NVM Express® (NVMe®) Innovations in Windows

Sponsored by NVM Express organization, the owner of NVMe® specifications

Speakers

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Agenda

- Updates in Windows 11 24H2 and Windows Server 2025
- Modernizing NVMe® Technology Support in Windows
- Upcoming Features

Windows 11 24H2 and Windows Server 2025

- Host Memory Buffer (HMB) max size adjustment
  - HMB allocation based on device's prefer size if it's within limits
  - Updating max from 64MB to min(1GB, 1/64 system RAM size)
- Enhanced passthrough command support (see Working with NVMe® drives - Win32 apps | Microsoft Learn for more details)
  - Support specifying all CDWs for a command, UUID support, no command restrictions in WinPE
- Timestamp update when exiting lowest non-operational power state
- Web page on Windows NVMe feature support and command usage
  - https://docs.microsoft.com/en-us/windows-hardware/drivers/storage/nvme-features-supported-by-stornvme

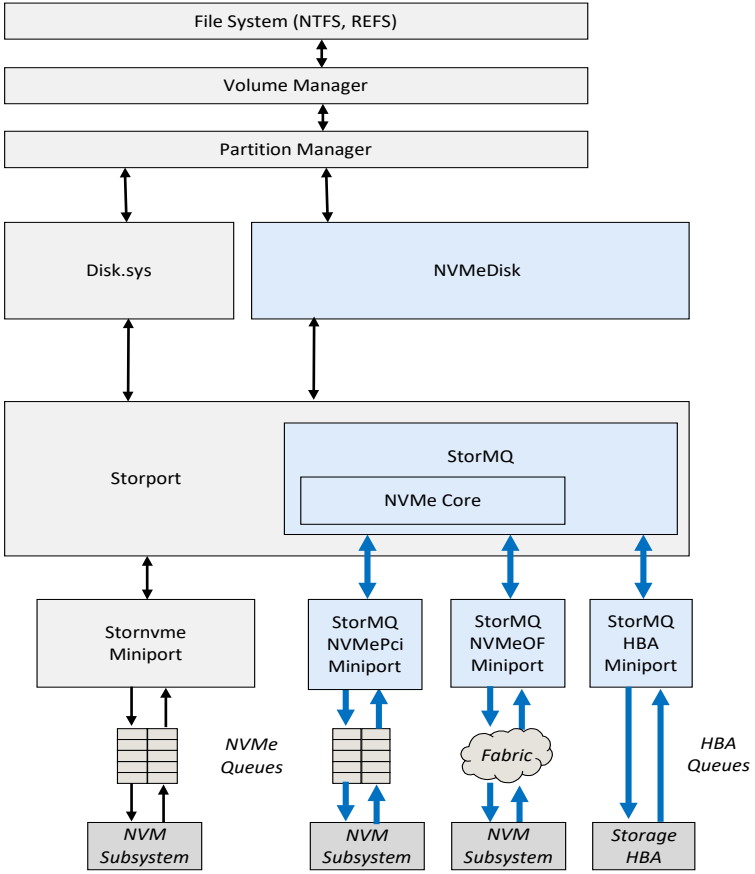
Modernizing NVMe® Technology Support in Windows

- Currently in the process of modernizing the NVMe technology support in Windows
  - Native NVMe technology - redesign of the Windows lower storage stack
  - NVMe over Fabric (NVMe-oF™) technology
- Preview available in Windows 24H2, Windows Servers 2025 and Windows Insider OS builds

Native NVMe® Technology

- Redesign of the Windows lower storage stack to optimize for high performance multi-queue storage hardware and use NVMe technology concepts and features
  - Internally referred to as StorMQ (Storage MultiQueue)
- Extending the Windows Storport driver model to support both existing miniports and new StorMQ miniports
  - Preview Microsoft NVMe miniport using StorMQ available
- New architecture provides significant improvements in CPU usage, performance and multi-device performance scalability compared with existing stack
- In preview and available to NDA partners of Microsoft. For questions, send to nativenvmepreview@microsoft.com.

Native NVMe® Technology



NVMe® over Fabrics (NVMe-oF™) Technology

- Working on supporting NVMe-oF technology in Windows
  - NVMe-oF technology support in Storport, transport initiators, software target, Multipath I/O (MPIO) and management
- Initial focus is on initiators
  - Storport support for NVMe-oF initiator miniports
  - Preview TCP initiator available in Windows Server 2025
  - RDMA initiator in progress
  - FibreChannel initiator support will be from ecosystem
- Targeting minimum of NVMe 2.0 specification compliance
- In preview for Windows Server 2025. For questions, send to nvmeofpreview@microsoft.com

Upcoming Features

- Dynamic Link Rate Management
  - Each new PCIe® technology generation has higher power consumption than previous. This is not sustainable especially on mobile systems
  - Windows will adjust PCIe link speed of NVMe® devices to improve power efficiency of the system
    - May see device operate in different PCIe link speed depending on state of the system (e.g. system performance mode, plugged in/battery, etc)
    - Dynamically adjust PCIe link speed based on usage
- Dataset Management (DSM) Hints
  - Expect Windows to be able to pass DSM hints for reads and writes commands
  - Believe this will help devices improve IO responsiveness and device lifetime

Questions?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