

# IBM ServeRAID-M5015 RAID controller simplified storage management

**More efficient initial setup**

**Greater flexibility with configuration options**

**Safer and better drive management**



IBM System x3650 M3 server with the IBM ServeRAID-M5015 RAID controller using LSI™ technology



HP ProLiant DL380 G7 server with HP Smart Array P410i RAID controller



## OUR FINDINGS

The IBM® ServeRAID®-M5015 RAID controller offers the following advantages over the HP Smart Array P410i RAID controller:

- **More efficient custom RAID setup process.** The IBM solution reduced setup time by up to 86.4 percent (less than 5 minutes vs. more than 35 minutes for the 8KB custom stripe size).
- **Greater flexibility in configuration options to get the most out of your server.** To test this, we compared key configuration features of each product.
- **Safer and better drive management features.** To test this, we compared the available drive management options of each product.

## OUR PROCESS

We performed our RAID controller operations on the IBM System x3650 M3 server using the IBM ServeRAID-M5015 RAID controller and on the HP ProLiant DL380 G7 server using the HP Smart Array P410i RAID controller. We then compared setup time as well as the available features that the IBM and HP controllers offered, and determined which RAID storage management solution offers a more robust set of features. In the *What we found* section, we present the results in terms of setup time and configuration features each RAID storage management solution offers.



## PROJECT OVERVIEW

We configured the following pair of 2U servers from IBM and HP and matched the hardware and operating systems as closely as possible:

- IBM System x3650 M3 server with the IBM ServeRAID-M5015 RAID controller (IBM solution)
- HP ProLiant DL380 G7 server with the HP Smart Array P410i RAID controller (HP solution)

Following initial RAID group setup, we ran Microsoft® Windows Server® 2008 R2 Enterprise Edition on both servers. For our testing, we used the MegaRAID Storage Manager™ version 6.9.0600 with the IBM System x3650 M3 server and the HP Array Configuration Utility version 8.50.5.0 with the HP ProLiant DL380 G7 server. *Appendix A* provides complete configuration information for the two servers.

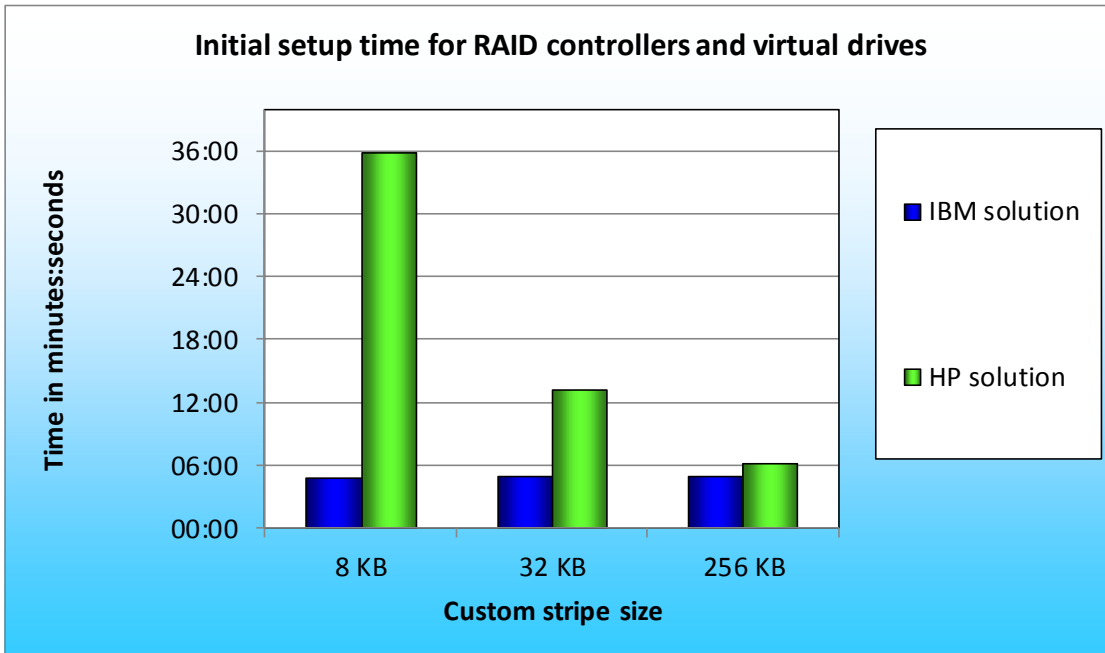
We evaluated both the IBM and HP RAID solutions in the following three areas: custom setup time, RAID configuration features, and drive management.

