Understanding 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 that use older drivers, such as AHCI (Advanced Host Controller Interface) – a feature of SATA SSDs. Because it was designed specifically for SSDs, NVMe is becoming the new industry standard.

Storage: Then and now
DATA BUSES: Transport data within a system

SATA
Transfers up to...

PCIe
Transfers up to...

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

<table>
<thead>
<tr>
<th>AHCI</th>
<th>NVMe</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Hard Drive Icon]</td>
<td>![Network Interface Icon]</td>
</tr>
<tr>
<td>Designed for Hard Drives with Spinning Disk technology</td>
<td>Designed for SSDs with Flash technology</td>
</tr>
<tr>
<td>Has only 1 command queue</td>
<td>Has 64K command queues</td>
</tr>
<tr>
<td>Can send only 32 commands per queue</td>
<td>Can send 64K commands per queue</td>
</tr>
<tr>
<td>Commands utilise high CPU cycles</td>
<td>Commands utilise low CPU cycles</td>
</tr>
</tbody>
</table>
AHCI

- Has a latency of 6 microseconds
- Must communicate with the SATA controller
- IOPs up to 100K

NVMe

- 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

- **SATA**
  - 2.5"
  - mSATA
  - 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

- **PCle**
  - HHHL – Half Height, Half Length (also called AIC or Add-in Card)
  - M.2
  - (supports AHCI version)
  - (supports NVMe version)
  - U.2 (only available in NVMe)

Beyond the numbers: Benefits of NVMe technology

**Optimal performance**

- **Superior storage**
  - PCIe sockets transfer >25x more data than their SATA equivalent
- **Superior speed**
  - 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 compatibility**
  - NVMe cuts out the middleman by communicating directly with the system CPU
  - NVMe-based drivers 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:

© 2020 Kingston Technology Europe Co LLP and Kingston Digital Europe Co LLP, Kingston Court, Brooklands Close, Sunbury-on-Thames, Middlesex, TW16 7EP, England. Tel: +44 (0) 1932 738888 Fax: +44 (0) 1932 785469
All rights reserved. All trademarks and registered trademarks are the property of their respective owners. EN