

SERVICEABILITY COMPARISON: DELL PCIe EXPRESS FLASH SSDs VS. HP IO ACCELERATORS

EXECUTIVE SUMMARY

Advances in PCIe flash storage technologies are enabling remarkable throughput in today's servers. Server manufacturers are now taking this technology to the next level by focusing on the serviceability of these same technologies. Simplifying common tasks such as installing PCIe flash devices or expanding existing storage can free up your IT staff for innovation. We tested the serviceability of two PCIe flash server-storage solutions—a Dell PowerEdge R820 server with Dell PowerEdge PCIe Express Flash SSDs (Dell PCIe Express Flash solution) and an HP ProLiant DL585 G7 server using HP IO Accelerators for ProLiant Servers (HP IO Accelerator solution).

While the initial physical installation of the Dell PCIe Express Flash SSD storage device took more time and more steps than installing the first HP IO Accelerator in the HP server, the Dell PCIe Express Flash solution was significantly easier to service in all other scenarios. With the Dell PCIe Express Flash solution, setting up the volumes for SSD deployment was dramatically easier than with the HP IO Accelerator solution—it took only 1 minute and 0 seconds to have it up and running, 98.0 percent less time than the HP IO Accelerator solution's 49 minutes and 0 seconds. We then added more storage to each solution, and found that the Dell PCIe Express Flash solution was again easier and quicker by 93.0 percent and required no user downtime. We needed only insert an SSD into the outside slot, while the HP IO Accelerator solution required us to power down the server and open the top access panel to add another storage card. The same would be true for adding any additional storage card; the HP requires a power down and user downtime while the Dell is as simple as adding a hot-swap drive. Figure 1 shows the times and number of steps it took to complete each task with the two solutions.

| | Dell PCIe Express Flash solution | HP IO Accelerator solution | Dell win |
|--------------------------------------|----------------------------------|----------------------------|----------|
| Initial physical installation | | | |
| Time (minutes:seconds) | 15:15 | 08:55 | |
| Number of steps | 8 | 5 | |
| Volume setup | | | |
| Time (minutes:seconds) | 1:00 | 49:00 | 98.0% |
| Number of steps | 5 | 29 | 82.8% |
| Adding storage | | | |
| Time (minutes:seconds) | 0:40 | 9:30* | 93.0% |
| Number of steps | 6 | 14* | 57.1% |

Figure 1: Serviceability testing results for the two solutions. Less time and fewer steps are better. *The HP solution requires powering off and opening the server to add more capacity.

The sections below detail the steps and times it took to complete the tasks for both solutions. [Appendix A](#) presents configuration information for the servers we tested, and [Appendix B](#) details our methodology.



Initial physical installation

Figure 2 presents our detailed findings for the physical setup for SSD deployment and configuration when we used the Dell PCIe Express Flash solution and the HP IO Accelerator solution. Note: For both servers, we assume that Windows Server 2008 R2 SP1 has already been installed and updated.

| Dell PCIe Express Flash solution 8 steps (15 min, 15 sec) | HP IO Accelerator solution 5 steps (8 min, 55 sec) |
|---|---|
| <ol style="list-style-type: none"> 1. Power down the server. (30 sec) 2. Disconnect the power cables, slide the server out using the rails, and remove the top access panel. (1 min) 3. Remove the fan module, and install the backplane to be used. (1 min, 20 sec) 4. Install the PCIe pass-through card. (1 min) 5. Install cabling from the new backplane to the PCIe pass-through card. (4 min) 6. Replace the fan module and top access panel, slide the server back into position, and reconnect all power cables. (45 sec) 7. Plug the SSD into the open bay slot. (10 sec) 8. Power the server on, and log in. (6 min, 30 sec) | <ol style="list-style-type: none"> 1. Power down the server. (30 sec) 2. Disconnect the power cables, slide the server out using the rails, and remove the top access panel. (1 min) 3. Install the HP IO Accelerator card. (40 sec) 4. Replace the top access panel, slide the server back into position, and reconnect all power cables. (1 min) 5. Power the server on, and log in. (5 min, 45 sec) |

Figure 2: Steps and times each solution required to install the initial components.

