Product performance/implementation

What is the HP Z Turbo Drive?
The HP Z Turbo drive is a PCIe connected SSD. It is a PCIe card form factor that requires a PCIe x4 slot for maximum performance. It will be available at launch in capacities of 256 GB and 512 GB.

How does the performance of a PCIe SSD compare to a SATA SSD?
The HP Z Turbo Drive is capable of significantly faster read and write speeds, both sequential and random. The HP Z Turbo Drive is not constrained by the 6Gb/s SATA bus, and therefore can perform at greater speeds than a standard SATA SSD. Some specific performance data include the following:

<table>
<thead>
<tr>
<th></th>
<th>Z Turbo Drive (PCIe SSD)</th>
<th>SATA SSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sequential Read</td>
<td>1,170 MB/s</td>
<td>550 MB/s</td>
</tr>
<tr>
<td>Sequential Write</td>
<td>930 MB/s</td>
<td>500 MB/s</td>
</tr>
<tr>
<td>Random Read</td>
<td>122K IOPS</td>
<td>80K IOPS</td>
</tr>
</tbody>
</table>

Sequential R/W Performance (MB/s)

Random R/W Performance (IOPS)

SolidWorks Specific Benchmark SPECwpc (IOPS)
Are there any significant differences when using a PCIe SSD as compared to a SATA SSD?
The HP Z Turbo Drive does not utilize any of the onboard storage controllers, nor will it appear in any of the onboard storage controller option ROM utilities. Because the HP Z Turbo Drive does not use the onboard storage controllers, the drivers for the onboard storage controllers will not be used for the HP Z Turbo Drive.

Is there a special driver that is required?
No. The HP Z Turbo Drive will use inbox drivers for all supported operating systems—Windows 7 64, Windows 8.1 64, RHEL 5/6, SLED 11, and Ubuntu 14.04. The inbox driver is included in the OS. The HP Z Turbo Drive does not require any additional drivers that would need to be loaded to use the device.

What capacities are available with the HP Turbo Drive?
The HP Z Turbo Drive will be available initially in 256 GB\(^1\) and 512 GB\(^1\) capacities. HP plans to introduce a 1 TB\(^1\) HP Z Turbo Drive in the future as NAND densities increase.

What is the endurance rating of the HP Z Turbo Drive?
The NAND used on the HP Z Turbo Drive is rated at 3,000 program/erase cycles. The endurance specification is stated as 40 GB\(^1\) Writes per day, for 5 years. This is a similar level of endurance to some of the SATA SSDs that we support in HP Z Workstations. The 256 GB\(^1\) capacity version is specified at 146 TBW (Total Bytes Written), and the 512 GB\(^1\) capacity version is specified at 292 TBW.

Which HP Workstation platforms will support the HP Z Turbo Drive?
The HP Z Turbo Drive is supported on the Z230 SFF, Z230 Tower, Z420, Z620, Z820, Z440, Z640, and Z840.

Will the platform support both HP Z Turbo Drive and other SATA/SAS drives?
Yes. On all supported platforms you can use additional SATA drives as data drives with the HP Z Turbo Drive. On the Z420, Z440, Z620, Z640, Z820, and Z840 you can use both SAS and SATA drives as data drives with the HP Z Turbo Drive. It is technically feasible to support other SAS controllers in addition to the HP Z Turbo Drive. Some of the PCIe M.2 modules supported with the HP Z Turbo Drive may have discrete OROMs that would need to coexist with the SAS controller’s OROM. If there are issues, the OROMs can be disabled for specific slots that are not being used for boot devices.

Are there any restrictions with using this drive as a Boot device?
There are no restrictions when using the HP Z Turbo Drive as a single boot device. Using the HP Z Turbo Drive in a RAID 0 array as a boot device is not allowed.

Can I add multiple drives to my system? Can I RAID the drives?
Yes. The technical requirement is for each device to be able to plug into a PCIe slot that supports Gen3 x4. The maximum number of drives supported is constrained by the available PCIe slots. When adding multiple devices to a system, the jumper switches need to be adjusted to enable the BIOS to uniquely identify each device. See the installation guide for more details. For RAID support, there are some specific differences and thus restrictions as compared to SATA/SAS HDDs or SSDs. Software RAID is used, as there is not a good solution today for hardware based RAID. See the table below for support details.

