Performance Characterization of Hyperscale Applications on NVMe SSDs

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**NVMe Hardware Interface**

NVMe SSDs built on PCIe provide:

- **Superior interface capabilities**
  PCIe x4 supports higher BW (4GB/s) compared to SATA (600MB/s)

- **Shorter hardware data path**
  NVMe directly connects to a PCIe port; SATA traverses through PCH and HBA

- **Simplified software stack**
  NVMe driver for SSDs bypasses the traditional OS block layer

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**Comparison of Software Overheads**

- Instrumented NVMe driver and blktrace
- NVMe S/W overhead is much lower than SATA overhead
- HDD S/W overhead is negligible because of very large seek and transfer times

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**NVMe SSD Performance for Cloud Databases**

- TPC-C used to drive MySQL; and YCSB used to drive Cassandra
- NVMe-backed database applications deliver up to 8x superior performance

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**Figure 1:** Comparison of the HW datapath of SATA and NVMe SSDs

**Figure 2:** Software interface comparison

**Figure 3:** S/W overhead comparison between HDD, SATA and NVMe SSDs

**Figure 4:** Performance improvement of (a) TPCC and (b) Cassandra over various storage configurations