## WHAT WE FOUND

The IBM solution offers more configurable features than the HP solution, resulting in less time spent in initial setup as well as allowing more customizations to meet specific storage needs. The IBM solution also provides safer and better integrated drive management features than the HP solution.

### Custom setup time

As Figure 1 shows, when performing a custom initial setup of the RAID controllers and virtual drives, the IBM solution is much speedier and less sensitive to custom stripe size than the HP solution, reducing setup time by 86.4 percent, 63.0 percent, and 20.5 percent depending on stripe size.



**Figure 1. Initial setup time, in minutes, for the IBM solution and HP solution. Lower numbers are better.**

For the custom setup portion of our testing, we measured the time needed to set up and customize each server in a RAID 5 configuration using the non-default stripe sizes of 8 KB, 32 KB, and 256 KB as the variable feature. We then compared the total setup time of our custom RAID 5 configurations, excluding tasks like OS or individual software installations across both servers. During our timed runs, we used a minimal RAID 5 configuration of three third-party Intel® SSDs with each server to eliminate any unfair advantages due to differing drive sizes or to the way the HP server controller handles default background initialization. We performed three timed runs for each stripe size, measuring the time to create the RAID virtual drive, the time to complete initialization, the time required to complete the virtual drive customization, and additional time for background initialization or parity checks. For the IBM solution, we configured and initialized the RAID using the WebBIOS utility. For the HP solution, we used the HP RAID BIOS to create the virtual drive, and the HP Array Configuration Utility following OS installation to complete any customization.

Figure 2 presents the median setup time for the IBM solution and the HP solution using various stripe sizes as the customized feature in the virtual drive. The IBM solution provides significant setup time savings, and its setup time is quite insensitive to stripe size. The IBM solution also allows full customization of all available features for the RAID controller from the integrated WebBIOS, while the HP solution allows configuration of only a limited set of its available features from the integrated RAID BIOS. This latter IBM feature lets you avoid using a DVD to boot into a special deployment tool to access additional controller features. It also saves time because you need not make changes to the virtual drive settings after installing the OS and RAID controller software.

RAID 5 median run	8 KB stripe size		32 KB stripe size		256 KB stripe size	
	IBM solution	HP solution	IBM solution	HP solution	IBM solution	HP solution
Time to create RAID group	01:56.8	00:11.3	01:55.5	00:14.4	01:56.3	00:12.2
Full initialization	02:55.6	N/A	02:59.0	N/A	03:00.1	N/A
Time to complete additional customizations	N/A	04:37.5	N/A	01:57.1	N/A	01:08.8
Additional background parity initialization time	N/A	31:06.5	N/A	11:04.7	N/A	04:51.6
<b>Total time (mm:ss)</b>	04:52.4	35:55.3	04:54.5	13:16.2	04:56.4	06:12.6

Figure 2. Comparison of median setup times for the IBM solution vs. the HP solution. Lower times are better.

### RAID configuration features

The additional features offered by the IBM solution allow easier fine-tuning of the server to perform in a target environment, as opposed to the more limited set of features offered by the HP solution. The IBM solution provides distinct RAID configuration advantages due to its ability to set read, write, and I/O policy options, and to provide simultaneous drive expansion and migration, both of which can simplify tuning for optimal performance in varying workload environments.

### Individual read, write, and I/O policy options

Unlike the HP solution, the IBM solution lets you configure the read, write, and I/O policy options independently. Being able to access these features individually lets you fine-tune virtual drives to obtain maximum drive performance from the hardware.

Specifically, you can set the write policy to *write-back* or *write-through*, the I/O policy to *direct* or *cached*, and the read policy to *no read ahead* or *read ahead*. To illustrate the advantages of these options, we first use the example of fine-tuning for enterprise SSD performance, and then address specific types of uses for a virtual drive.

When configuring a RAID virtual drive with enterprise SSDs, you can maximize overall performance by setting the write policy to *write-through* and setting the I/O policy to *direct I/O*. These settings maximize the advantage of the flash technology of enterprise SSDs, because the RAID controller makes reads and writes directly to the drives rather than first routing them through cache memory. This is the opposite case of maximizing performance for HDDs, which benefit from having the controller's cache buffer reads and writes. Additionally, the ability to customize the read policy lets you further maximize virtual drive performance based on the task(s) for which you are using the virtual drive. The read policy affects performance based on whether the RAID controller writes and accesses data on the drive in a sequential order or in random order. For example, if the server is performing database activity, users perform queries that are constantly accessing information written on different parts of the drive. This type of activity is random, and benefits from disabling the read ahead policy. On the other hand, when accessing data written sequentially, such as log files, enabling the read ahead policy for that virtual drive allows the RAID controller to read ahead and have the data readily accessible.

