



Dell PowerVault DL2100 powered by Symantec Backup Exec 2010: Source deduplication advantages in a file server scenario

Executive summary

Companies with remote locations often back up remote workers' data via wide area networks (WANs) to avoid the cost of local backups and local support staff. A large portion of the remote data remains constant from day to day, which means backup systems waste WAN and storage resources by transferring multiple copies of the same data to the central office. Source deduplication eliminates this inefficiency by transferring only unique chunks of data across the wire.

Symantec commissioned Principled Technologies (PT) to measure the source deduplication capabilities of the Dell™ PowerVault™ DL2100 powered by Symantec™ Backup Exec™ 2010 when backing up a Microsoft® Windows®-based file server solution. As Figure 1 shows, this solution delivered an average 24.6 to 1 deduplication ratio over a simulated 2-week period. This indicates that, by deduplicating the data at the source, the solution reduced the amount of data traveling over the WAN connection by a factor of more than 24, greatly reducing WAN traffic, media server storage capacity needs, and administrative overhead, which all translate to reduced costs.

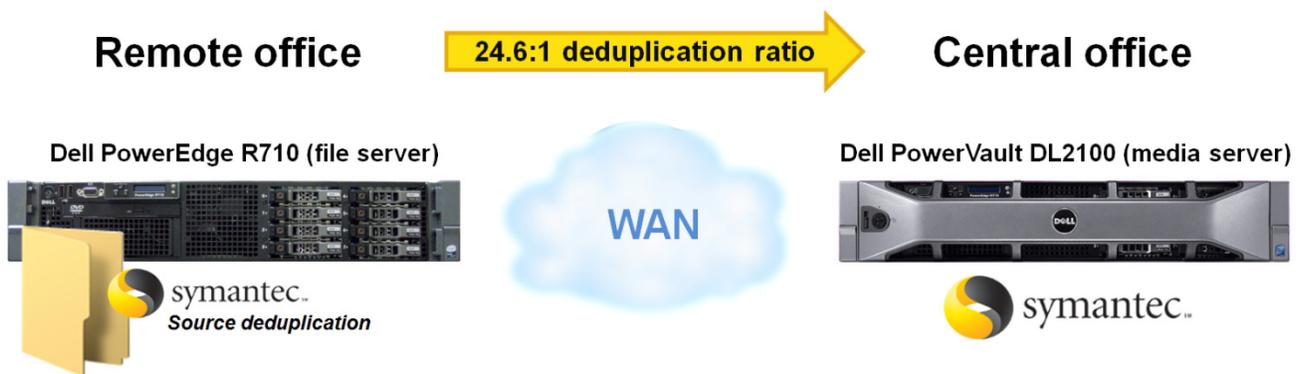


Figure 1: The source deduplication scenario we tested.

KEY FINDINGS

- The Dell PowerVault DL2100, powered by Symantec Backup Exec 2010, backed up the entire file server share in an average of 22 minutes after the initial backup when performing source deduplication as opposed to over 6 hours when not performing source deduplication.
- The Dell PowerVault DL2100, powered by Symantec Backup Exec 2010 performing source deduplication, achieved an average deduplication ratio of 24.6:1 on our file server backup tests during a simulated 2-week period.

Symantec Backup Exec 2010 lets businesses easily eliminate duplicate backup data—in our case, files stored on a file server. The backup technician uses the familiar Symantec Backup Exec console to simply select the deduplication storage folder and select the option for remote access of the media server while configuring the backup job.

Source deduplication in Symantec Backup Exec 2010 eliminates redundant data directly on the source machine before that data makes its way to the media server. The remote agent compares the chunks of data on the remote server to the existing backup chunks on the media server, and if it finds a duplicate, sends only a marker to the media server. This process greatly reduces the amount of data that is transmitted to the media server and the amount of data the media server must store. Source deduplication also enables bandwidth optimization as part of the backup process. In our test case, Symantec Backup Exec 2010 reduced the backup time window for a full backup from over 6 hours to an average of 22 minutes.

Our testing scenario represents a company using the Dell PowerVault DL2100 appliance to automate and simplify the remote office backup process to ensure consistent and reliable data backup. Because the company is sensitive to the high cost of WAN connections and backup storage, the solution uses source-side deduplication. Figure 2 presents a visual depiction of source deduplication, which eliminates backup inefficiencies by transferring only unique chunks of data across the WAN.

