NVMe™ ‘Interoperability’ – Conformance, Interoperability, Stress/RAS testing, and Support

Conformance, Interoperability, Test Plans, and Plugfest updates
Abstract and Agenda

• Abstract:
  • Testing and Interoperability: This session will cover testing for Conformance, Interoperability, Resilience/error injection testing, and support infrastructures to ensure interoperable supported solutions base on NVM Express® solutions.

• Panel
  • NVMe™ Interoperability Panel Introduction – Brandon Hoff, Broadcom
  • Conformance and Interoperability Testing at the UNH-IOL – Tim Sheehan
  • FC-NVMe Testing and Interoperability – Mark Jones, FCIA
  • Testing and Validation - Nick Kriczky, Teledyne LeCroy – Austin Labs
  • Support for NVMe over Fabrics in production environments – Brandon Hoff, Broadcom
Definitions

- Conformance: This refers to a product being tested for conformance in reference to a standard. For NVM Express®, this refers to NVMe™, NVMe-oF™, and NVMe-MI™.
  - Example: [https://www.iol.unh.edu/testing/storage/nvme/test-plans](https://www.iol.unh.edu/testing/storage/nvme/test-plans)

- Interoperability: While two devices may conform to a standard, they may not be interoperable. Interoperability testing proves that multiple devices can be connected and work together, as expected.
  - Ex. IoL and FCIA Interoperability Testing

- RAS testing via Error Injection: RAS (Reliability, Availability, and Scalability) are required by Enterprise customers.
  - Testing covers error injection, large fabrics, etc. Example is the FCIA plugfest
  - IoL?

- Vendor Supported: Server Vendors, OS Vendors, storage vendors, and HBA/NIC vendors take support calls
NVMe™ Conformance and Interoperability Testing at the UNH-IOL

Conformance, Interoperability, Test Plans and Plugfest updates

Tim Sheehan - UNH-IOL
Today’s NVMe™ 9.0 Integrators List News

• UNH-IOL offering NVMe PCIe Testing Services and Integrator’s List in 2012 (150+ Products listed)

• UNH-IOL offering NVMe-MI™ Testing Service and Integrators List in June 2017 (7 Products listed)

• UNH-IOL launched NVMe-oF™ Testing Services and Integrators List in December 2017 (22 Products listed)
NVMe™ Integrator’s List Conformance Testing

- NVMe Conformance Test Cases: 220
- NVMe Interop Test Cases: 9
- NVMe-MI™ Conformance Test Cases: 53
- NVMe-oF™ Conformance Test Cases: 132
- NVMe-oF Interop Test Cases: 4
NVMe™ Integrator’s List Interoperability Testing

• NVMe™ over PCIe® Interoperability requires running against 5 unique configurations

• NVMe-MI™ Interoperability is something that requires additional attention, no test plan today

• The NVMe-oF™ Interoperability testing requires the following:
  • Target – run against two unique Initiator products
  • Switch – run against two unique Target products
  • Initiator – run against two unique Target products
NVMe™ Next

Continual evolution of the NVMe Integrator’s List program in 2H18

- NVMe Plugfest #10 covering PCIe SSDs and NVMe-oF™, November 12, 2018 in Durham NH. NVMe PCIe, NVMe-MI, NVMe/FC, & NVME/RoCE
- NVMe/TCP Conformance test offering as Proof of Concept
FC-NVMe™ Conformance, Interoperability, and Error Injection

Mark Jones - FCIA
Fibre Channel Industry Association (FCIA) Plugfest Legacy

• Fibre Channel – Legacy of Interoperability, reliability and robustness
  • Products have been shipping in volume for more than 20 years – 120M ports shipped, 43M in current use.

• Key Factors to Fibre Channel’s success
  • Industry-wide participation in FC standards – INCITS T11
  • ~Avg of Two Plugfests per year that ensure vendors conform to industry standards
FCIA FC-NVMe™ Plugfest Events

- July 23, 2018 - 4th FC-NVMe plugfest
  - 13 Companies/products tested
    - HBAs, Switches, Storage Arrays, Analyzers/Jammers
  - Key Accomplishments
    - Testing of End-end commercial available products
    - Multi vendor interoperability, standards conformance
    - Data Integrity validation over switch multi-hop fabrics
    - Error injection to validate correct FC-NVMe and FC recovery
    - Concurrent FC-NVMe + FC over same Initiator, fabric, target ports
    - “Big Build” overnight stress testing of all of the above.
Test Track 5  GEN6, GEN5 FC and FC-NVMe Dual Fabric HA Large Fabric Build

Implement pair wise zone for each I-T

Concurrent FC and FC-NVMe outlined in black

Analyzers inserted inline between switches and T328 and VIAVIE cascaded; Initiator and Target separation enables ISL visibility to all I-T traffic.
How to Participate in FCIA Plugfests

• [https://fibrechannel.org/plugfest-general-info/](https://fibrechannel.org/plugfest-general-info/)
  • FCIA member and non-members welcome
  • Plugfest fees apply to cover event costs
  • Call for Interest Meetings – Logistics agreement
  • NDA restricted planning meetings
  • Results of testing are confidential
  • Post event PR opportunities
  • Everyone always learns something!
Testing and Validation

Third-party validation and pre-compliance testing

Nick Kriczky - Teledyne LeCroy, Austin Labs
Third-Party Testing – What and Why?

• Customized testing solutions
  • Built to fit your needs
  • Labs that specialize in testing as a service
  • Provides additional resources for validation
    • Hardware
    • Headcount
  • Interoperability
• Customer environment
• Extra set of Eyes
• Improved time to market
What Type of Testing is Available?

- Data Integrity
- Performance Analysis
- Interoperability
- Compliance and Pre-certification
  - PCI-SIG® PCI Express®
  - NVMe™ Conformance Test
  - NVMe-MI™ Conformance Tests
  - NVMe-oF™ validation
Tools of the Trade

- Protocol Analyzer
- Protocol Jammer
- Protocol Exerciser
- Compliance Suites
Where Can I Find Help?

Plugfest – Industry standard organizations host Plugfests throughout the year for NVMe™ and NVMe-oF™.

Compliance workshops – Industry standard events for compliance and certifications.

Teledyne LeCroy’s Austin Labs – Provides testing and training for protocols supporting NVMe, PCIe®, and NVMe-oF™. Complete testing partner for customized testing requirements and pre-compliance. Austin Labs is also the host for industry Plugfests.
Support Types

• Roll your own
  • E.g. upstream Linux and taking off-the-shelf parts and assembling
  • Customer troubleshoots and fixes solutions on their own
  • Vendors provide basic hardware repair/replacement

• Supported Solutions
  • SUSE + Lenovo + Broadcom + NetApp
  • Vendors take first call for support and work with each other to close support issues for software and hardware

• Support Contracts – Vendor Specific
Support Ecosystem

- Customers will want to get support from their vendors
  - Servers, storage, NIC/HBA, Network, and OSVs
- Launch of a new technology is requires each to qualify the solution
- Supported products are listed on a list of supported hardware or software
Contact Information

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