



# Testing New Features of NVMe SSDs: Computational Storage and Beyond

**Presenter: Carter Snay**

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# Presenter



**Carter Snay**

**Lead Technical Manager**

Data Center Technologies

Datacenter Industry Manager

6+ years of experience working in  
NVMe® technology



# Why is NVMe SSD Testing Important?

*Amaturing technology, no?*

There are still new features to be worked out, and even old features that are not being implemented properly (according to the specifications!)



## Agenda

Introduction to the UNH-IOL

Program to Testing NVMe  
SSDs

Test Updates and Real  
World Issues

Testing Requirements for  
Computational Programs

What is Coming Next



About

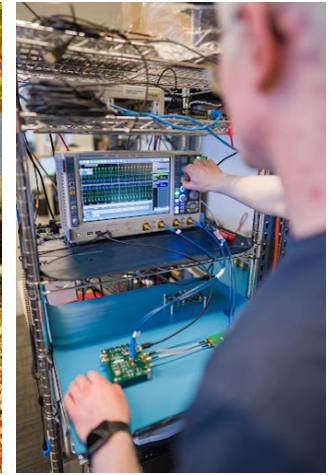
# Who We Are

IOL is a neutral and independent lab that tests networking and data communications products for businesses across the globe.

We started in 1988 on the University of New Hampshire Durham, NH campus.

We are a non-profit organization and 100% funded by commercial industry.

Since 2012, NVM Express has collaborated with UNH-IOL to manage the Integrator's List based Test Program on behalf of NVM Express Organization.



## UNH-IOL and NVM Express Organization

Since 2012, NVM Express has collaborated with UNH-IOL to manage the Integrator's List based Test Program on behalf of NVM Express Organization.

IOL Hosts the NVMe Integrators List.



# Products Listed on the NVMe Integrator's List

436

Unique NVMe®  
IL Devices

92

NVMe-oF  
Products



# Test Plan Development Process



## # 1

Major updates to test plans happen twice a year in order to keep pace with updates to the NVMe® specifications being developed at NVMe.org

## # 2

All Test Plan updates are created by NVMe interop and Compliance Committee.

## # 3

All updates are approved and voted on by the NVMe Technical Work Group and the NVMe Board of Directors.