Volume setup

Figure 3 presents our detailed findings for the setup for SSD deployment and configuration with the two solutions. The HP IO Accelerator solution took 29 steps and a total of 49 minutes to complete setup, and required a firmware update—which took 35 minutes, 35 seconds—before the solution was operable. The Dell PCIe Express Flash solution, which took only 1 minute and five steps to completely set up, required no downloads and no such firmware update. Setting up the OS for SSD deployment and configuration for the Dell PCIe Express Flash solution took 98.0 percent less time and 82.8 percent fewer steps than with the HP IO Accelerator solution. Even excluding the lengthy firmware update, it took the HP IO Accelerator solution 13 minutes 25 seconds to complete setup, significantly longer than the 1 minute the Dell PCIe Express Flash solution required.

| Dell PCIe Express Flash solution 5 steps (1 min) | HP IO Accelerator solution 29 steps (49 min) |
|--|---|
| <p>Setting up new disk volumes (1 min)</p> <ol style="list-style-type: none"> 1. Once the server reboots, navigate to Disk Management. 2. At the prompt to initialize disks, keep defaults, and click OK. 3. Right-click on the unallocated disks, and select New Simple Volume. | <p>Installing HP IO Accelerator using all default settings (11 min, 55 sec)</p> <ol style="list-style-type: none"> 1. Ensure that no existing IO Accelerator drivers have been used. (10 sec) <ol style="list-style-type: none"> a. Open Device Manager. b. Two mass storage controllers should be listed with yellow bangs. |

| Dell PCIe Express Flash solution 5 steps (1 min) | HP IO Accelerator solution 29 steps (49 min) |
|---|--|
| <ol style="list-style-type: none"> 4. Click Next on the next four screens, and click Finish. 5. Check that the disks show up as normal. | <ol style="list-style-type: none"> 2. Download latest HP IO Accelerator from HP site (2.3.10 current). (2 min, 30 sec)+(2 min download) <ol style="list-style-type: none"> a. Extract zip file, which should contain two executable files. 3. Run HP_IO_Accelerator_SNMPDefault_2.3.10.110_x64.exe. 4. Click Next. 5. Check I accept. 6. Click Next. 7. Click Next. 8. Click Install. 9. Wait for install to finish. 10. Click Finish. (1 min, 5 sec) 11. Restart the server. (6 min, 10 sec) Installing HP IO Accelerator Manager (30 sec) 12. Run HP_IO_Accelerator_IO_Manager_3.1.0_x64.exe. 13. Click Next. 14. Click Next. 15. At the pop-up, click OK. 16. Click Install. 17. Wait for the install to finish. 18. Click Finish. 19. After installation is finished, IE will launch to access the management page. Close it for now. Updating the firmware on the device (35 min, 35 sec) 20. Open a command prompt. 21. Enter the following commands after verifying the firmware file is correct. <pre>cd c:\program files\hp io accelerator\utils fio-update-iodrive "C:\Program Files\HP IO Accelerator\Firmware\ioaccelerator_1070 53.fff"</pre> 22. Wait for the firmware update to finish completely. (29 min, 25 sec) 23. Restart the server. (6 min, 10 sec) Setting up new disk volumes (1 min) 24. Once server reboots, navigate to Disk Management. 25. At the prompt to initialize disks, keep defaults and click OK. |

| Dell PCIe Express Flash solution 5 steps (1 min) | HP IO Accelerator solution 29 steps (49 min) |
|---|--|
| | 26. Right-click on the unallocated disks and select New Simple Volume. 27. Click Next on the next four screens, and click Finish. 28. Repeat steps 26 and 27 for the next disk. 29. Check that the disks show up as normal. |

Figure 3: Steps and times each solution required to finish setup after the initial OS setup.