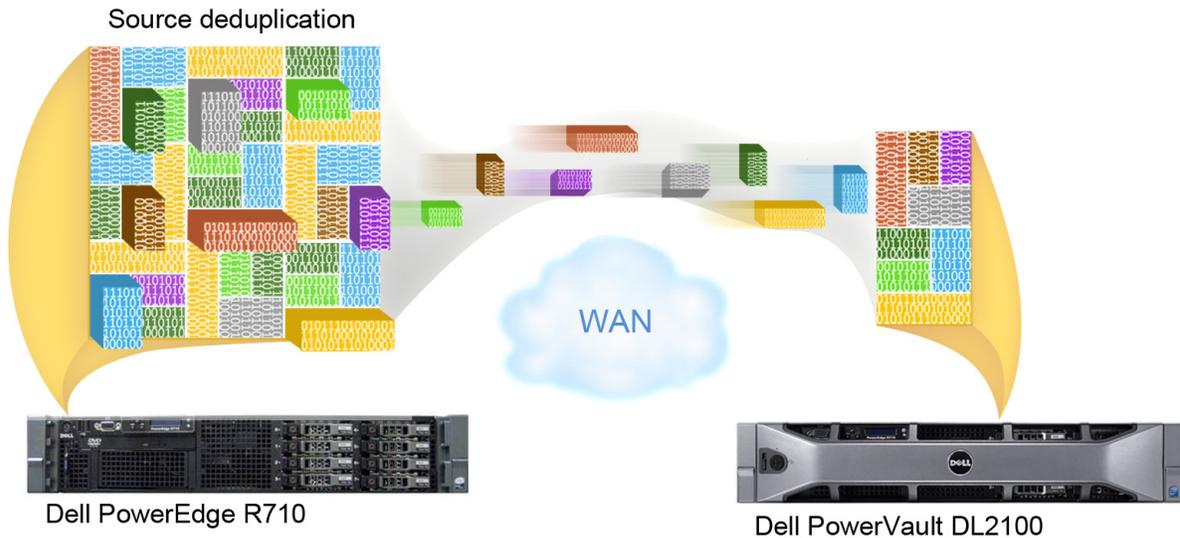


Figure 2: Source deduplication eliminates backup inefficiencies by transferring only unique chunks of data across the WAN.

We used a file server running Microsoft Windows 2008 R2 and a custom workload to simulate data change rates. Our custom workload browsed through the specified directory on the fileserver, which contained 50 GB of data, updating, deleting, and adding files, thus simulating real-world data set changes in a file server.

Our scenario includes an Active Directory server, a file server running Microsoft Windows 2008 R2 with the file server role enabled, and a client machine on the “remote office” side of the WAN. We set our WAN emulator to use a T3 bandwidth with 15ms latency. We installed a Dell PowerVault DL2100 powered by Symantec Backup Exec 2010 on the “central office” side of the WAN. We performed a full backup of the 50GB dataset initially, and then ran our custom workload. Our workload changed 3 percent of Microsoft PowerPoint®, Excel®, and Word® files, deleted 1 percent of all files, moved 2 percent of all files, and added between 160 and 200 files per iteration. We then repeated the backup and workload operations, using full backups each time. For more information on the custom workload we used, see the Test methodology section.

Test results

We used a custom file server workload to simulate a real-world file server backup scenario of a business modifying approximately 3 to 5 percent of their files per day. We performed an initial full backup of our 50GB file share using the Dell PowerVault DL2100 and Symantec Backup Exec 2010. We then proceeded to simulate 13 additional days of activity, running the workload, and then executing a full file server backup, each time.

For the backup device, we allowed the Dell PowerVault DL2100 to auto-provision the storage for deduplication, and configured the remote agent on the Dell PowerEdge™ R710 file server to have direct access to the Dell PowerVault DL2100 appliance, for the purposes of source deduplication.

For our backup job, we browsed to the file server, selected the relevant folder, directed the backup to the deduplication storage folder, and allowed the remote agent direct access. From that point, our backup job used source deduplication. As Figure 3 shows, the difference between the amount of data protected versus the actual amount of data stored becomes greater over time, benefiting the business by requiring significantly less long-term storage capacity.