#### [Simultaneous logical drive expansion and migration](#)

Using the IBM solution, you can simultaneously expand an existing RAID group to add more drives and migrate the whole group to another RAID level. For example, you can migrate directly in one operation from a single-drive RAID 0 directly to a two-drive RAID 1 or a three-drive RAID 5. The HP solution requires you to perform two separate operations to achieve the same result: (1) expand the existing RAID group to include the additional drives and then (2) migrate to the desired RAID level.

## Drive management

The IBM solution and MegaRAID Storage Manager software offers several additional drive management features that the HP solution and Array Configuration Utility do not. These include providing customizable notification options to warn you when a virtual disk enters a degraded state and protecting critical virtual drives from operations that would render the operating system unusable.

Although both solutions with their respective storage management software can detect a failed drive, only the IBM solution and MegaRAID Storage Manager software provides a pop-up window notification on the server in addition to offering a built-in email notification feature when a drive fails. Figure 3 compares the features for each solution's RAID controller in relation to drive failure management.

	IBM solution	HP solution
Alert within RAID management software	Yes	Yes
Pop-up notification	Yes	No
Built-in email notification	Yes	No

**Figure 3: Drive failure management features for the IBM and HP solutions.**

Additionally, the IBM solution with LSI technology and MegaRAID Storage Manager software has integrated features that protect the virtual drive containing the operating system whereas the HP solution does not. This integrated safety barrier prevents the accidental initialization or deletion of the virtual drive containing the operating system from within the MegaRAID Storage Manager, potentially saving you from a mistake that is costly in terms of both time and data loss.

## HOW WE TESTED

### Configuring and testing the IBM System x3650 M3

#### Accessing the RAID WebBIOS on IBM System x3650 M3

1. Boot the system.
2. When the application prompts you to do so, press F1 to enter Setup.
3. In the System Configuration and Boot Management screen, highlight System Settings, and press Enter.
4. Highlight Adapters and UEFI Drivers, and press Enter.
5. Press Enter to compile the list of drivers.
6. Under LSI EFI SAS Driver, select the first option (I-PciRoot...), and press Enter.

7. When the application prompts you to do so, press 1 for WebBIOS.

#### Setting up a test volume on IBM System x3650 M3

1. When the LSI GUI loads, select the adapter (ServeRAID M5015 SAS/SATA Controller), and click Start.
2. In the left-hand WebBIOS pane, click Configuration Wizard.
3. Under Please choose appropriate configuration type, select New Configuration, and click Next.
4. At the Are you sure you want to clear the configuration? prompt, click Yes.
5. Under Select Configuration Method, select Manual Configuration, and click Next.
6. In the Drive Group Definition window, select the first drive (Slot 0) in the Drives pane, and click Add to Array.
7. Repeat Step 6 for the remaining drives.
8. When you have added all the appropriate drives, click Accept DG in the Drive Groups pane.
9. Click Next.
10. In the Span Definition window, select the appropriate drive group in the Array With Free Space pane, and click Add to Span. Repeat this with other drive groups if necessary.
11. Click Next.
12. In the Virtual Drive Definition window, select the appropriate RAID Level, and click Accept.
13. At the Confirm the selected write policy prompt, click Yes.
14. Click Next.
15. In the Configuration Preview window, click Accept.
16. At the Save this Configuration? prompt, click Yes.
17. At the Do you want to Initialize prompt, click Yes.
18. In the Virtual Drives pane, select Slow Initialize, and click Go.
19. At the Do you want to proceed with initialization? prompt, click Yes.
20. When Initialization is complete, click Home.
21. Press Ctrl+Alt+Delete to reboot the system.

#### Installing MegaRAID Storage Manager on IBM System x3650 M3

1. Download MegaRAID Storage Manager for Windows v. 6.9.0600 from <http://www-947.ibm.com/support/entry/portal/docdisplay?Indocid=MIGR-5077712>
2. Double-click setup.exe.
3. At the InstallShield Wizard window for installing requirements, click OK.
4. Click Yes to install Microsoft Visual C++ 2005.
5. At the Welcome screen for the InstallShield Wizard, click Next.
6. Accept the terms in the license agreement, and click Next.
7. At the Customer Information screen, fill in the appropriate information, and click Next.
8. Accept the Default destination folder, and click Next.
9. Leave the default Setup Type as Complete, and click Next.