Adding storage

We compared how long it took to add more storage after initial setup and installation for both solutions, adding an SSD with the Dell PCIe Express Flash solution and another IO Accelerator card for the HP solution. The Dell approach of exposing four PCIe flash bays to the front of the server made adding additional capacity far easier than the HP approach of requiring discrete internal accelerator cards. Adding additional PCIe flash capacity to the Dell PowerEdge R820 took 93.0 percent less time and 57.1 percent fewer steps than with the HP IO Accelerator solution. Upgrading the HP IO Accelerator solution requires a server reboot and reconfiguration, activities which can lead to an increased risk of unplanned downtime. According to Emerson Network Power’s February 2011 study (<http://www.emersonnetworkpower.com/en-US/Brands/Liebert/Documents/White%20Papers/sl-24659.pdf>), such unplanned downtime can cost tens of thousands of dollars per incident. The hot-plug capabilities of the Dell PCIe Express Flash solution help avoid this potential downtime risk.

Figure 4 shows the steps we followed to add storage to the servers.

| Dell PCIe Express Flash solution 6 steps (40 seconds) | HP IO Accelerator solution 14 steps (9 min, 30 seconds) |
|--|--|
| <p>Adding the new storage (10 seconds)</p> <ol style="list-style-type: none"> 1. Insert the SSD into the server. <p>Setting up new disk volumes (30 seconds)</p> <ol style="list-style-type: none"> 2. Navigate to Disk Management. 3. At the prompt to initialize disks, keep defaults, and click OK. 4. Right-click on the unallocated disks, and select New Simple Volume. 5. Click Next on the next four screens, and click Finish. 6. Check that the disks show up as normal. | <p>Adding the new storage (8 min, 55 seconds)</p> <ol style="list-style-type: none"> 1. Power down the server. (30 sec) 2. Disconnect the power cables, slide the server out using the rails, and remove the top access panel. (1 min) 3. Install the IO Accelerator card. (40 sec) 4. Replace the top access panel, slide the server back into position, and reconnect all power cables. (1 min) 5. Power the server on, and log in. (5 min, 45 sec) <p>Setting up new disk volumes (35 seconds)</p> <ol style="list-style-type: none"> 6. Once server reboots, go to disk management. 7. At the prompt to initialize disks, keep defaults and click OK. 8. Right-click on the first unallocated disk, and select New Spanned Volume. |

| Dell PCIe Express Flash solution 6 steps (40 seconds) | HP IO Accelerator solution 14 steps (9 min, 30 seconds) |
|--|--|
| | <ol style="list-style-type: none"> 9. At the Welcome screen, click Next. 10. On the Select Disks screen, select the other available drive in the left box, and click the Add > button. 11. Click Next. 12. Click Next at the next two screens, and click Finish. 13. At the warning about converting basic disks to dynamic disks, click Yes. 14. Check that the disk shows up as normal. |

Figure 4: Steps and times each solution required to add an SSD after initial setup is complete.

CONCLUSION

Companies who invest in PCIe flash storage technologies benefit from devices that are quick and easy to service. While the Dell PCIe Express Flash storage device required more time upfront to install the first time, once in place it made setting up volumes and adding storage dramatically faster. Thanks to the Dell design and not needing to power down the server, we were able to complete each of these tasks in about 1 minute and we would expect no user downtime. In contrast, using the HP IO Accelerator solution setting up volumes took 49 minutes and adding storage took just under 10 minutes and could require significant user downtime or after-hours installation. These time savings and the lack of required downtime make the Dell PCIe Express Flash solution a good choice for your enterprise.

