	\$269.00*	71	71
Internally connected SATA Drive	Server HDD (7200RPM / 32MB)	\$130.00	253	196
	WorkStation HDD 1 (7200RPM / 8MB)	\$60.00	173	165
	WorkStation HDD 2 (7200RPM / 8MB)	\$81.00	189	181
	2.5" Laptop HDD (7200RPM / 16MB)	\$121.00	253	208
Tape drives	HP LTO-1 (external SCSI)	\$1499.00	N/A	53
	Quantum DLT-4 SATA	\$1100.00	N/A	35
	LTO-1 theoretical maximum – not tested			54
	LTO-2 theoretical maximum – not tested			144
	LTO-3 theoretical maximum – not tested			288
	LTO-4 theoretical maximum – not tested			432

*drive only. Server / Workstation hdd 1 + 2 referenced in part 2.2 and appendix

All prices based on google street price results 8th May 2009

** appears limited by the speed of compression in the Windows Block Level Backup engine

1. USB versus eSATA:

Use eSATA if possible. As we can see, SATA clearly holds the lead over USB devices in both the HDD enclosures and the RDX drives. It is interesting to note that all USB devices (apart from the rdx) were capped at around 90 GB/hr for file copying, and just a little more for drive imaging.

2. eSata enclosure vs. straight wiring to eSata port:

No difference. With both HDD enclosures tested, the eSATA was a simple SATA pass through to the motherboard header. We saw similar speeds between the internal SATA and eSATA backups, with an acceptable fluctuation of ~10% in speeds most likely due to random environmental variation factors.

3. Desktop grade HDD vs. Server grade HDD:

Bigger cache is good. The differences between these hard drives are only apparent with the higher speed eSATA connection. Although they were both 7200 rpm devices the large cache on the server HDD provided a substantial speed increase. A HDD cache is designed to allow the disk to signal that the data has been written while the data is still in the drive's cache. A large cache allows a larger amount data to be stored before being written. This in turn means a request for more data occurs sooner and more frequently decreasing the time that the reading or writing disk remains idle while waiting for a command. We were actually surprised by how wide the margin in performance was.

4. HDD enclosures:

Minimal difference. The HDD enclosures used in the test were from two different manufacturers; however both used the same

USB controller so it is hard to draw a conclusion whether a different controller would outperform the two tested. The difference in speed is quite marginal between the two cases; however neither is close to the theoretical maximum of USB II nor of their advertised maximum speeds.

5. HDD vs. Tape:

HDD wins at a given price range. In terms of throughput at a given price range, tape was outperformed by all traditional hard drives, as well as the SATA REV. However, it is important to realise that Tape and HDD have very different characteristics and are ideally suited to different applications. HDD is random access, making it suitable for newer backup technologies that perform in-place modifications to backups, or that reference data in a non-sequential manner. Tape is sequential, making it suitable for continuous streaming of data, and long term archiving.

6. New HDD vs. Old HDD:

Not much difference. Workstation HDD 1 was manufactured in June 06 while Workstation HDD 2 was manufactured in May 08 and both are identical in RPM and cache. In all internal SATA testing the older HDD was out performed by the newer model. However this was a small margin and we had seen larger differences retesting the same device; so this may be coincidental.

6. RDX cartridge notes:

Slower than comparable HDD: The USB RDX was ~22% slower than the 2.5" 5200 RPM portable USB HDDs for file copying and imaging. The SATA RDX was also slower than the comparable SATA laptop drive (however this is not a direct comparison because the laptop drive tested was a 7200 RPM model).

1.3 Date and location of testing

The tests were carried out in May 2009 at the Cortex I.T. test labs in Melbourne, Australia.

1.4 Testing methodology

Backup Scenarios

Three common backup scenarios were tested using BackupAssist, the popular backup software for SMB:

1. Drive Imaging (also known as Block Level Backup),
2. File Copy of one large file and
3. File Copy of many smaller files.