<table>
<thead>
<tr>
<th>Software RAID support with Z Turbo Drive PCIe SSD</th>
<th>Boot configuration</th>
<th>Data configuration (non-boot)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows RAID (^*)</td>
<td>Limited support – RAID 1(^*)</td>
<td>Supports RAID 0, 1</td>
</tr>
<tr>
<td></td>
<td>No support – RAID 0, 5, 10</td>
<td>No support – RAID 5, 10</td>
</tr>
<tr>
<td>Linux (^**)</td>
<td>Functional(^**) – RAID 0, 1(^*)</td>
<td>Functional(^**) – RAID 0, 1, 5, 10</td>
</tr>
<tr>
<td></td>
<td>No support – RAID 5, 10</td>
<td></td>
</tr>
</tbody>
</table>

\(^*\) RAID 1 can be set up, yet will not provide complete, redundant protection as the boot partition is not replicated on both drives. An OS boot partition cannot be protected by software RAID 1.

\(^**\) Limited testing has been done with Linux to confirm RAID support and performance characteristics.

Which PCIe slots support the HP Z Turbo Drive?
For all HP Workstation platforms the tested and approved slots for the HP Z Turbo Drive are as follows (in order of preference):

**Z840 and Z820 Single card configuration:**
1. Slot 1
2. Slot 6
3. Slot 3 (Requires 2nd CPU)
4. Slot 4 (Requires 2nd CPU)

**Z840 and Z820 Dual card configuration:**
1. Slot 1 & 6
2. Slot 3 & 4 (Requires 2nd CPU)
3. Slot 1, 3, 4 or 6 (Requires 2nd CPU)
How do I reimage my system with the HP Z Turbo Drive?
If the Z Turbo Drive is purchased as an AMO kit, HP recommends as a standard procedure that the machine be restored to the factory configuration prior to restoring the system. That would mean the Z Turbo Drive would need to be removed prior to restoring the system with restore media or HDD recovery. If the system is purchased with the Z Turbo Drive, it would not need to be removed prior to restoring the system. If the Z Turbo Drive is being added as a storage device / data drive, then the process involves following the installation guide. The summary of the process is to ensure correct BIOS, install the card, and power on the workstation.

Which Operating Systems are supported?
The HP Z Turbo Drive is supported with the following operating systems supported by HP Workstations: Windows 7 64, Windows 8.1 64, RHEL 5/6, SLED 11 and Ubuntu 14.04.

Is there a specific BIOS required to use the HP Z Turbo Drive?
Yes. Minimum BIOS revision of 3.69 for Z420, Z620, and Z820. Minimum BIOS revision of 1.21 for Z230 SFF and Z230 Tower. These are available on the Web. There is no minimum BIOS for Zx40. All shipped products will support HP Z Turbo Drive.

Will the HP Z Turbo Drive be supported with HP Performance Advisor?
Yes. The HP Z Turbo Drive will be supported as a Storage device in HP Performance Advisor. SMART attribute data will be supported, including the wear level of the SSD.

Are there any additional thermal concerns when using the HP Z Turbo Drive?
No. The airflow within the HP Workstation desktop platforms will allow the HP Z Turbo Drive to operate over a broad temperature range.

Does the HP Z Turbo Drive support hardware encryption?
The HP Z Turbo Drive does not yet support hardware encryption. It is possible that future products would be released with hardware encryption features.

Does the HP Z Turbo Drive have the ability to do Secure Erase?
No. This feature is not supported at this time.

Product strategy

Why has HP decided to add HP Z Turbo Drive?
Our goal is to enable our customers to solve the toughest problems with our workstations. We believe that our customers can take advantage of reducing storage bottlenecks with the HP Z Turbo Drive with an unprecedented level of storage performance at price points which are in the same range as SATA SSDs.

Can I use the HP Z Turbo Drive in other HP Systems?
The HP Z Turbo Drive has been developed for support in the stated HP Workstation platforms.

1 For hard drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 16 GB (for Windows 7) of system and up to 30 GB (for Windows 8) disk is reserved for system recovery software.