NVMe Conformance and Interoperability

David Woolf, University of New Hampshire's Interoperability Lab

Agenda

- **NVMe Test Program Overview**
- May 2013 NVMe Plugfest
- NVMe Integrators List
- Improving the Test Program – Continue to Climb

NVMe Test Program Overview

- **NVMe Test Program is focused on a public Integrators List hosted by UNH-IOL**

- **Promoters group decides the qualifications for a product to get on the Integrators List**

- **UNH-IOL performs the testing to determine if a products meets those qualifications**

NVMe Test Program Overview

- New Testing Requirements approved by NVMe Promoters group and debuted at plugfests

- Testing for Integrators List performed throughout the year at UNH-IOL.

- UNH-IOL makes test tools available to members to enable conformance checking

Agenda

- NVMe Test Program Overview
- **May 2013 NVMe Plugfest**
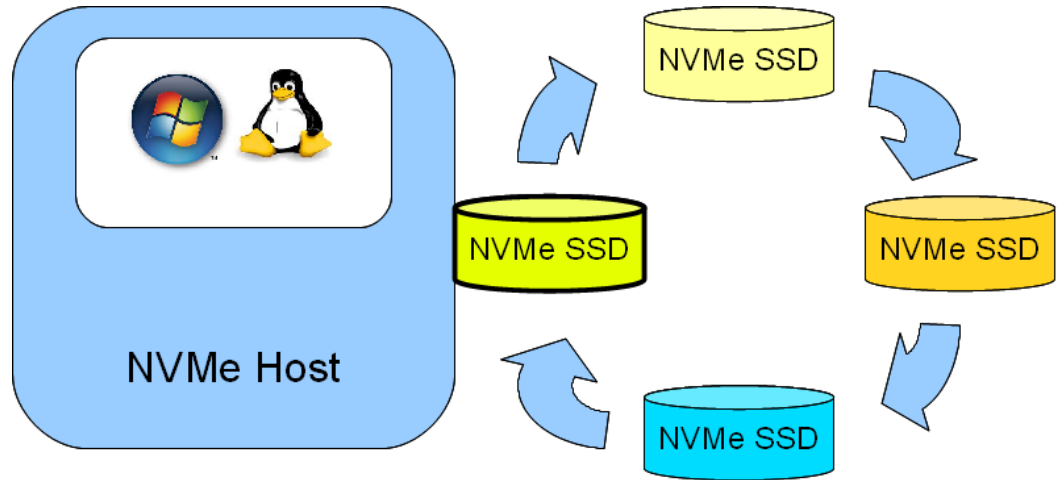- NVMe Integrators List
- Improving the Test Program – Continue to Climb

May 2013 NVMe Plugfest
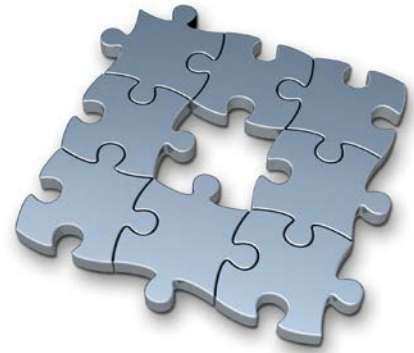
- 1st ever NVMe plugfest held at UNH-IOL May 13-16, 2013
- 11 Companies participating
- 6 products added to NVMe Integrators List

May 2013 NVMe Plugfest
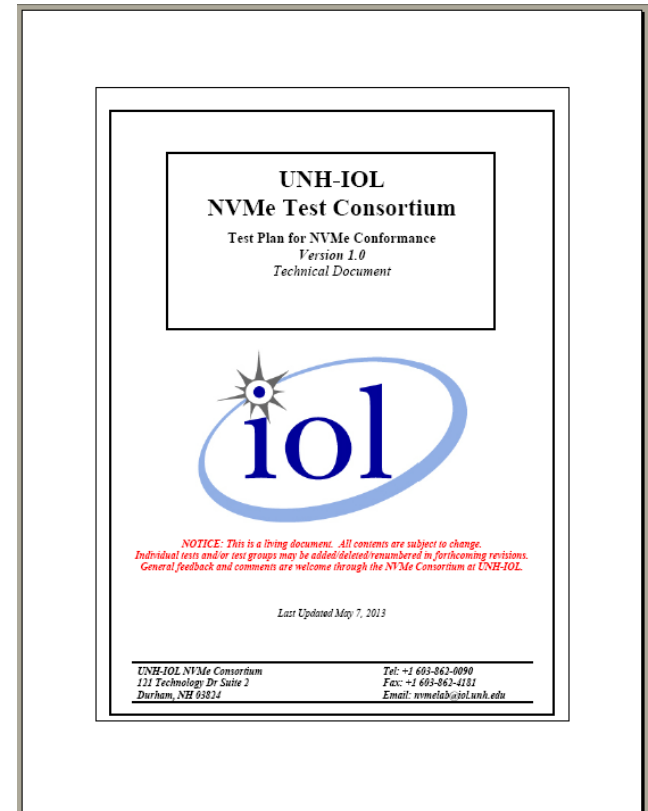
- ## Interop Testing