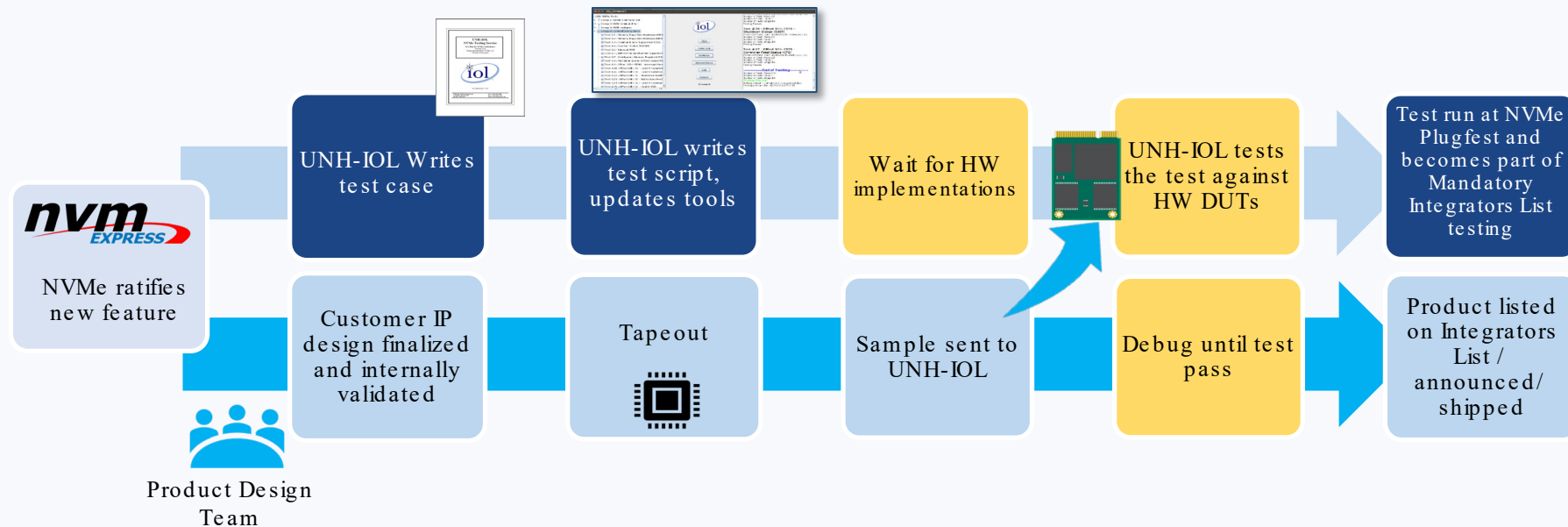
## # 4

All new tests added are made FYI, since in many cases there are no existing product in the market. This gives time for the Test Plan, DUT, and test scripts to be further validated.



# The Journey of a New Feature

## Implementation and Compliance







**Russ Bishop**

@xenadu02

...

Fun story: I tested a random selection of four NVMe SSDs from four vendors. Half lose FLUSH'd data on power loss. That is the flush went to the drive, confirmed, success reported all the way back to userspace. Then I manually yanked the cable. Boom, data gone.



Reddit · r/archlinux

8 comments · 1 year ago

## Two NVME SSD Problem on arch linux : r/archli

Hi ! I have **two** same **2 TB nvme ssd** same vendor and sam connected on mainboard :-( and i see with dmesg: **nvme r**

Windows wont boot after installing 2nd **Nvme - Kernel e**

BSOD after **second m.2** installation : r/pcmasterrace -

**NVMe SSD** failures : r/archlinux - Reddit

**M.2 NVMe** boot drive suddenly stopped working - R

More results from [www.reddit.com](http://www.reddit.com)



Ask Ubuntu

<https://askubuntu.com> · questions · ubuntu-sees

## Ubuntu sees only one of two nvme

Dec 8, 2020 — Ubuntu sees only one of two nvme

**PCI problem** The

1



Proxmox Support Forum

<https://forum.proxmox.com> · threads · only-one-of-tw...

## only one of two nvme detected in linux (duplicate subnqn)

May 21, 2019 — I just ran into it the other day with my new Thinkpad laptop. I've made a patch for this that should be going out in the **Linux 5.3 kernel**. It's a problem with the firmware, but...



Kernel Bugzilla

<https://bugzilla.kernel.org> · show\_bug

## globally duplicate IDs for nsid 1

Sep 29, 2023 — I have 2 NVMe (PCIe) SSD's that are the same model and firmware and both installed in the system and booted at the same time ( my guess to maybe why they're the same...



Arch Linux Forums

<https://bbs.archlinux.org> · Kernel & Hardware

## NVME Issues [SOLVED] / Kernel & Hardware

Dec 17, 2023 — So, I'm trying to troubleshoot some strange behavior on my Samsung

the primary NVMe slot (Asus Rog Strix B550-E board) - Slot=PCIe GEN 4) - Arch Linux installed...

[Resolved] Apparently, the new kernel slowed

System hangs after suspend when ser

Two SSD NVMe swapping devi

[SOLVED] NVMe SSD not

More results from

nvme ...	11 posts	Jul 3, 2023
...d installed	4 posts	Feb 9, 2024
...	4 posts	Dec 10, 2023
...	16 posts	Aug 1, 2023

# New Testing Updates!

## New Command Sets Added

1. TP 4091 Computational Programs
2. TP 4131 Subsystem Local Memory
3. TP 4182 Computational Programs Command Set Specification changes to other specifications
4. TP 4171 Subsystem Local Memory Command Set Specification