Data set:

The sample data was 100GB random files contained on a single partition for both the **Drive imaging** and the **File Copy of many smaller files**. For the **File Copying of a single large file** the partition was formatted then populated with the image created with the Drive Imaging backup.

Testing procedure

For each device the following test jobs were run, with the exclusion of the tape drives.

Job setup: Tape testing

Tape was the only device tested in a separate way to the other hardware. Tape throughput was measured by the time taken to fill the tape with uncompressed data. For each test the tape media was rewound then overwritten, with only the write time being recorded.

Job setup: Drive imaging (100GB partition size)

The device to be tested was attached and formatted. Then a Windows Imaging job was created in BackupAssist and run via the quick actions menu. The backup to be run was always the first future backup scheduled on the BackupAssist calendar.

The default job settings were used for this job and VSS creation time was calculated to the nearest 10 second interval from the Windows Imaging log file. VSS creation time was then subtracted from the overall backup time to calculate device speeds.

Job setup: File Copy, large (100,000+) file set (100GB data set)

This test was carried out for all devices using data set 2. The device to be tested was attached and formatted. Then a File Replication job was created in BackupAssist. To assist with achieving a consistent result the following options were configured after the job was created:

Copy NTFS security attributes and alternate data streams: **Disabled**

Microsoft volume shadow-copy service: **Disabled**

Enable VSS writers: **Disabled**

The job was then run via the quick actions menu. The backup to be run was always the first future backup scheduled on the BackupAssist calendar.

Job setup: File Copy, single large file (100GB data set)

This test was carried out for all devices using data set 3. The device to be tested was attached and formatted. Then a File Replication job was created in BackupAssist. To assist with achieving a consistent result the following options were configured after the job was created:

Copy NTFS security attributes and alternate data streams: **Disabled**

Microsoft volume shadow-copy service: **Disabled**

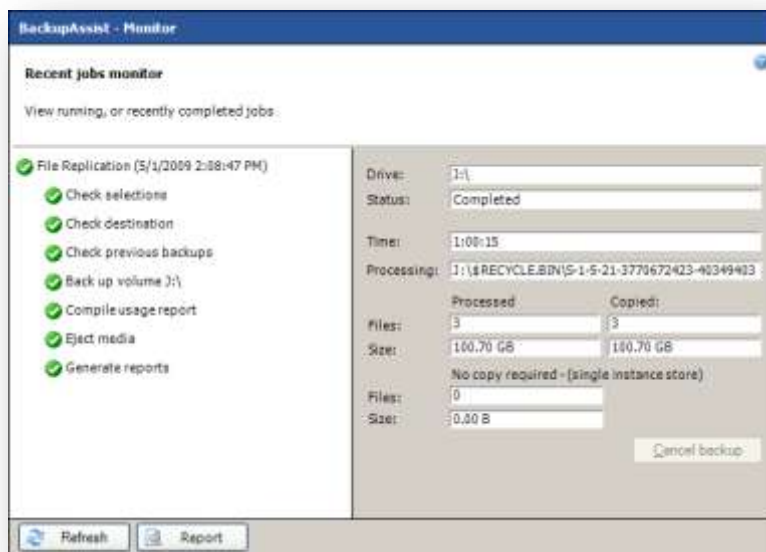
Enable VSS writers: **Disabled**

The job was then run via the quick actions menu. The backup to be run was always the first, future backup scheduled on the BackupAssist calendar.

Data collection

Each job was run through BackupAssist, as it records all job details with its reporting function. The job duration was calculated from the total job running time, excluding any VSS creation time, while the total job size was taken from the media usage report. Using this data the throughput for each device was calculated.


All time and size data was taken from the detailed BackupAssist job report, as well as checked against the BackupAssist job monitor for consistency.




The BackupAssist job monitor after completing a Windows Imaging Backup.