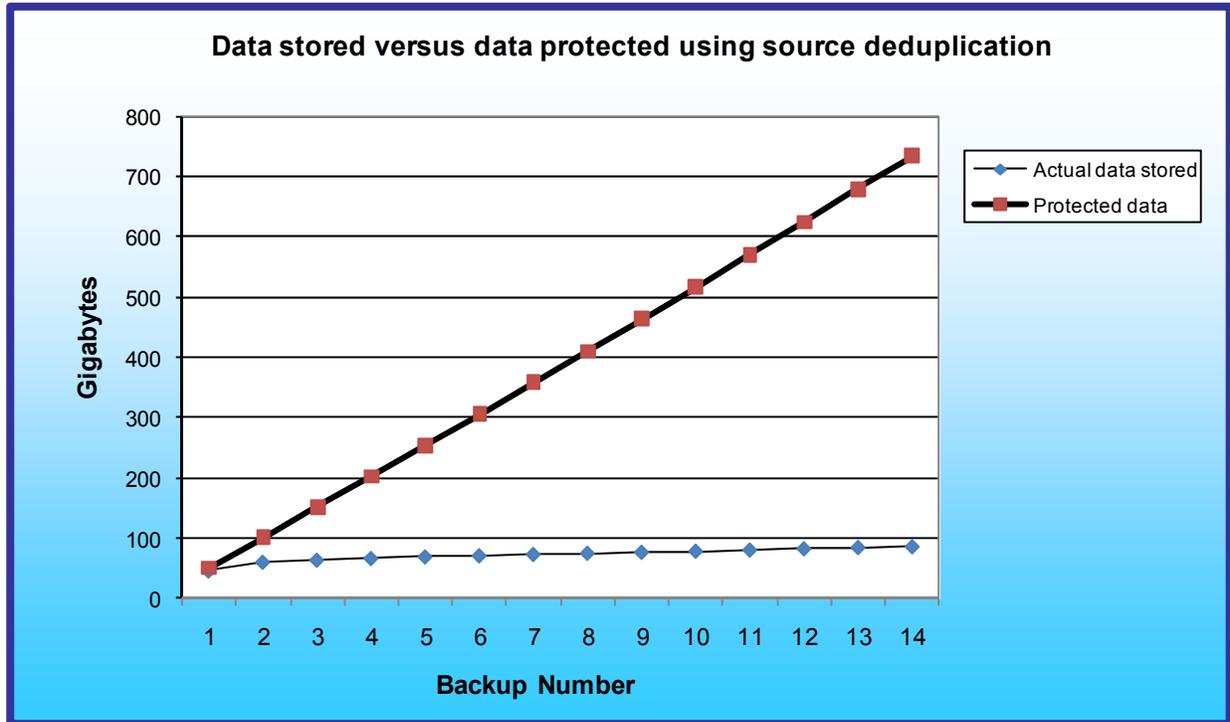


Figure 3: Comparison of protected data versus the actual data stored from our 2-week file server backup simulation.

Specifically, our deduplication scenario contained the following hardware:

- A Dell PowerEdge R710 file server at the remote office running Windows Server 2008 R2 with the file server role enabled and the Symantec remote agent with source deduplication
- An Active Directory server and a client machine to simulate the remaining components of the remote office
- A Dell PowerVault DL2100 powered by Symantec Backup Exec 2010 at the central office for backup

See Appendix A for a detailed description of the test servers. See Appendix B for detailed results from our testing.

Workload

To build the workload, we used AutoIT, an automation scripting tool that you can customize to simulate different actions on Microsoft Office® documents, as well as other file formats. We wrote and executed scripts that performed the following actions:

- Changed 3 percent of Microsoft Excel files in the following ways:
 - Modified a random number (between 1 and 20) of cells.
 - With cells containing numeric values, the script appended random values to the existing value.
 - With cells containing string values, the script appended a string retrieved from another file to the existing string.

- With other cells, it filled the cell with a random numeric value.
 - On worksheets containing more than 20 columns, the script deleted a single column.
 - On worksheets containing more than 20 rows, the script deleted a single row.
 - On worksheets 1 to 5 of workbooks containing fewer than 10 columns and fewer than 200 rows, the script added a row of numeric values.
 - In workbooks containing three worksheets, the script added an additional worksheet with a random number of rows and columns, all containing random values.
 - After making the changes, the script saved and closed two-thirds of the changed files and saved the remaining files to a new filename in the same folder.
- Changed 3 percent of Microsoft Word files in the following ways:
 - Copied between 1 and 10 randomly chosen paragraphs from a source document into random places in the target document.
 - After making the changes, the script saved and closed two-thirds of the changed files and saved the remaining files to a new filename in the same folder.
- Changed 3 percent of Microsoft PowerPoint files in the following ways:
 - Copied a randomly chosen slide from a source PowerPoint file containing more than 300 slides onto the end of the target PowerPoint file.
 - After making the changes, saved the file.
- Deleted 1 percent of all files.
- Moved 2 percent of all files.
- Copied between 160 and 200 files into random directories in the file share.