- ## Tests defined in NVMe Interop Test Suite document, publically available at : https://www.iol.unh.edu/services/testing/NVMe/testsuites/
- ## Cycle SSDs against each NVMe host
- ## Used vdbench on Windows and Linux OS to read/write/verify data
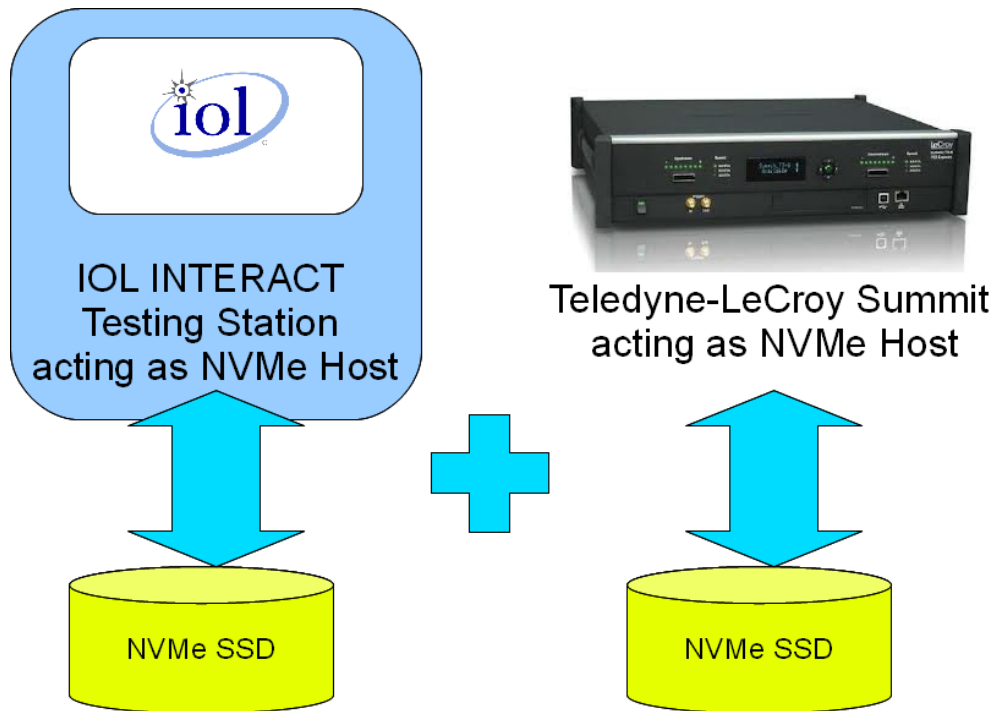
May 2013 NVMe Plugfest

- **Conformance Testing**
  - Tests defined in NVMe Interop Test Suite document (publically available at www.iol.unh.edu)
  - Test tools used to check proper construction and response to different NVMe Stimuli
  - Admin Commands, NVM Commands, Controller Registers

UNH-IOL
NVMe Test Consortium

Test Plan for NVMe Conformance
Version 1.0
Technical Document

NOTICE: This is a living document. All contents are subject to change.
Individual tests and/or test groups may be added/deleted/renumbered in forthcoming revisions.
General feedback and comments are welcome through the NVMe Consortium at UNH-IOL.

