PCIe NVMe Controller Firmware and Drivers

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Agenda

- PCIe NVMe Controller Firmware Features
- Qualification & Logo Compliance
- Platform Firmware (UEFI/BIOS) Support
- OS Driver Support
- Resources
- Q&A

Scope

- Important PCIe NVMe firmware features
- NAND features are not covered in this session
- Covers the items mentioned in the agenda

PCIe NVMe Controller Firmware

- Support latest specs including Technical Proposals (TPs) and Errata (ECNs)
  - NVMe Core Spec 1.2+
  - NVMe Management Interface Spec 1.0+
  - Latest PCIe, TCG …
- Support full PCIe bandwidth
- Provide proper queue management

PCIe NVMe Controller Firmware

- Provide consistent read / write performance
- Provide low power performance
- Provide dynamic power management for supported power states
- Provide Power Loss Protection (PLP)

PCIe NVMe Controller Firmware

- Optimize firmware boot time during system power-on
- Implement lower rebuild times when rebuild is required
- Optimize safe shutdown timings
- Adhere to Platform specific shutdown/restart and sleep/resume time constraints

PCIe NVMe Controller Firmware

- Firmware Update
- Implement Security (TCG) features
- Error Logging
  - Persistent & Non-persistent
  - Debug, Field failure analysis, BMC, Host Event Logging

PCIe NVMe Controller Firmware

- Implement Built-In Self Tests (BIST)
  - Test each module
  - Used in Manufacturing
  - Some OEMs require it for BMC/UEFI POST
- Implement Vendor Commands
- Provide tools for firmware update etc.

PCIe NVMe Controller Firmware

- Management Interface support
  - Inventory
  - Health status
  - Power management
  - Thermal Management
  - Firmware Update
  - Configuration

Feature dependency on target platforms

- Servers, Clients and Mobile Platforms
- Management Interface
- Operating Systems
- Device Form Factors
  - Varying length M.2, BGA, 2.5”SSDs
  - U.2 (formerly SFF-8639) and many more

Qualification & Logo Compliance

- Microsoft Windows 10 HLK (Previously WHCK)
- UNH-IOL NVMe Compliance Plugfest
- PCI SIG Compliance Plugfest
- UEFI Plugfest for OEM, BIOS and OS platform compatibility testing on several platforms.

Implement Debugging

- Error Logs / Trace for field failures
- Serial port debug logs
- UEFI shell, UEFI driver and Test tools
- BIST and Sanity tests
- System and OS event loggers
- Compliance Test Tools

Platform Firmware (UEFI/BIOS)

- Most latest UEFI platforms has built-in NVMe driver support
- Required to boot from NVMe drive
- Required to recognize NVMe drive during pre-OS boot
- Open Source code available for debug
- Most useful during board bring up phase
- OEM may customize the drive

OS Drivers – Inbox & Community

- Inbox drivers
  - MS Windows 8.1/2012R2 and Windows 10 systems
  - MS Windows 7/8/2008 through Hotfixes
  - Linux Kernel 3.9+ has proper NVMe support
- Open Source / Community Drivers
  - Windows 7/8/2008/2012R2
  - Windows 10 is not supported yet
  - Linux, FreeBSD, VMware, Solaris

Resources

- NVM Express http://nvmexpress.org
- Visit http://nvmexpress.org/drivers
- UEFI http://uefi.org
- PCI Express http://pcisig.org
- UNH-IOL NVMe https://www.iol.unh.edu/testing/storage/nvme

Q&A