APPENDIX A – SERVER CONFIGURATION INFORMATION

Figure 5 provides detailed configuration information for the test servers.

| System | Dell PowerEdge R820 | HP ProLiant DL585 G7 |
|---------------------------------------|---------------------------|--------------------------|
| Power supplies | | |
| Total number | 2 | 4 |
| Vendor and model number | Dell E1100E-S0 | HP DPS-1200FB-1 A |
| Wattage of each (W) | 1,100 | 1,200 |
| Cooling fans | | |
| Total number | 6 | 4 |
| Vendor and model number | San Ace 60 9GA0612P1J611 | DC Brushless PFC0912DE |
| Dimensions (h x w) of each | 2.5" x 2.5" | 3.5" x 3.5" |
| Volts | 12 | 12 |
| Amps | 1.50 | 4.32 |
| General | | |
| Number of processor packages | 4 | 4 |
| Number of cores per processor | 8 | 16 |
| Number of hardware threads per core | 2 | 1 |
| System power management policy | Balanced | Balanced |
| CPU | | |
| Vendor | Intel | AMD |
| Name | Xeon | Opteron™ |
| Model number | E5-4650 | 6282 SE |
| Stepping | 7 | B2 |
| Socket type | LGA2011 | G34 |
| Core frequency (GHz) | 2.70 | 2.60 |
| Bus frequency (GT/s) | 8.0 | 6.4 |
| L1 cache | 32 KB | 8 x 64 KB, 16 x 16 KB |
| L2 cache | 256 KB | 8 x 2 MB |
| L3 cache (MB) | 20 | 16 |
| Platform | | |
| Vendor and model number | Dell PowerEdge R820 | HP DL585 G7 |
| Motherboard model number | Dell UL94V-0 | HP 604046-001 |
| BIOS name and version | Dell 1.0.0 | ProLiant System BIOS A16 |
| BIOS settings | Default | Default |
| Memory module(s) | | |
| Total RAM in system (GB) | 256 | 256 |
| Vendor and model number | Samsung® M393B2G70BH0-YH9 | Samsung M393B1K70BH1-CH9 |
| Type | PC3L-10600R | PC3-10600R |
| Speed (MHz) | 1,333 | 1,333 |
| Speed running in the system (MHz) | 1,333 | 1,333 |
| Timing/Latency (tCL-tRCD-tRP-tRASmin) | 9-9-9-36 | 9-9-9-24 |
| Size (GB) | 16 | 8 |

| System | Dell PowerEdge R820 | HP ProLiant DL585 G7 |
|--|--|--|
| Number of RAM module(s) | 16 | 32 |
| Chip organization | Double-sided | Double-sided |
| Rank | Dual | Dual |
| Operating system | | |
| Name | Windows Server 2008 R2 Enterprise 64-bit | Windows Server 2008 R2 Enterprise 64-bit |
| Build number | 7601 | 7601 |
| File system | NTFS | NTFS |
| Service Pack | SP1 | SP1 |
| Language | English | English |
| Graphics | | |
| Vendor and model number | Matrox® G200eR | ATI ES1000 |
| Graphics memory (MB) | 16 | 16 |
| RAID controller | | |
| Vendor and model number | Dell PERC H710P Adapter | HP Smart Array P410i |
| Firmware version | 21.0.1-0130 | 3.66 |
| Cache size | 1 GB | 512 MB |
| Hard drive 1 (operating system) | | |
| Vendor and model number | Seagate® ST9300653SS | Seagate ST9300653SS |
| Number of drives | 2 | 2 |
| Size (GB) | 300 | 300 |
| RPM | 15,000 | 15,000 |
| Type | SAS | SAS |
| Hard drive 2 | | |
| Vendor and model number | Dell RealSSD P320h MTFDGal350SAH | HP 320GB SLC PCIe ioDrive Duo for ProLiant Servers |
| Number of drives | 2 | 1 |
| Size (GB) | 350 | 320 |
| RPM | n/a | n/a |
| Type | PCIe | PCIe |
| Ethernet adapter | | |
| Vendor and model number | Intel Gigabit 4P I350-t | HP NC375i |
| Type | Integrated | Integrated |
| Optical drive(s) | | |
| Vendor and model number | PLDS DVD+-RW DS-8A5SH | None |
| Type | Internal | N/A |
| USB ports | | |
| Number | 4 external, 1 internal | 4 external, 1 internal |
| Type | 2.0 | 2.0 |

Figure 5: System configuration information for the test servers.