Last Updated May 7, 2013

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May 2013 NVMe Plugfest

- **Conformance Testing**
  - **2 types of test stations used**

IOL INTERACT
Testing Station
acting as NVMe Host

Teledyne-LeCroy Summit
acting as NVMe Host

NVMe SSD

NVMe SSD

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- NVMe Test Program Overview
- May 2013 NVMe Plugfest
- **NVMe Integrators List**
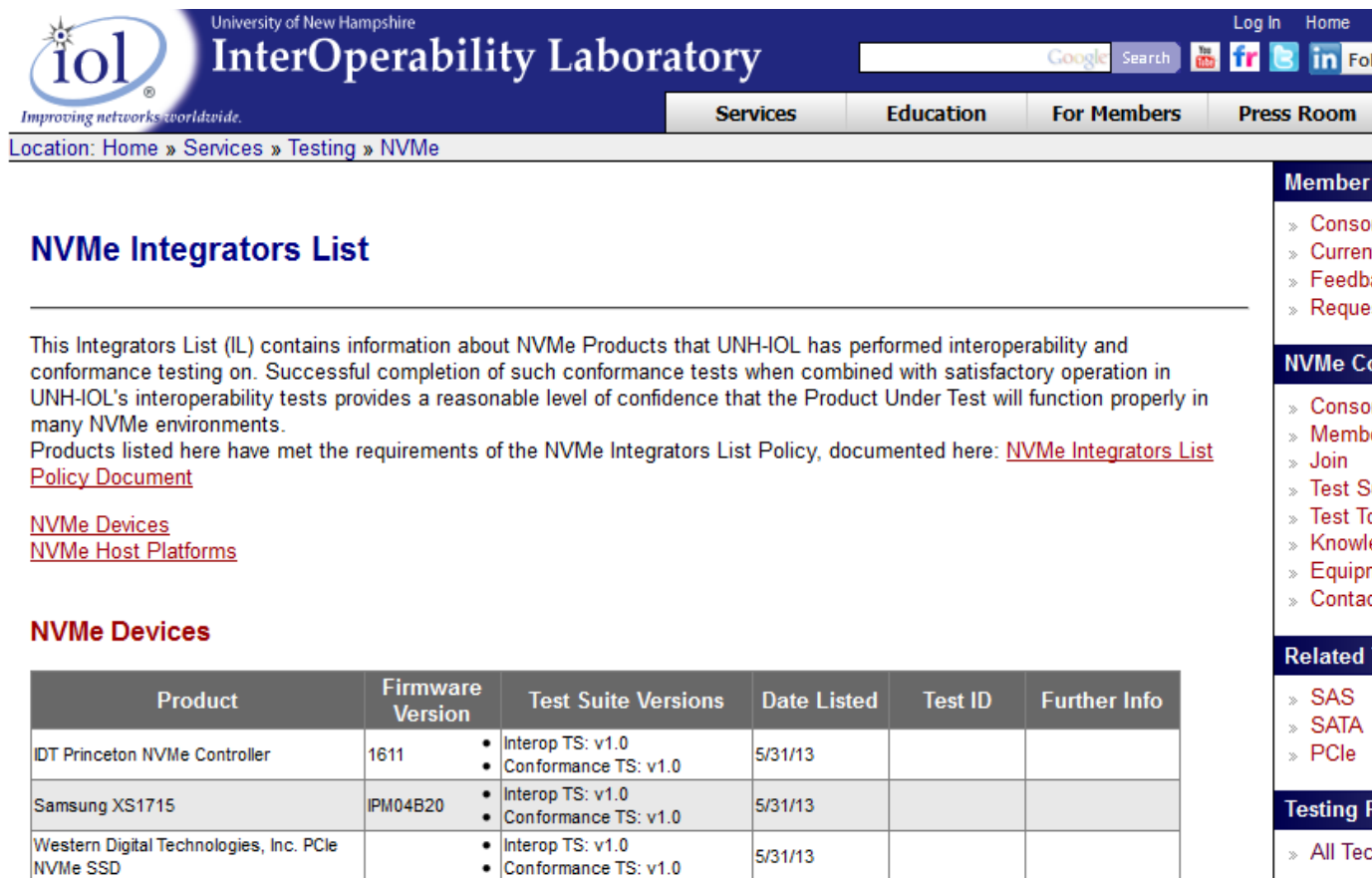- Improving the Test Program – Continue to Climb

NVMe Integrators List

- Hosted by UNH-IOL at www.iol.unh.edu

- Opt-in list of qualifying NVMe products

- No PCIe component to qualification today

  - UNH-IOL does offer PCIe testing to complement NVMe testing, but it is not a component of the NVMe IL Qualification

NVMe Integrators List

https://www.iol.unh.edu/services/testing/NVMe/integratorslist.php

NVMe Integrators List

This Integrators List (IL) contains information about NVMe Products that UNH-IOL has performed interoperability and conformance testing on. Successful completion of such conformance tests when combined with satisfactory operation in UNH-IOL's interoperability tests provides a reasonable level of confidence that the Product Under Test will function properly in many NVMe environments.

