Understanding What's New in SSD Technology

NVMe (Non-Volatile Memory Express) is a communications interface and driver that defines a command set and feature set for PCIe-based SSDs with the goals of increased and efficient performance and interoperability on a broad range of enterprise and client systems.

NVMe was designed for SSD. It communicates between the storage interface and the System CPU using high-speed PCIe sockets, independent of storage form factor.

Input/Output tasks performed using NVMe drivers begin faster, transfer more data, and finish faster than older storage models using older drivers, such as AHCI (Advanced Host Controller Interface).

Because it was designed specifically for SSDs, NVMe is becoming the new industry standard.

What Should You Know?

Storage: Then and Now

<table>
<thead>
<tr>
<th>DATA BUSES: Transport data within a system</th>
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<tbody>
<tr>
<td>SATA</td>
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<tr>
<td>Transfers up to...</td>
</tr>
<tr>
<td>150MB/s</td>
</tr>
<tr>
<td>600MB/s</td>
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<tr>
<td>1 LANE</td>
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<tr>
<td>SATA I</td>
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<tr>
<td>SATA II</td>
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<td>SATA III</td>
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<tr>
<td>PCIe</td>
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<tr>
<td>Transfers up to...</td>
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<tr>
<td>2000MB/s Per Lane</td>
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<tr>
<td>1000MB/s Per Lane</td>
</tr>
<tr>
<td>500MB/s Per Lane</td>
</tr>
<tr>
<td>16 LANES</td>
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<tr>
<td>PCIe Gen 2</td>
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<td>PCIe Gen 3</td>
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<td>PCIe Gen 4</td>
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</table>

Using 16 lanes, PCIe Gen 4 can transfer data at 32,000MB/s.

Communication Drivers

Used by Operating Systems to communicate data with storage devices

AHCI
- Designed for Hard Drives with Spinning Disk technology
- Has only 1 command queue
- Can only send 32 commands per queue
- Commands utilize High CPU cycles
- Has a latency of 6 microseconds
- Must communicate with the SATA controller
- IOPs up to 100K

NVMe
- Designed for SSDs with Flash technology
- Has 64K command queues
- Can send 64K commands per queue
- Commands utilize Low CPU cycles
- Has a latency of 2.8 microseconds
- Communicates directly with the System CPU
- IOPs over 1 million

SSD Form Factors

The shapes and sizes of solid-state storage

2.5" |
1.8" |
mSATA (designed for smaller form factor systems) |
M.2 |
U.2 (only available in NVMe)

M.2 (supports AHCI version)
- AHCI versions of these drives plug into the PCIe slot, but use the AHCI drivers
- Some older versions of HHHL use proprietary drivers
- NVMe versions typically use native OS drivers

Beyond the Numbers

Benefits of NVMe Technology

- **Optimal Performance**
  - PCIe sockets transfer >25x more data than their SATA equivalent
  - NVMe begins sending commands more than 2x faster than AHCI drivers
  - NVMe Input/Output Operations per Second exceeds 1 million and is up to 900% faster than its AHCI equivalent

- **Superior Storage**
  - NVMe technology allows for more efficient performance and increased storage capacity

- **Superior Speed**
  - NVMe cuts out the middle man by communicating directly with the System CPU
  - NVMe-based drives work with all major Operating Systems, regardless of form factor

Contact your local Kingston representative to find out which Kingston SSD drive is right for you, or visit: kingston.com/en/ssd/enterprise

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