10. Click Install.
11. Click Finish.

#### Viewing configuration options via the MegaRAID Storage Manager

1. Double-click the MegaRAID Storage Manager desktop icon.
2. Select the Host server for the appropriate controller, and click Login.
3. Enter the login Username and Password, leave the Login mode at the default of Full Access, and click Login.
4. View the configuration and other options by navigating the Dashboard, Physical, and Logical tabs on the upper left corner of the screen.

#### Setting up email notifications on MSM

1. Double-click the MegaRAID Storage Manager desktop icon.
2. Select the Host server for the appropriate controller, and click Login.
3. Enter the login Username and Password, leave the Login mode at the default of Full Access, and click Login.
4. At the MegaRAID Storage Manager window, click Tools, Configure Alerts.
5. In the Configure Alerts window, click the Mail Server tab, and enter the appropriate mail server information.
6. Click the Email tab, and enter the appropriate recipient email address.

### Configuring and testing the HP ProLiant DL380 G7

#### Accessing the RAID BIOS on the HP ProLiant DL380 G7

1. Boot the server.
2. When the window prompts you to Press any key to view Option ROM messages, press any key.
3. When the HP Smart Array P410i Controller posts, press F8 when the application prompts you to enter the Option ROM Configuration.

#### Setting up a test volume on the HP ProLiant DL380 G7

1. On the Main Menu, select Create Logical Drive, and press Enter.
2. All drives should be selected by default, but if they are not, select each one by highlighting it and pressing the Space Bar.
3. Press Tab to navigate to the RAID Configuration pane, select the appropriate RAID level, and press Enter.
4. At the notification screen, press F8 to save the configuration.
5. At the Configuration saved screen, press Enter to continue.
6. Press Esc to exit.

#### Installing the HP Array Configuration Utility

1. Download the ProLiant Support Pack for Microsoft Windows Server 2008 R2 from <http://h20000.www2.hp.com/bizsupport/TechSupport/SoftwareDescription.jsp?lang=en&cc=us&prodTypeId=15351&prodSeriesId=4091412&prodNameId=4091432&swEnvOID=4064&swLang=13&mode=2&taskId=135&swItem=MTX->



[358b3bcb8b5241ceb740ccdd6d](#) and follow HP's instructions on how to prepare the installer.

2. Open the installer (hpsum.exe).
3. In the Source Selections window, accept the defaults, and click Start Inventory.
4. In the Select Installation Host(s) window, select Local Host, and click Next.
5. In the Select Bundle Filter window, check the box next to ProLiant Support Pack for Microsoft Windows Server 2008 R2, and click OK.
6. In the Select Items to be Installed window, accept the defaults, and click Install.

#### Viewing configuration options via HP Array Configuration Utility

1. Open the utility by clicking Start→All Programs→HP System Tools→HP Array Configuration Utility→HP Array Configuration Utility.
2. Under the configuration tab, use the drop-down menu to select an available device, and choose Smart Array P410i in Embedded Slot.
3. Use the options on this screen to view configuration and available options.

#### Testing drive failure notification

To test drive failure notifications, we set up two additional virtual drives in a RAID 5. To simulate the failure of a drive, we physically removed a drive from one of these virtual drives while the server was in operation, using the following steps.

1. Reboot the server.
2. Log into the administrator account in Windows Server 2008 R2.
3. Physically remove one of the drives and observe for any warning notifications regarding the drive failure.
4. Open the corresponding RAID storage management software and observe for any warning notifications regarding the drive failure.
5. Repeat steps 1 through 4 two more times.

#### Timing RAID configuration on the HP ProLiant DL380 G7

To time this task, we used the Robic SC-888 Triple Timer stopwatch.

#### Timing RAID virtual drive creation

1. Boot the server.
2. When the window prompts you to Press any key to view Option ROM messages, press any key.
3. When the HP Smart Array P410i Controller posts, press F8 when the application prompts you to enter the Option ROM Configuration.
4. On the Main Menu, select Create Logical Drive, and press Enter and simultaneously start timing.
5. Ensure that all drives are selected and press Tab to navigate to the RAID Configuration pane, select RAID level 5, and press Enter.
6. At the notification screen, press F8 to save the configuration.