After writing the script, we compiled it into a self-contained executable that we executed from a command-line prompt. Our workstation executed this workload against the Dell PowerEdge R710 file server under test once per backup period, and we repeated this workload-plus-backup iteration 14 times to simulate 14 days of activity. We started with one copy of our 50GB data set on the file server, which the workload then manipulated over the course of the 14 simulated days.

To measure the deduplication ratio and elapsed time from Symantec Backup Exec 2010, we created a backup job, targeted our folder containing 50 GB of files on the Dell PowerEdge R710, selected the deduplication storage folder as the destination, and selected the option to allow the remote agent to have direct access to the media server. We then executed this same backup job between workload iterations to gather the deduplication, job rate, and elapsed time statistics. As a comparison point, we also created an additional backup job, using a backup-to-disk destination instead with no deduplication. For more details on this process and the results, see the Test methodology section and the Test results section.

Test configuration

Networking switch

- Dell PowerConnect™ 5448

Dell PowerVault DL2100 powered by Symantec Backup Exec 2010

- Dell PowerVault DL2100 with 2 x Intel® Xeon® Processor E5520s and 48GB RAM
- 4 x Broadcom BCM5709C Network Interface Cards
- One volume containing 2 x 160GB disks in RAID 1 configuration
- One volume containing 4 x 160GB disks in RAID 5 configuration

File server

- Dell PowerEdge R710
- 2 x Intel Xeon Processor E5540s
- 4 x Broadcom BCM5709C Network Interface Cards
- 8 x 15K SAS 2.5" drives; 1 x 2-disk RAID 1 and 1 x 6-disk RAID 5
- Windows Server 2008 R2
- File Server role enabled

Active Directory server

- Dell PowerEdge 2650
- 2 x Intel Xeon Processor 2.80 GHz
- 2 x Broadcom NetXtreme Gigabit Ethernet NICs
- One volume containing 2 x 36GB SCSI disks in a RAID 1 configuration

File server load-generating clients

- One workstation-class machines
 - Windows Vista® Ultimate
 - AutoIT3 compiled workload driver

WAN emulator

- Dell PowerEdge T605
 - FreeBSD 8.0
 - Compiled with ipfw and dumynet
 - Use the following command line settings to restrict the bandwidth and add delay:

```
ipfw add 1000 pipe 1 ip from any to any
ipfw pipe 1 config delay 2ms bw 45813Kbit
```

Note: ipfw 2ms delay results in 15ms actual round-trip latency.

Figure 4 illustrates our Dell PowerVault DL2100 WAN test bed.

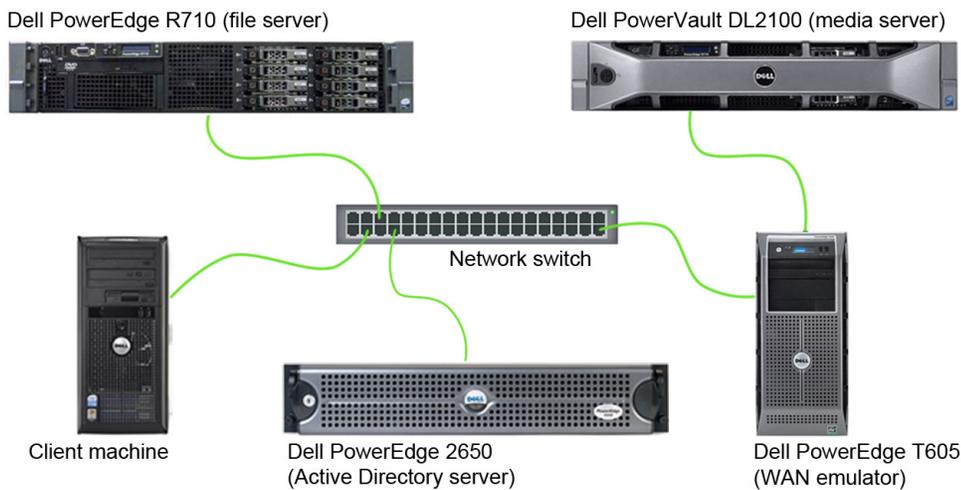


Figure 4: Dell PowerVault DL2100 WAN test bed.

Test methodology

Setting up and configuring the Active Directory server

We used a separate Active Directory server for our test bed.

