NVMe Conformance and Interoperability - How do we get there?

David Woolf

Senior Engineer

University of New Hampshire InterOperability Laboratory

Presentation Overview

1. *Why is UNH-IOL involved in NVMe Conformance and Interop?*
2. What is Conformance?
   - How will we prove conformance for NVMe?
3. What is Interoperability?
   - How will we prove Interoperability for NVMe?
4. Conclusions

UNH-IOL – Why are we involved?

University of New Hampshire InterOperability Laboratory

UNH-IOL is an ***interop facilitation*** organization

Our Goals:

- conformance and interop test services and reporting
- Training students to understand modern data communications and test tools.

UNH-IOL – Why are we involved?

- UNH-IOL is applying our collaborative test model to NVMe

- Since late 2011 UNH-IOL has been working with the NVMe promoters group developing NVMe test documentation and tools

Goal: Demonstrate that NVMe is interoperable through a continuous industry program of conformance and interop testing.

Presentation Overview

1. How is UNH-IOL involved in NVMe Conformance and Interop?
2. *What is Conformance?*
   - How will we prove conformance for NVMe?
3. What is Interoperability?
   - How will we prove Interoperability for NVMe?
4. Future Steps

What is Conformance?

Prove that a product meets all the requirements defined in the specification.

Why is it valuable?

- it's the foundation that allows the next generation of products to be backwards compatible
- build confidence in a new technology

What are its limitations?

- Conformant products are not automatically interoperable

What is Conformance?

How do we facilitate proving NVMe conformance?

- Open Documentation of Conformance Requirements
- Common Tools

Open Documentation of Conformance Requirements

- UNH-IOL has created an NVMe conformance test suite document
- Extracts all of the requirements of the specification and defines an algorithm for how test them
- *Available for download on UNH-IOL website*
  - *comments/feedback welcome*

https://www.iol.unh.edu/services/testing/NVMe/testsuites/

Common Tools

- Intel has provided tNVMe tool to the community via github.

- Common PCIe analysis tools are adding NVMe functionality, such as LeCroy Summit.

- UNH-IOL is building on both of these platforms

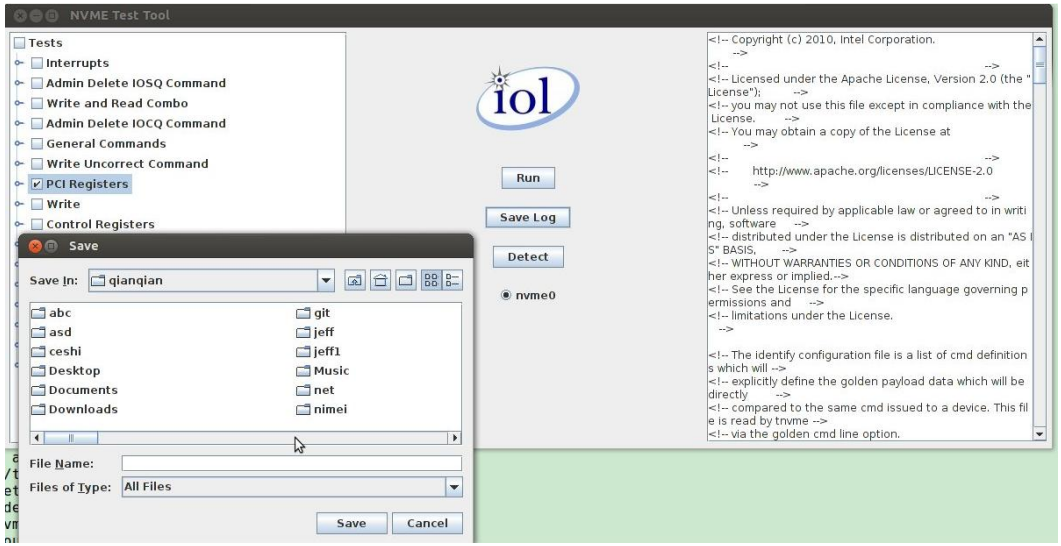
Common Tools – UNH-IOL T.N.T. Software

- UNH-IOL T.N.T. Software is based on tNVMe, but has a simple user interface for performing the conformance test requirements.