7. At the Configuration saved screen, press Enter to continue and stop timing.

#### Timing RAID virtual drive customization

Following installation of OS, drivers, and the Array Configuration utility, complete the following steps.

1. Click Start→All Programs→HP System Tools→HP Array Configuration Utility→HP Array Configuration Utility.
2. In the Select an available device drop-down menu, select SmartArray P410i in Embedded Slot.
3. In the left pane under Systems and Devices, expand the array, select the logical drive, and click More Information. Verify that the parity initialization has completed before continuing. The status of the initialization is posted in the Logical Drive chart under Parity Initialization Status. For updates to this status, click Refresh under System Status (in the left pane,) and click More Information again.
4. In the left pane under Systems and Devices, select the target Logical Drive.
5. Simultaneously click Migrate RAID/Stripe Size in the right pane and start the Triple Timer stopwatch.
6. Leave the Fault Tolerance at RAID 5. Under Stripe size select 8 KB from the drop-down menu, and click Save.
7. The status of the stripe size migration will be posted by the logical drive in the left pane under Systems and Devices. When it says (Transforming 100%), continually click Refresh under System Status; when the Transforming status disappears, immediately press the split time button on the stopwatch.
8. Using the method in step 3, monitor the Parity Initialization Status of the logical drive. When the status says Initialization Complete, stop the stopwatch.
9. Record the times from steps 7 and 8.
10. Repeat steps 1 through 9 a total of three times for each of the three stripe sizes at 8 KB, 32 KB, and 256 KB.

#### Timing RAID configuration on the IBM System x3650 M3

To time this task, we used the Robic SC-888 Triple Timer stopwatch.

#### Timing RAID virtual drive creation

1. Boot into the LSI MegaRAID BIOS Config Utility Virtual Configuration WebBIOS.
2. Simultaneously click Configuration Wizard and start the stopwatch.
3. Select Add Configuration, and click Next.
4. In the Select Configuration window, select Virtual Drive Configuration, and click Next.
5. In the Select Configuration Method window, select Manual Configuration, and click Next.

6. Under the Drives pane in the Drive Group Definition window, select all three available drives by clicking in the pane, holding down Shift, and pressing the down arrow key three times.
7. Click Add to Array.
8. Under the Drive Groups pane in the Drive Group Definition window, click Accept DG, and click Next.
9. In the Span Definition window click Add to SPAN, and click Next.
10. In the RAID configuration window, verify that RAID 5 is selected, set the Stripe Size to 8 KB, enter 57.740 into the Select Size field, and click Accept.
11. When asked if you want to proceed with the selected write policy, click Yes.
12. Click Next.
13. In the Configuration Preview window, click Accept.
14. When asked Save this Configuration, click Yes.
15. When warned that All the data...will be lost, click Yes to initialize. This begins a fast initialization.
16. As soon as the fast initialization is complete, stop the stopwatch. Note: The initialization is complete when Virtual Drives pane displays the word Optimal next to VD0:RAID5:57.740GB.
17. Select Slow Initialize, and click Go.
18. When warned that All data...will be lost, simultaneously click Yes and start the stop watch.
19. As soon as the initialization is complete, stop the stopwatch. Note: The initialization is complete when Virtual Drives pane displays the word Optimal next to VD0:RAID5:57.740GB:
20. Record the times from steps 16 and 19.
21. Under the Virtual Drives pane, make sure that the VD0 is highlighted, select Properties, and click Go.
22. Under Operations, select Delete, and click Go.
23. When asked Are you sure you want to delete Virtual Drive 0, click Yes.
24. Repeat steps 1 through 23 two more times, completing three runs each for stripe sizes 8 KB, 32 KB, and 256 KB.

## APPENDIX A – SERVER CONFIGURATION INFORMATION

Figure 4 provides detailed configuration information for the two test servers.