Setting up the operating system

1. Boot the server, and insert the Windows Server 2003 R2 installation CD in the CD drive.
2. At the Welcome to Set up screen, press Enter to begin the installation.
3. At the Windows Licensing Agreement screen, press F8 to agree to the terms.
4. Press Enter to install in the default location.
5. Select Format the partition using the NTFS file system (Quick), and press Enter to continue.
6. At the Regional and Language Options screen, click Next.
7. Enter Name and Organization, and click Next. Note: Organization is an optional field, while username is required.
8. At the Your Product Key screen, enter your product key, and click Next.
9. At the Licensing Modes screen, click Next.
10. At the Computer Name and Administrator Password screen, type `Password1` as the new password in both fields, and click Next.
11. At the Date and Time Settings screen, change the Date & Time and Time Zone if appropriate, and click Next.
12. After the system restarts automatically, follow the prompt to log into the server.
13. At the Windows Setup screen, the installer will prompt you to insert the second installation CD. Insert the appropriate CD, and click OK.
14. At the Windows Server 2003 R2 Setup Wizard Welcome screen, click Next.
15. At the Windows Server 2003 R2 Setup Wizard Summary screen, click Next.
16. When the installer prompts you, click Finish to end the installation.

Promoting the active directory server using dcpromo

1. Click Start, click Run, type `cmd` in the prompt, and press Enter.
2. Type `dcpromo`, and press Enter.
3. Click Next.
4. Click Next.
5. Click Next.
6. Select Create a new domain in a new forest, and click Next.
7. Type `domainname.local` as the FQDN (Fully Qualified Domain Name), where `domainname` is the name of your domain, and click Next.
8. Set the forest functional level to Windows Server 2003, and click Next.
9. Set the domain functional level to Windows Server 2003, and click Next.
10. Leave defaults on the Additional Domain Controller Options screen, and click Next.
11. If a warning window appears asking about dynamically assigned IP addresses, click Yes.
12. Click Yes to continue.
13. Leave defaults at the Location for Database, Log Files, and SYSVOL screen, and click Next.
14. At the Directory Services Restore Mode Administrator Password screen, type `Password1`.
15. At the summary screen, click Next.
16. Click Finish.
17. Click Restart now.

Setting up and configuring the file server

Installing the operating system

1. Boot the Dell PowerEdge R710 server.
2. When prompted by the boot to enter the storage configuration, press Ctrl+R.
3. Highlight Controller 0 and press F2, and choose Clear Config.
4. Accept the warning of loss of data.
5. Highlight Controller 0 and press F2, and choose Create New VD.
6. Choose RAID 1, select the first two disks, leave other options at the default values, and press OK.

7. Accept the warning regarding initialization.
8. Highlight the Virtual Disk, and press F2, Initialization, Start Init.
9. Highlight Controller 0, press F2, and choose Create New VD.
10. Choose RAID 5, select the remaining six disks, leave other options at the default values, and press OK.
11. Accept the warning regarding initialization.
12. Highlight the new Virtual Disk and press F2, Initialization, Start Init.
13. After initialization completes, press Esc to reboot the machine.
14. Insert the installation DVD for Windows Server 2008 R2 Enterprise x64 into the DVD drive.
15. Choose the language, time and currency, and keyboard input. Click Next.
16. Click Install Now.
17. Choose Windows Server 2008 R2 Enterprise (Full Installation), and click Next.
18. Accept the license terms, and click Next.
19. Click Custom.
20. Click the disk, and click Drive options (advanced).
21. Click New, Apply, Format, and click Next.
22. Let the installation process continue. The server will reboot several times.
23. After the installation completes, click OK to set the Administrator password.
24. Enter the administrator password twice, and click OK.
25. Click Start, Control Panel, and double-click System.
26. Click Change Settings.
27. Click Change.
28. Enter the new computer name, and click OK.
29. Click OK to restart, click Close, and click Restart Now.

Installing Windows updates on the file server

1. Click Start, type `update`.
2. Click View Advanced Options.
3. Click Never Check for Updates.
4. Click OK.
5. Click Check for Updates.
6. When the application prompts you to install an update for Windows Update, click Install Now.
7. Click View available updates to ensure you install the necessary updates.
8. Click Install.
9. Agree to the license terms, and click Finish.
10. When the application requests you do so, reboot the machine.
11. After reboot, check Windows Update again for further updates. Click Start→Windows Update.
12. Click Check for updates.
13. If Windows lists no important updates, close the updates window.