## New Features Being Tested

1. TP 4152 Post-Sanitize Media Verification
2. HMB With Low Power Support
3. TP 4170 Boot Partition Write Protection




# Computational Programs and Subsystem Local Memory Command Sets

**UNH-IOL  
NVMe Testing Service**

Test Plan for NVMe  
Computational Programs Command Set  
Conformance  
Version 22.0

*Target Specification:  
NVMe Computational Programs  
Command Set Specification 1.0  
Technical Document*



Last Updated: July 8, 2024

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Last Updated: July 9, 2024

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**UNH-IOL  
NVMe Testing Service**

Test Plan for NVMe Command Set Conformance  
Version 22.0

*Target Specification: NVMe Express NVMe Command  
Set Specification 1.0d and NVMe Express  
Base Specification 2.0d  
Technical Document*



Last Updated: July 26, 2024

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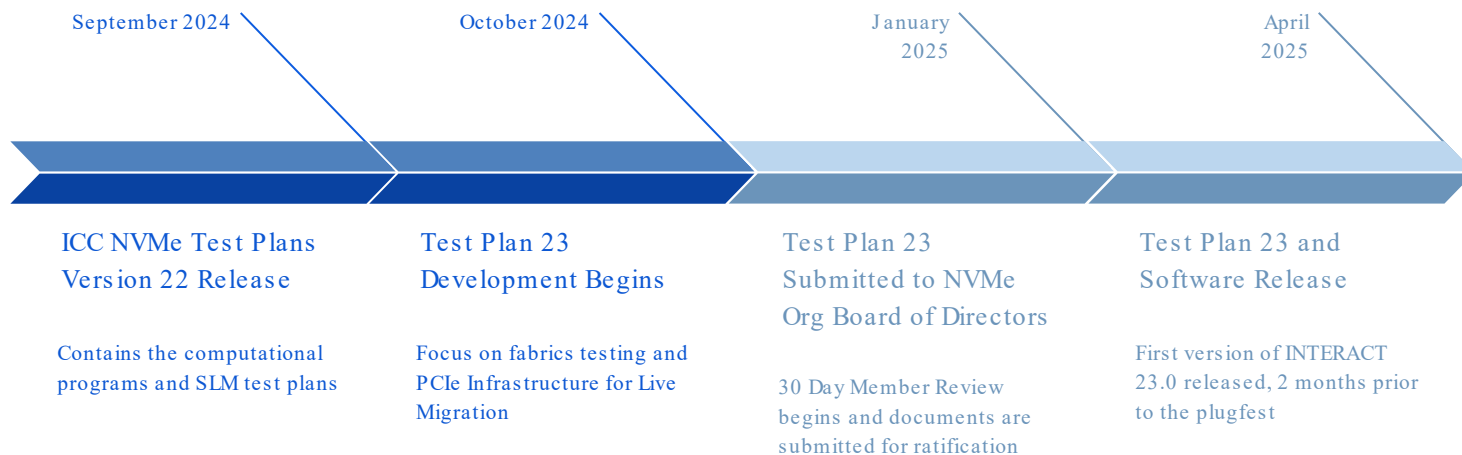
# New Features to Be Tested Next

## NVMe 2.1 Features

- PCIe Infrastructure for Live Migration
- Security enhancements such as support for TLS 1.3
- NVMe over Fabrics zoning
- NVMe over Fabrics Centralized Discovery
- Flexible Data Placement



# Timeline of Future Updates and Releases



## Takeaways

1. The NVMe ICC program is continuing to evolve and meet requirements of current interoperability and compliance issues
2. Issues with NVMe SSDs can be caught with the proper testing, and test gaps are filled as soon as possible
3. The Computational Programs and Subsystem Local Memory Command Sets from NVMe Org are available and the IOL is ready to test devices that implement them for compliance.



University of New Hampshire  
InterOperability  
Laboratory

**Thank You for Attending!**

**Q&A**

# Contact Us



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