- Will be available to active UNH-IOL members

Common Tools – UNH-IOL T.N.T. Software

- Maps tNVMe functions to match tests described in UNH-IOL test suite
- Auto discovery of NVMe devices
- Log and Save tNVMe output



Common Tools – LeCroy Summit

•Commonly used in PCIe testing, but is expanding NVMe functionality

•LeCroy and UNH-IOL cooperating to create a set of scripts that can be used to perform NVMe validation, also matching what is described in the UNH-IOL conformance test suite.

Presentation Overview

1. How is UNH-IOL involved in NVMe Conformance and Interop?
2. What is Conformance?
   - How will we prove conformance for NVMe?
3. *What is Interoperability?*
   - How will we prove Interoperability for NVMe?
4. Future Steps

Interoperability vs. Conformance

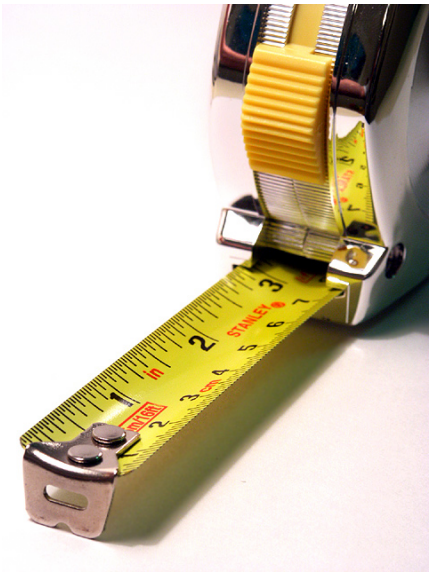
- Interop Tests tell us about a system.
  - Combination of host chipset, BIOS, OS, driver, cabling, drive.
  - Interop tests are performed on ***systems***
- Conformance tests tell us about a ***single device.***
  - i.e. the product implemented this feature correctly
- We do both because
  - interoperable products may be non conformant
  - Conformant products not always interoperable

What is Interoperability?

Briefly, it means things work together… but how well do they work together? Do they work together under all conditions and do all features work?

To know for sure, we must measure it

- Testing Interop means **measuring Interop.**
- We need an **Interop Metric** to measure.



Interop Metric

- The Interop Metric must be documented in an Interoperability Test Specification.
- Allows industry to review and agree on Interop Metric
- UNH-IOL has created Interoperability Test Specifications for NVMe.
- *Available for download on UNH-IOL website*
  - *comments/feedback welcome*

https://www.iol.unh.edu/services/testing/NVMe/testsuites/

Proving Interop

To prove interoperability we must demonstrate it publicly.

We do this through:

- Initial Plugfest
- Continuous testing at an industry test center

Plugfests

- We are targeting 1st half of 2013 for an NVMe plugfest

- The *NVMe Interop Test Suite (v0.2).pdf* is the basis for an interop event test plan.

- We will use this plugfest to bootstrap an NVMe Integrators List

At the Plugfest

- Use the procedure defined in the Interop Test Suite
- Each Host Chipset will act as a Golden Host when running the reference driver for a given OS.
- We will cycle through all available SSDs to test all Host/Device combinations
- Record the BIOS , chipset, driver, and motherboard model #.

Continuous Testing

NVMe Integrators List: list is initially populated after the plugfest

Will also populate an Interop Test Bed at UNH-IOL.

Products are added as they pass interop and conformance testing at the industry test center at UNH-IOL.

Presentation Overview

1. How is UNH-IOL involved in NVMe Conformance and Interop?
2. What is Conformance?
   - How will we prove conformance for NVMe?
3. What is Interoperability?
   - How will we prove Interoperability for NVMe?
4. *Conclusions*

Conclusions

- Use case and need for NVMe is clear
- Success depends on a thorough conformance and interop program

- NVMe promoters group and UNH-IOL are laying the groundwork for the testing infrastructure of a healthy NVMe ecosystem
  - Open documentation of test requirements
  - Common tools
  - Plugfests
  - Integrators List