Products listed here have met the requirements of the NVMe Integrators List Policy, documented here: NVMe Integrators List Policy Document

NVMe Devices
NVMe Host Platforms

NVMe Devices

Product	Firmware Version	Test Suite Versions	Date Listed	Test ID	Further Info
IDT Princeton NVMe Controller	1611	• Interop TS: v1.0 • Conformance TS: v1.0	5/31/13		
Samsung XS1715	IPM04B20	• Interop TS: v1.0 • Conformance TS: v1.0	5/31/13		
Western Digital Technologies, Inc. PCIe NVMe SSD		• Interop TS: v1.0 • Conformance TS: v1.0	5/31/13		

NVMe Integrators List as of August 7, 2013

NVMe Integrators List

- NVMe Host Qualification
  - Perform Interop Test against 4 different SSDs
  - Pass with 3 SSDs
  - Pass = data transfers without errors

NVMe Integrators List

- **NVMe Device Qualification**
  - **Perform Interop Test against 4 different Hosts, pass with 3 Hosts**
    - **One of the hosts must be either the Windows or Linux Reference Driver**
  - **Pass all conformance tests**

Agenda

- NVMe Test Program Overview
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- NVMe Integrators List
- **Improving the Test Program – Continue to Climb**

Improving the Test Program

- First NVMe Plugfest and Current IL Qualifications established baseline.
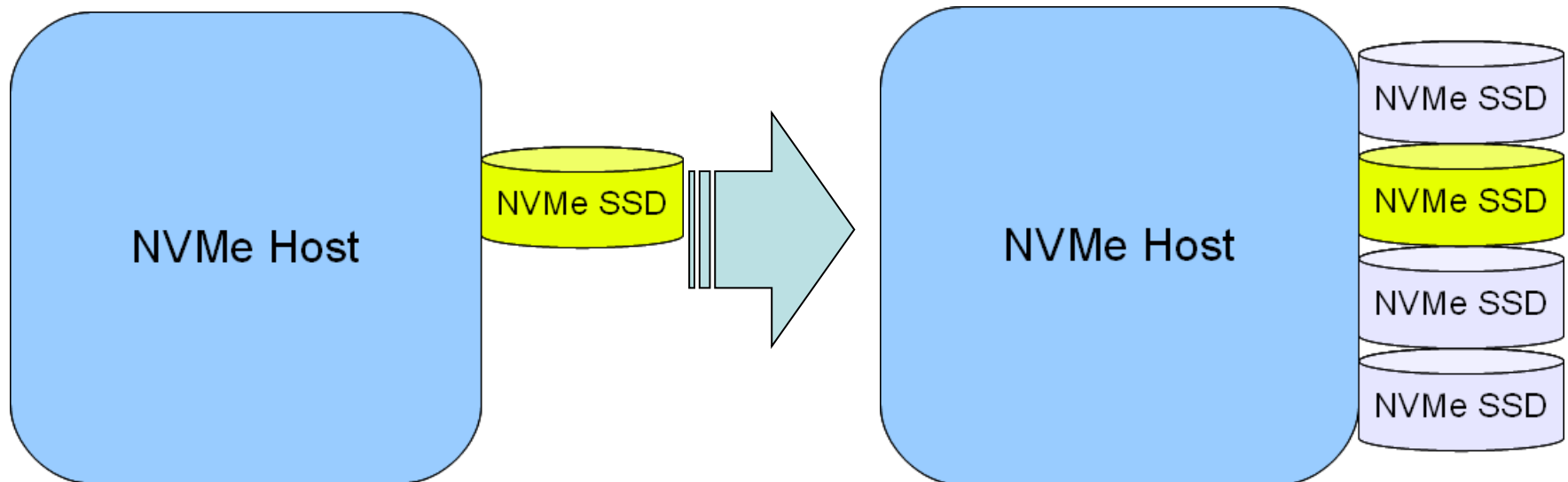- We are making the testing program more rigorous on both the interop and conformance fronts.