APPENDIX B – HOW WE TESTED

Testing the HP IO Accelerator solution

Installing the HP IO Accelerator

1. Cleanly shut down the server.
2. Disconnect the power cables.
3. Pull out server and remove the top access panel.
4. Verify an open PCIe slot is available.
5. Install the card in any available PCIe slot.
6. Secure the card to the chassis with the latch.
7. Replace the top access panel.
8. Push the server back into place.
9. Reconnect the cables.
10. Turn the server on.

Installing HP IO Accelerator using all default settings

1. Ensure that no existing IO Accelerator drivers have been used.
 - a. Open Device Manager and check for two unconfigured mass storage controllers.
2. Download latest HP IO Accelerator from HP site (2.3.10 current).
 - a. Extract the zip file, which should contain two executable files.
3. Run HP_IO_Accelerator_SNMPDefault_2.3.10.110_x64.exe.
4. Click Next.
5. Check I accept.
6. Click Next.
7. Click Next.
8. Click Install.
9. Wait for install to finish.
10. Click Finish.
11. Restart the server.

Installing HP IO Accelerator Manager

1. Run HP_IO_Accelerator_IO_Manager_3.1.0_x64.exe
2. Click Next.
3. Click Next.
4. At the pop-up, click OK.
5. Click Install.
6. Wait for install to finish.
7. Click Finish.
8. After installation is finished, IE will launch to access the management page. Close it for now.

Updating the firmware on the device

1. Open a command prompt.
2. Enter the following commands after verifying the firmware file is correct.

```
cd c:\program files\hp io accelerator\utils
fio-update-iodrive "c:\program files\hp
accelerator\ioaccelerator_107053.fff"
```
3. Wait for firmware to finish completely.
4. Restart the server.

Setting up new disk volumes

1. After server reboot, navigate to Disk Management.
2. At the prompt to initialize disks, keep defaults and click OK.
3. Right-click on the unallocated disks and select New Simple Volume.
4. Click Next four times.
5. Click Finish.
6. Check that the disks show up as normal.

Testing the Dell PCIe Express Flash solution

Installing the SSD and related components

1. Cleanly shut down the server.
2. Disconnect the power cables.
3. Pull out the server and remove the top access panel.
4. Remove the fan module.
5. Install the backplane to be used in the open backplane slot.
6. Lift the PCIe cage from the back of the server.
7. Plug in the PCIe pass-through card
8. Secure the card in place using the brackets.
9. Replace the PCIe cage.
10. Install cabling from the new backplane to the PCIe pass-through card. Cabling should route around the CPU and memory trays.
11. Replace the fan module.
12. Replace top access panel.
13. Push the server back into place.
14. Reconnect the cables.
15. Plug in the SSD to the first open bay slot on the side where the new backplane was installed.
16. Turn the server on.

Setting up new disk volumes

1. From the Start Menu, select Control Panel→Administrative Tools→Computer Management.
2. Expand Storage, and select Disk Management.
3. At the prompt to initialize disks, keep defaults and click OK.
4. If you do not see the prompt.
 - a. Check if the disk is listed in the center panel.
 - i. Right click on the left hand box representing your disk and choose initialize disk.
 - b. Rescan the disks by right clicking disk management and selecting Rescan Disks.
 - c. If disk does not appear after some time, a reboot may be required.
5. Right click on the left hand box representing your disk and choose Online.
6. Right click the box labeled “unallocated” in the box representing your disk.
7. Select New Simple Volume.
8. Click Next four times.
9. Click Finish.
10. Check that the disks show up as normal.

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