System	IBM System x3650 M3 (7945)	HP ProLiant DL380 G7
<b>Power supplies</b>		
Total number	2	2
Vendor and model number	Emerson 7001484-J000 Rev H	HP DPS-750RB A
Wattage of each (W)	675	750
<b>Cooling fans</b>		
Total number	3	6
Vendor and model number	IBM 46M6416	Nidec Ultraflo V60E12BS1A7-09A032
<b>General</b>		
Number of processor packages	2	2
Number of cores per processor	4	4
Number of hardware threads per core	2	2
System power management policy	Balanced	Balanced
<b>CPU</b>		
Vendor	Intel	Intel
Name	Xeon®	Xeon
Model number	E5620	E5620
Stepping	2	2
Socket type	Socket 1366 LGA	Socket 1366 LGA
Core frequency (GHz)	2.40	2.40
Bus frequency (MHz)	5.8 GT/s	5.8 GT/s
L1 cache	32 KB + 32 KB (per core)	32 KB + 32 KB (per core)
L2 cache	256 KB (per core)	256 KB (per core)
L3 cache	12 MB (shared)	12 MB (shared)
<b>Platform</b>		
Vendor and model number	IBM System x3650 M3 (7945)	HP ProLiant DL380 G7
Motherboard model number	IBM 69Y4438	ProLiant DL380 G7
Motherboard chipset	Intel 5520	Intel 5520

System	IBM System x3650 M3 (7945)	HP ProLiant DL380 G7
BIOS name and version	IBM Corp. D6E148BUS-1.08	HP v.P67 (05/14/2010)
BIOS settings	Default	Default
<b>Memory module(s)</b>		
Total RAM in system (GB)	24	24
Vendor and model number	IBM 47J0156	Samsung M393B5270CH0-CH9Q4
Type	PC3-10600R	PC3-10600R
Speed (MHz)	1,333	1,333
Speed running in the system (MHz)	1,067	1,067
Timing/Latency (tCL-tRCD-tRP-tRASmin)	7-7-7-20	7-7-7-20
Size (GB)	4	4
Number of RAM module(s)	6 x 4 GB	6 x 4 GB
Chip organization	Double-sided	Double-sided
Rank	Dual	Dual
<b>Disk controller</b>		
Vendor and model	IBM ServeRAID M5015	HP Smart Array P410i Controller
Controller cache	512 MB	512 MB
Controller driver	LSI Corp. 4.31.1.64 (2/4/2010)	HP 6.20.0.64 (02/22/2010)
Controller firmware	12.7.0.0013	3.00
Standard RAID levels available	0, 1, 5, 10, 50	0, 1, 5, 10, 50
Optional RAID levels available	6, 60	6, 60
<b>Operating system</b>		
Name	Windows Server 2008 R2	Windows Server 2008 R2
Build number	7600	7600
Service pack	Service Pack 1	NA
File system	NTFS	NTFS
Kernel	ACPI x64-based PC	ACPI x64-based PC
Language	English	English
<b>Graphics</b>		
Vendor and model number	Matrox G200eV (Maxim)	ATI ES1000
Graphics memory	8 MB	64 MB

System	IBM System x3650 M3 (7945)	HP ProLiant DL380 G7
Driver	Matrox® Graphics Inc. 1.1.3.0 (10/28/2009)	ATI Technologies 8.240.50.5000 (06/23/2009)
<b>Ethernet</b>		
Vendor and model number	Broadcom® BCM5709C NetXtreme® II GbE	HP NC382i DP Multifunction Gigabit Server Adapter
Type	Integrated	Integrated
Driver	Broadcom 5.2.14.0 (12/17/2009)	HP 5.2.14.0 (12/17/2009)
<b>Optical drive(s)</b>		
Vendor and model number	HL-DT-ST GT30N	NA
Type	DVD-RW	NA
<b>USB ports</b>		
Number	4 external	4 external
Type	2.0	2.0

Figure 4: Configuration information for the test servers.

Figure 5 provides detailed SSD configuration information for the two test servers during the setup time testing.

System	IBM System x3650 M3 (7945)	HP ProLiant DL380 G7
<b>Drive</b>		
Vendor and model number	Intel SSDSA2SH032G1GN	Intel SSDSA2SH032G1GN
Number of drives in system	3	3
Size (GB)	32	32
Buffer size (MB)	N/A	N/A
RPM	N/A	N/A
Type	SATA	SATA

Figure 5: Drive configuration for setup time testing.

Figure 6 provides detailed drive configuration information for the two test servers during the feature comparison testing.

System	IBM System x3650 M3 (7945)	HP ProLiant DL380 G7
<b>Drive</b>		
Vendor and model number	Intel SSDSA2SH032G1GN	HP MK0060EAVDR
Number of drives in system	8	8
Size (GB)	32	60
Buffer size (MB)	N/A	N/A
RPM	N/A	N/A
Type	SATA	SATA

Figure 6: Drive configuration for feature comparison testing.

## ABOUT PRINCIPLED TECHNOLOGIES



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