Joining the domain

1. Click Start, right-click Network, and choose Properties.
2. Click Change adapter settings.
3. Right-click the relevant network adapter, and choose Properties.
4. Click Internet Protocol Version 4 (TCP/IPv4).
5. Click properties.
6. Click Use the following IP address.
7. Enter a valid IP address, Subnet mask.
8. Click Use the following DNS server addresses.
9. Enter the IP address of the Active Directory Server.
10. Click OK.
11. Click Close.
12. Click Start, right-click Computer, and choose Properties.
13. Click change settings.
14. Click change.
15. Choose Domain, and enter the domain name.

16. Enter valid credentials, and click OK.
17. When prompted by Windows to restart, restart the machine.

Enabling the file server role

1. Click the Server Manager icon.
2. Click Roles.
3. Click Add Roles.
4. Click Next.
5. Click File Services, then click Next.
6. At the Introduction to File Services screen, click Next.
7. At the Role Services screen, click Next.
8. At the Confirm Installation Selections screen, click Install.
9. After the installation completes, click Close.

Configuring additional drives in Disk Management

1. Click Start, Administrative Tools, Computer Management.
2. Click Disk Management.
3. Right-click the uninitialized disks (if any), and choose Initialize Disk.
4. Choose MBR.
5. Right-click the volume meant for file server data, and choose New Simple Volume. Click Next.
6. Accept the default volume size, and click Next.
7. Choose E: from the drop-down menu for the drive letter, and click Next.
8. Type `filedata` for the volume name, and click Next.
9. Choose NTFS, 64K allocation unit size, and check the Perform a quick format checkbox. Click Next.
10. Click Finish.

Setting up and configuring the Dell PowerVault DL2100 powered by Symantec Backup Exec 2010

Setting up the operating system

1. Power on the Dell PowerVault DL2100 appliance.
2. At the License agreement screen, accept license agreements, and click Next.
3. At the Set up Windows screen, click Start.
4. At the Default password warning, click OK.
5. At the Welcome screen, click Next.
6. At the Locate Symantec licenses screen, click Next.
7. At the Storage connections screen, click Next.
8. At the Change default local administrator password screen, enter the new password. Enter the password again for confirmation, and click Next.
9. Select the network interface you wish to configure, and click Next.
10. Enter network configuration information, and click Next.
11. Enter a new hostname. Join the domain if your configuration requires you to do so, and click Next.
12. At the SNMP settings screen, click Next.
13. At the Disk configuration policy screen, choose Automatic with confirmation (default), and click Next.
14. Under the deduplication scenario, choose Internal storage controller (default), and click Next. Under the Backup to Disk scenario, choose to not configure deduplication at this point.
15. Click Finish. After the configuration completes, click Reboot. The system will reboot.
16. After reboot, press Ctrl+Alt+Delete to login.
17. Click Switch User, and click Other User.
18. Log in as a domain user with administrative credentials.
19. Wait a few minutes for the Configuration Wizard to continue.
20. At the Symantec Backup Exec 2010 welcome screen, click Next.
21. Accept license agreements, and click Next.
22. At the license key screen, enter license keys, and click Next.
23. On the components screen, choose desired components, and click Next.
24. On the user credentials screen, enter the password, and click Next.

25. On the summary screen, click Install.
26. After installation completes, click Finish.
27. After configuration of the appliance completes, click Exit. Do not shut down the appliance until automatic disk provisioning is complete. You can check the status of this operation on the Appliance Console.
28. On the PowerVault DL Backup To Disk Appliance Console, click Launch Symantec Backup Exec.
29. Click OK when the application prompts you regarding the disk configuration changes.
30. On the Device Warning screen, click OK when the application informs you of the configuration of the deduplication folder.
31. Open Backup Exec 2010, click Tools, Backup Exec Services, and click Restart All Services.
32. Click OK upon completion of the services being restarted.
33. Click Tools, Options, and click Device and Media.
34. Select the Deduplication Storage Folder 1 storage device as the default storage location.
35. Open Backup Exec 2010, and click Tools, LiveUpdate to download the latest updates for the Backup Exec 2010.

Installing the Symantec Remote Agent on the file server

1. Log into the file server.
2. Map a drive to the C:\ root share of the Dell PowerVault DL2100 appliance. Use command line text as follows:

```
net use x: \\dl2100hostname\c$
```

3. While in the context of the mapped drive, navigate to X:\Program Files\Symantec\Backup Exec\Agents\RAWXS64 using the following command line text:

```
cd X:\Program Files\Symantec\Backup Exec\Agents\RAWXS64
```

4. Execute the setupaax64.cmd file to install the remote agent.

Setting up the Remote Agent Direct Access

1. Open Symantec Backup Exec 2010.
2. Click the Devices tab.
3. Click the Configure devices assistant.
4. Click Remote Agent with Direct Access.
5. Provide the fully qualified server name of the server running the agent you wish to provide direct access to.
6. Click OK.