- Continue to Climb– How?
  - Make the Interop Tests more Rigorous
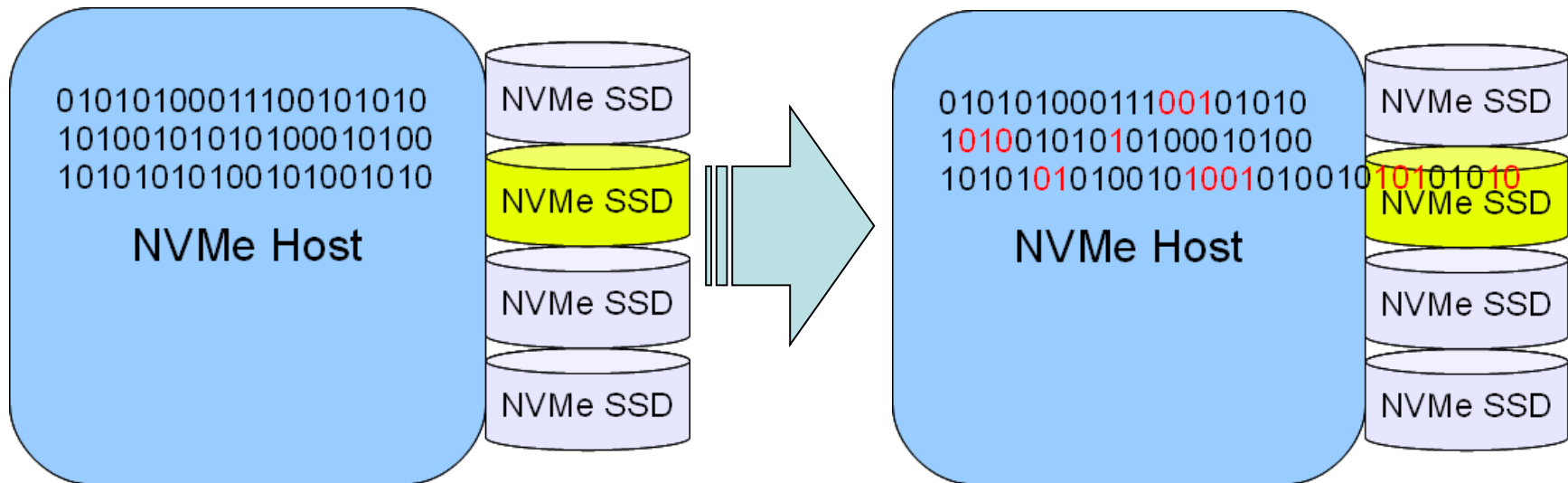 - Raise the IL Qualification requirements
  - Improve the Tools

Improving the Test Program

- Make the Interop Tests more Rigorous:
  - multiple SSDs in the system

Improving the Test Program

- Make the Interop Tests more Rigorous
  - stressing patterns

Improving the Test Program

- Make the Interop Tests more Rigorous:
  - larger/varying transfer sizes

Improving the Test Program
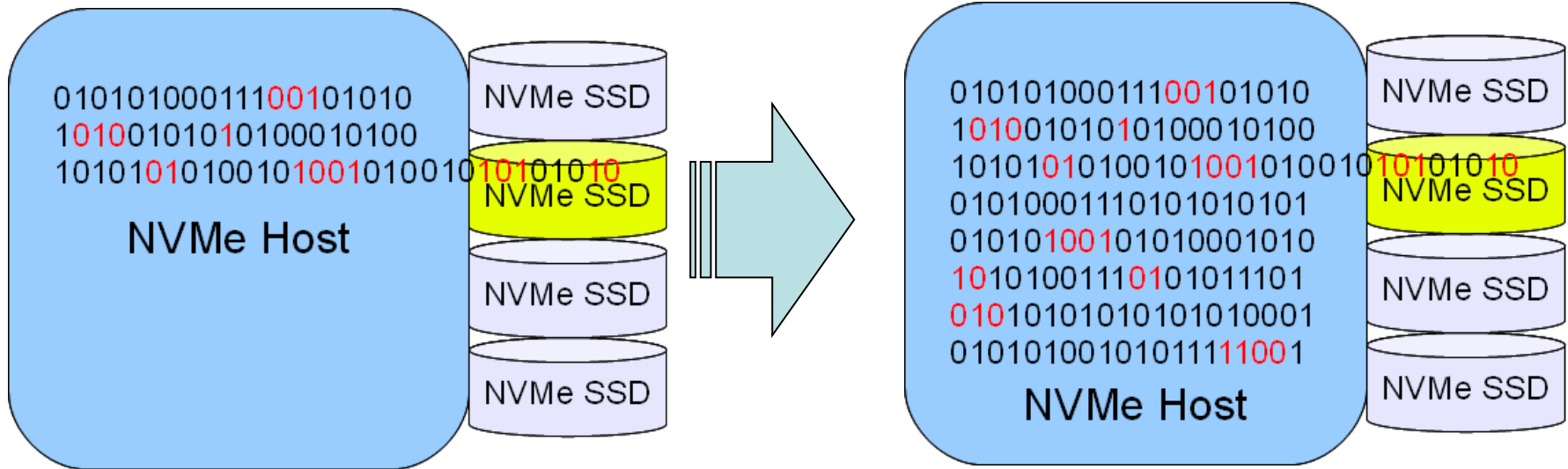
- Make the Interop Tests more Rigorous:
  - boot tests, rather than just data transfers