"File Replication" Report Backup to: External hard drive

Date: Friday, May 01, 2009 3:09:12 PM

 "File Replication" Successful

 **Errors / Warnings Summary**

No errors or warnings to report.

 **Backup Job Summary**

Item	Details / Results
BackupAssist Version	5.2.3
Computer Name	TESTCOMPLETE
Backup User	SYSTEM
Backup Destination	External hard drive
Backup Label	Daily 1
Start Time	Friday, May 01, 2009 2:08:48 PM
End Time	Friday, May 01, 2009 3:09:12 PM
Duration	1 hours, 24 seconds

The corresponding, comprehensive report with job run time and media usage (to ensure data size backed up was consistent).

2. Test Environments

2.1 Software configuration

Operating system: Windows Server Standard 2008 with Service Pack 1

All tests were performed on Windows Server 2008 Standard, as this is the most common server installation in Microsoft's current line-up.

Backup Software: BackupAssist v5.2.3

BackupAssist was used to provide a varied array of test scenarios on Windows Server 2008. In addition to the File Copy engine and the added functionality to Windows Server backup it allows us to run the same job using the same setting each time with ease. This provided a consistent result for our test backups that could be checked in both the provided job monitor and job report.

2.2 Hardware configuration

Hardware for the test was selected to meet/exceed the system requirements outlined at:

<http://msdn.microsoft.com/en-us/windowsserver/cc196364.aspx>

Processor: Intel Core2 Duo E7400

Motherboard: ASUS P5KPL-CM

Ram: Kingston 4GB DD2

OS host HDD: Seagate Barracuda 250GB 7200rpm

Data host HDD: Seagate Barracuda 250GB 7200rpm

SCSI card: Adaptec SCSI Card 29160LP

All external and internal devices were connected to the onboard ports of the motherboard, with the exception of SCSI tape testing.

3. Detailed Results

Below is a detailed look at the performance of each device tested under each set of test outlined in the section above.

Overall throughput of devices on each test:

Device class	Specifics	Test 1 GB/s	Test 2 GB/s	Test 3 GB/s
3.5" USB Case	WD10EADS in Astone case	101.46	81.60	99.21
	WS1600JS in Astone case	102.03	80.20	100.28
	WD10EADS in Channel+ case	101.66	82.38	99.59
	WS1600JS in Channel+ case	100.62	80.49	100.06
3.5" eSATA Case	WD10EADS in Astone case	280.81	203.40	181.07
	WS1600JS in Astone case	163.15	135.14	138.79
	WD10EADS in Channel+ case	290.25	215.94	166.14
	WS1600JS in Channel+ case	163.15	138.78	142.5
Internal SATA	ST9320421AS	250.78	212.13	205.28
	HD161HJ	189.23	189.81	195.53
	WS1600JS	172.97	168.30	163.00
	WD10EADS	253.94	207.85	185.53
2.5" USB Portable HDD	Lacie Little disk	96.21	78.78	98.75
	Seagate Freeagent GO	91.87	76.76	95.02
RDX drives	Tandberg Quikstor SATA	108.11	105.04	154.32
	Tandberg Quikstor USB	71.57	60.04	81.99
Tape drives	HP LTO1 (external SCSI)	N/A	N/A	53.06
	HP LTO2 (external SCSI)	N/A	N/A	53.31
	Quantum DLT v4 (Internal SATA)	N/A	N/A	34.96