Setting up the Backup to Disk folder (only when using the backup-to-disk scenario)

1. Configure the Dell PowerVault DL2100 as above, choosing not to auto-provision storage and choosing not to create deduplication folders.
2. Open Symantec Backup Exec 2010.
3. Click the Devices tab.
4. Click the Configure devices assistant.
5. Click Backup to Disk folder.
6. If the application asks about configuring additional storage devices, click Yes.
7. Click Next.
8. Name the backup to disk folder.
9. Provide the path to the folder, and click OK.
10. Click Next.
11. On the Maximum Size screen, choose No, and click Next.
12. Type 200 for the maximum size (GB) for the backup-to-disk file. This is adjustable.
13. Click Next.
14. Type 250 for the maximum number of backup sets per backup-to-disk file.
15. On the concurrent jobs screen, click Next.

16. On the low disk space threshold screen, enter the low space threshold for your environment, and click Next.
17. Click Next to finish the configuration.

Configuring the backup job

1. Open Symantec Backup Exec 2010.
2. Click the Job Setup tab.
3. Click New Job.
4. Browse Domains→Active Directory Domains→Domainname→Servername, and select the folder containing the 50GB file set. All subfolders should be auto-selected.
5. Under Destination, click Device and Media.
6. When running a deduplication scenario, select Deduplication Storage Folder. When running a backup to disk scenario, select the Backup To Disk device.
7. When running a deduplication scenario, ensure the Allow this job to have direct access to the device checkbox is checked. This enables source deduplication.
8. Under Settings, click General.
9. Uncheck the Verify after backup completes checkbox.
10. Click Run Now.

Setting up and configuring the load-generating client

For the file manipulation scripts, we used a workstation client machine to simulate a number of users putting a load on the server. For our client, we installed Microsoft Windows Vista Ultimate and Microsoft Office 2007 Professional, as the AutoIT test executable requires these components. We accepted all defaults as part of the Windows Vista and Microsoft Office installation process.

Performing the test

To perform the test, we created a backup job in the Symantec Backup Exec 2010 console, then used a combination of batch files and the bemcmd.exe utility to execute our workload and backup jobs from our client machine.

The testing procedure consisted of the following general steps:

1. Copy the initial 50GB data set to our file server.
2. Create a backup job in Symantec Backup 2010 console, choosing the deduplication storage folder as the destination, and also selecting the option to allow the remote agent to have direct access to the Dell PowerVault DL2100.
3. Run the backup job to initially backup the file share to the media server.
4. Execute the custom AutoIT workload to simulate one business day of activity, modifying approximately 3 percent of Microsoft Office files, and copying, deleting, and moving other files.
5. Rerun the backup job in Symantec Backup Exec 2010.
6. Repeat steps 4 and 5 through the end of testing.
7. Export the job details results data.

For the backup to disk scenario, we performed similar tasks as above, but targeted the backup destination to the backup to disk device, as opposed to the deduplication storage folder device.

Appendix A – Test server information

Figure 5 presents detailed information for the test servers we used in this report.

Servers	Dell PowerEdge R710	Dell PowerVault DL2100
General dimension information		
Height (inches)	3.50	3.50
Width (inches)	17.50	17.50
Depth (inches)	27.00	27.00
U size in server rack (U)	2	2
General processor setup		
Number of processor packages	2	2
Number of cores per processor package	4	4
Number of hardware threads per core	2	2
CPU		
Vendor	Intel	Intel
Name	Xeon E5540	Xeon E5520
Stepping	D0	D0
Socket type	LGA1366	LGA1366
Core frequency (GHz)	2.53	2.26
L1 cache	32 KB + 32 KB (per core)	32 KB + 32 KB (per core)
L2 cache	1 MB (4 x 256 KB)	1 MB (4 x 256 KB)
L3 cache (MB)	8	8
Platform		
Vendor and model number	Dell PowerEdge R710	Dell PowerVault DL2100
Motherboard model number	00W9X3	0M233H
Motherboard revision number	A03	X02
BIOS name and version	Dell 1.3.6	Dell 1.3.6
Memory modules		
Total RAM in system (GB)	24	48
Vendor and model number	Micron MT36JSZF51272PY-1G4D1AB	Samsung M393B1K70BH1-CF8
Type	PC3-10600 DDR3	PC3-8500 DDR3
Speed (MHz)	1,333	1,067
Speed in the system currently running @ (MHz)	1,067	1,067
Timing/latency (tCL-tRCD-iRP-tRASmin)	7-7-7-20	7-7-7-20
Size (GB)	24	48
Number of RAM modules	6 x 4 GB	6 x 8 GB
Chip organization	Double-sided	Double-sided