Improving the Test Program
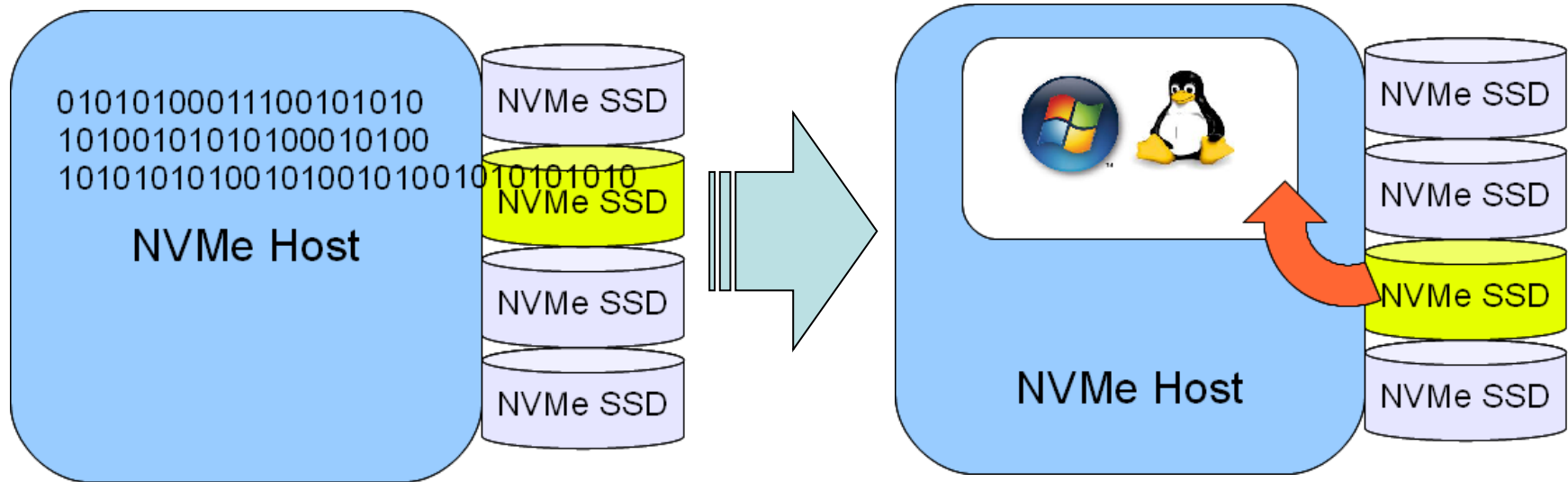
- Raise the IL Qualification Requirements:

Today	Tomorrow
Test with 4 products, pass with 3	Test with 5 products pass with 4
Pass with Windows or Linux reference driver	Pass with Windows and Linux reference driver

Improving the Test Program

- Improve the Tools:

    - Add MSI-X support to Summit scripts.
    - Already undertaken by UNH-IOL and distributed to some members.

Improving the Test Program

- Improve the Tools:

  - Improve OS support (update to Ubuntu 13.04) for IOL INTERACT.
  - Bug Fixes:
    - Set NSID to FFFFFFFFh
    - Correct AB value

IOL INTERACT
Testing Station
acting as NVMe Host

Improving the Test Program

- Make the Interop Tests More Rigorous
    1. Multiple Devices in the System
    2. Stressing Patterns
    3. Larger/Varying Transfer Sizes
    4. Boot from NVMe
- Raise the IL Qualification Requirements:
    - Require these more rigorous tests to be performed against more interop partners.
- Improve the tools
    - MSI-X, better OS Support, bug fixes

Improving the Test Program

- These improvements to be implemented by UNH-IOL prior to the next NVMe Plugfest:

    Planning Q4 2013

    @ UNH-IOL Durham, NH

- UNH-IOL will continue to work with member companies to add products to the Integrators List outside of plugfest events.

nvmexpress.org