Test 1 results: Windows Imaging Engine

Device class	Specifics	Total run time HH:MM:SS	Total data size GB	VSS creation time
3.5" USB Case	WD10EADS in Astone case	0:59:43	100.7	10sec
	WS1600JS in Astone case	0:59:23	100.7	10sec
	WD10EADS in Channel+ case	0:59:36	100.7	10sec
	WS1600JS in Channel+ case	1:00:13	100.7	10sec
3.5" eSATA Case	WD10EADS in Astone case	0:21:41	100.7	10sec
	WS1600JS in Astone case	0:37:12	100.7	10sec
	WD10EADS in Channel+ case	0:20:59	100.7	10sec
	WS1600JS in Channel+ case	0:37:12	100.7	10sec
Internal SATA	ST9320421AS	0:24:15	100.7	10sec
	HD161HJ	0:32:05	100.7	10sec
	WS1600JS	0:35:05	100.7	10sec
	WD10EADS	0:23:57	100.7	10sec
2.5" USB Portable HDD	Lacie Little disk	1:02:58	100.7	10sec
	Seagate Freeagent GO	1:05:56	100.7	10sec
RDX drives	Tandberg Quikstor SATA	0:56:02	100.7	10sec
	Tandberg Quikstor USB	1:24:33	100.7	10sec

Test 2 results: File Replication Engine, large file set

Device class	Specifics	Total run time HH:MM:SS	Total data size GB
3.5" USB Case	WD10EADS in Astone case	1:13:42	100.23
	WS1600JS in Astone case	1:14:59	100.23
	WD10EADS in Channel+ case	1:13:00	100.23
	WS1600JS in Channel+ case	1:14:43	100.23
3.5" eSATA Case	WD10EADS in Astone case	0:29:34	100.23
	WS1600JS in Astone case	0:44:30	100.23
	WD10EADS in Channel+ case	0:27:51	100.23
	WS1600JS in Channel+ case	0:43:20	100.23
Internal SATA	ST9320421AS	0:28:21	100.23
	HD161HJ	0:31:41	100.23
	WS1600JS	0:35:44	100.23
	WD10EADS	0:28:56	100.23
2.5" USB Portable HDD	Lacie Little disk	1:16:20	100.23
	Seagate Freeagent GO	1:18:21	100.23
RDX drives	Tandberg Quikstor SATA	0:57:15	100.23
	Tandberg Quikstor USB	1:40:10	100.23

Test 3 results: File replication engine, single large file

Device class	Specifics	Total run time HH:MM:SS	Total data size GB
3.5" USB Case	WD10EADS in Astone case	1:00:54	100.7
	WS1600JS in Astone case	1:00:15	100.7
	WD10EADS in Channel+ case	1:00:40	100.7
	WS1600JS in Channel+ case	1:00:23	100.7
3.5" eSATA Case	WD10EADS in Astone case	0:33:22	100.7
	WS1600JS in Astone case	0:43:32	100.7
	WD10EADS in Channel+ case	0:36:22	100.7
	WS1600JS in Channel+ case	0:42:24	100.7
Internal SATA	ST9320421AS	0:29:26	100.7
	HD161HJ	0:30:54	100.7
	WS1600JS	0:37:04	100.7
	WD10EADS	0:32:34	100.7
2.5" USB Portable HDD	Lacie Little disk	1:01:11	100.7
	Seagate Freeagent GO	1:03:35	100.7
RDX drives	Tandberg Quikstor SATA	0:39:09	100.7
	Tandberg Quikstor USB	1:13:41	100.7
Tape drives	HP LTO1 (external SCSI)	1:50:02	97.3
	HP LTO2 (external SCSI)	1:50:38	97.3
	Quantum DLT v4 (Internal SATA)	4:23:49	153.7

4. Hardware Appendix

Below is information for each device tested, including model number and manufactures estimated throughput.