Servers	Dell PowerEdge R710	Dell PowerVault DL2100
Hard disk		
Vendor and model number	Seagate ST973451SS	Western Digital WD1602ABKS
Number of disks in system	8	6
Size (GB)	73	160
Buffer size (MB)	16	8
RPM	15,000	7,200
Type	SAS	SATA
Controller	Dell PERC 6/i Integrated RAID Controller	Dell PERC 6/i Integrated RAID Controller
Driver version	LSI 4.5.0.64 (02/06/2009)	Dell 2.24.0.64 (01/19/2009)
Operating system		
Name	Windows Server 2008 R2 Enterprise	Windows Server 2008 Standard
Build number	7600	6002
File system	NTFS	NTFS
Language	English	English
Network card/subsystem		
Vendor and model number	Broadcom BCM5709C NetXtreme II	Broadcom BCM5709C NetXtreme II
Type	Integrated	Integrated
Driver version	Microsoft 4.8.4.1 (12/23/2008)	Broadcom 5.0.15.0 (10/2/2009)
Optical drive		
Vendor and model number	TEAC DV28SV DVD-ROM	PLDS DVD+-RW DS-8A3S
USB ports		
Number	4	4
Type	2.0	2.0

Figure 5: Detailed system configuration information for the two test servers.

Appendix B – Detailed test results

Figures 6 and 7 present detailed results of our tests using source deduplication and our test using a backup-to-disk folder.

Dell PowerVault DL2100 powered by Symantec Backup Exec 2010 <i>with source deduplication</i>				
Backup number	Job time (HH:MM:SS)	Job rate (MB/min)	Deduplication ratio	Total backup size (GB)
1	6:00:28	143	1.1:1	49.99
2	0:23:36	2,419	3.5:1	50.37
3	0:20:31	2,844	15.2:1	50.84
4	0:20:11	2,924	17.3:1	51.03
5	0:21:07	2,809	20.9:1	51.54
6	0:21:51	2,798	26.0:1	51.88
7	0:21:26	2,805	24.6:1	52.29
8	0:21:48	2,771	28.2:1	52.64
9	0:22:21	2,716	31.7:1	53.02
10	0:22:02	2,790	31.0:1	53.45
11	0:23:21	2,701	26.1:1	53.86
12	0:22:23	2,770	26.0:1	54.06
13	0:23:31	2,646	27.3:1	54.58
14	0:24:12	2,581	42.2:1	54.99

Figure 6: Backup metrics when using source deduplication.

Dell PowerVault DL2100 powered by Symantec Backup Exec 2010 <i>without source deduplication</i>		
Job time (HH:MM:SS)	Job rate (MB/min)	Total backup size (GB)
6:05:29	140	49.99

Figure 7: Backup metrics when using no source deduplication.

About Principled Technologies

We provide industry-leading technology assessment and fact-based marketing services. We bring to every assignment extensive experience with and expertise in all aspects of technology testing and analysis, from researching new technologies, to developing new methodologies, to testing with existing and new tools.

When the assessment is complete, we know how to present the results to a broad range of target audiences. We provide our clients with the materials they need, from market-focused data to use in their own collateral to custom sales aids, such as test reports, performance assessments, and white papers. Every document reflects the results of our trusted independent analysis.

We provide customized services that focus on our clients' individual requirements. Whether the technology involves hardware, software, Web sites, or services, we offer the experience, expertise, and tools to help you assess how it will fare against its competition, its performance, whether it's ready to go to market, and its quality and reliability.

Our founders, Mark L. Van Name and Bill Catchings, have worked together in technology assessment for over 20 years. As journalists, they published over a thousand articles on a wide array of technology subjects. They created and led the Ziff-Davis Benchmark Operation, which developed such industry-standard benchmarks as Ziff Davis Media's Winstone and WebBench. They founded and led eTesting Labs, and after the acquisition of that company by Lionbridge Technologies were the head and CTO of VeriTest.



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