Astone USB/SATA HDD enclosure

Serial :	481E
Capacity :	1.5TB (HDD dependent)
Interfaces :	Hi-Speed USB 2.0 and eSATA
USB Interface Transfer Rate:	up to 480Mbits/s
Burst Transfer Rate :	Up to 32MB/s
eSATA Interface Transfer Rate:	Up to 3GBits/s



Channel+ USB/SATA HDD enclosure

Serial :	N/A
Capacity :	1.5TB (HDD dependent)
Interfaces :	Hi-Speed USB 2.0 and eSATA
USB Interface Transfer Rate:	up to 480Mbits/s
Burst Transfer Rate :	Up to 32MB/s
eSATA Interface Transfer Rate:	Up to 3GBits/s



Lacie Little disk

Serial :	301273
Capacity :	120 GB
Rotational speed :	5200rpm
Interface :	Hi-Speed USB 2.0
Interface Transfer Rate USB:	up to 480Mbits/s
Burst Transfer Rate :	Up to 32MB/s



Seagate Freeagent GO

Serial :	301273
Capacity :	120 GB
Rotational speed :	5200rpm
Interface :	Hi-Speed USB 2.0
Interface Transfer Rate USB:	up to 480Mbits/s
Burst Transfer Rate :	Up to 32MB/s


External Tandberg Quikstor USB with 160Gb cartridge

Serial :	8461
Capacity :	160 GB
Rotational speed :	5200rpm
Interface :	Hi-Speed USB 2.0
Interface Transfer Rate USB:	up to 480Mbits/s
Burst Transfer Rate :	Up to 32MB/s


Internal Tandberg Quikstor SATA with 160Gb cartridge

Serial :	8417
Capacity :	160 GB
Rotational speed :	5200rpm
Interface :	SATA
Interface Transfer Rate USB:	364Mbits/s (160Gb per hr quoted)
Burst Transfer Rate :	Up to 32MB/s


Western Digital Server SATA HDD

Serial :	WD10EADS
Capacity :	1Tb
Rotational speed :	7200rpm
Interface :	Serial ATA
Interface Transfer Rate :	up to 3Gbits/s
Cache size :	32MB



Western Digital Workstation 1 SATA HDD

Serial :	WD1600JS
Capacity :	160Gb
Rotational speed :	7200rpm
Interface :	Serial ATA
Interface Transfer Rate :	up to 3Gbits/s
Cache size :	8MB



Samsung Workstation 2 SATA HDD

Serial :	HD161HJ
Capacity :	160Gb
Rotational speed :	7200rpm
Interface :	Serial ATA
Interface Transfer Rate :	up to 3Gbits/s
Cache size :	8MB



Seagate Momentus 7200 0.3 SATA HDD

Serial :	ST9320421AS
Capacity :	320Gb
Rotational speed :	7200rpm
Interface :	Serial ATA
Interface Transfer Rate :	up to 3Gbits/s
Cache size :	16MB



HP Ultrium 232 LTO 1 - External

Serial :	N/A
Capacity :	100/200GB (uncompressed/compressed)
Recording technology:	LTO 1
Interface :	Ultra160 LVD SCSI
Interface Transfer Rate :	57.5/115GB/hr (uncompressed/compressed)



HP Ultrium LTO2 - External

Serial :	N/A
Capacity :	200/400GB (uncompressed/compressed)
Recording technology:	LTO 2
Interface :	Ultra160 LVD SCSI
Interface Transfer Rate :	86.5/173GB/hr (uncompressed/compressed)


Quantum DLT V4 - Internal

Serial :	N/A
Capacity :	150GB uncompressed
Recording technology:	DLT
Interface :	SATA
Interface Transfer Rate :	150MB/s



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About BackupAssist

At around 1/3rd the price of the major brands, BackupAssist is a great choice in backup software for Small and Medium Businesses.

With a reputation for being **easy to use**, and simple to understand, BackupAssist has fast become the leading choice in backup software for thousands of VARs and users in 93 countries.

BackupAssist is one of the few backup software packages with solutions for a wide variety of backup and DR needs:

- Drive Imaging on Server 2008
- File Backup, with support for VSS aware applications
- Exchange Mailbox Backup
- SQL Server Backup
- Bandwidth efficient Internet backup, with support for VSS aware applications

You can read more about BackupAssist here:

<http://www.backupassist.com/education/articles/backup-software-SMB-better-protection.html>