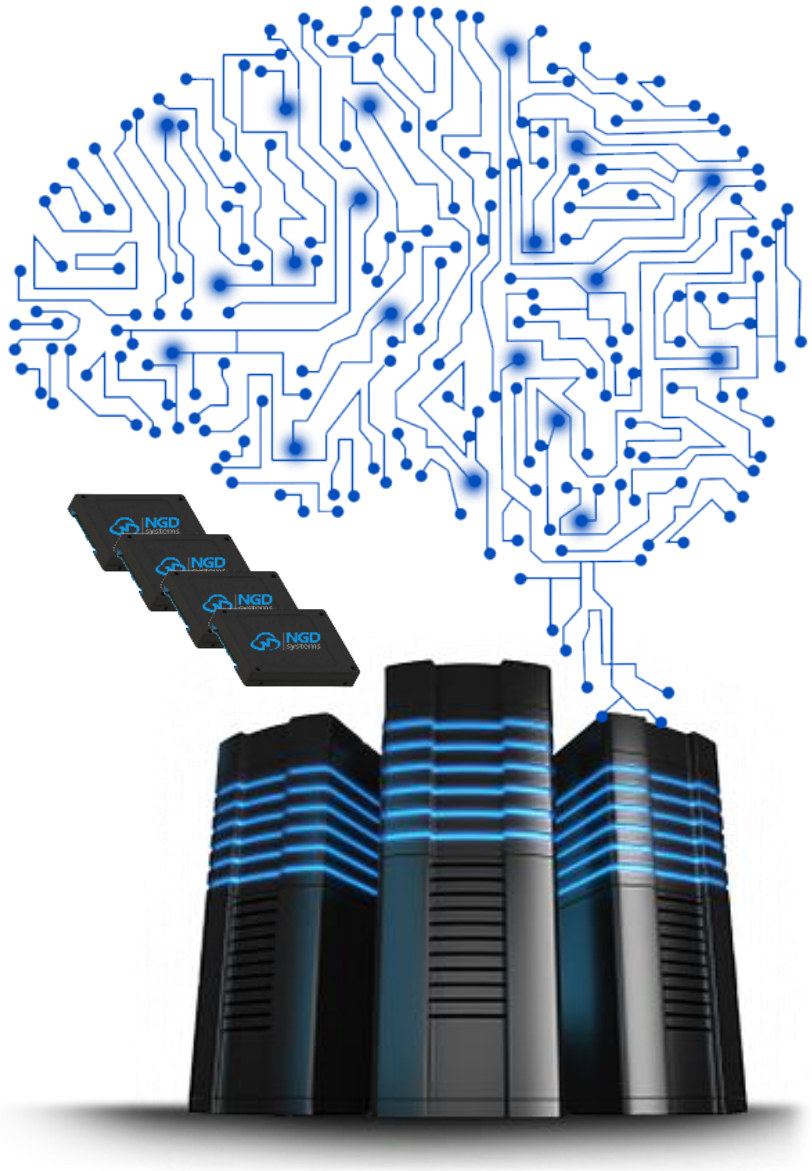


NGD systems

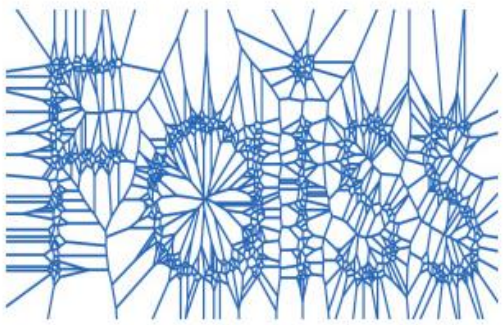
Bringing Intelligence to Storage

Intelligent Storage Enables Image Similarity Search

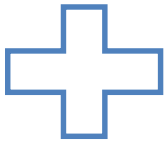
Newport Platform Solution

August 2018

AI Use Case: Image Similarity Search Problem Definition



Facebook **AI** Similarity Search



Computational Storage

10 M images — UCSB 2007

1 Billion images — Facebook 2017

1 Trillion images — 2019

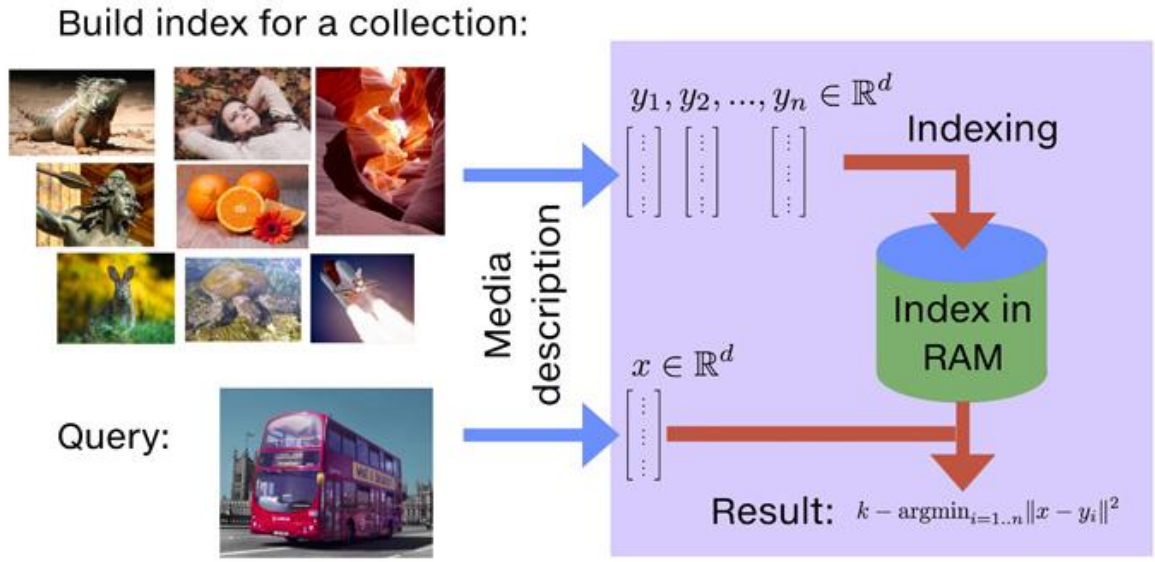
Query

Data Set 1B --> 1T images

....

Real Time Image Similarity Search (ISS) model – Where RAM Fails

- Indexing Process – **Google TensorFlow™**
  - Image to vector conversion
  - Dataset creation
  - Training Index
  - Database load (I/O)
  - Add vectors to index



- Searching Process – **Facebook AI Similarity Search (FAISS)**
  - Query Management
  - Search

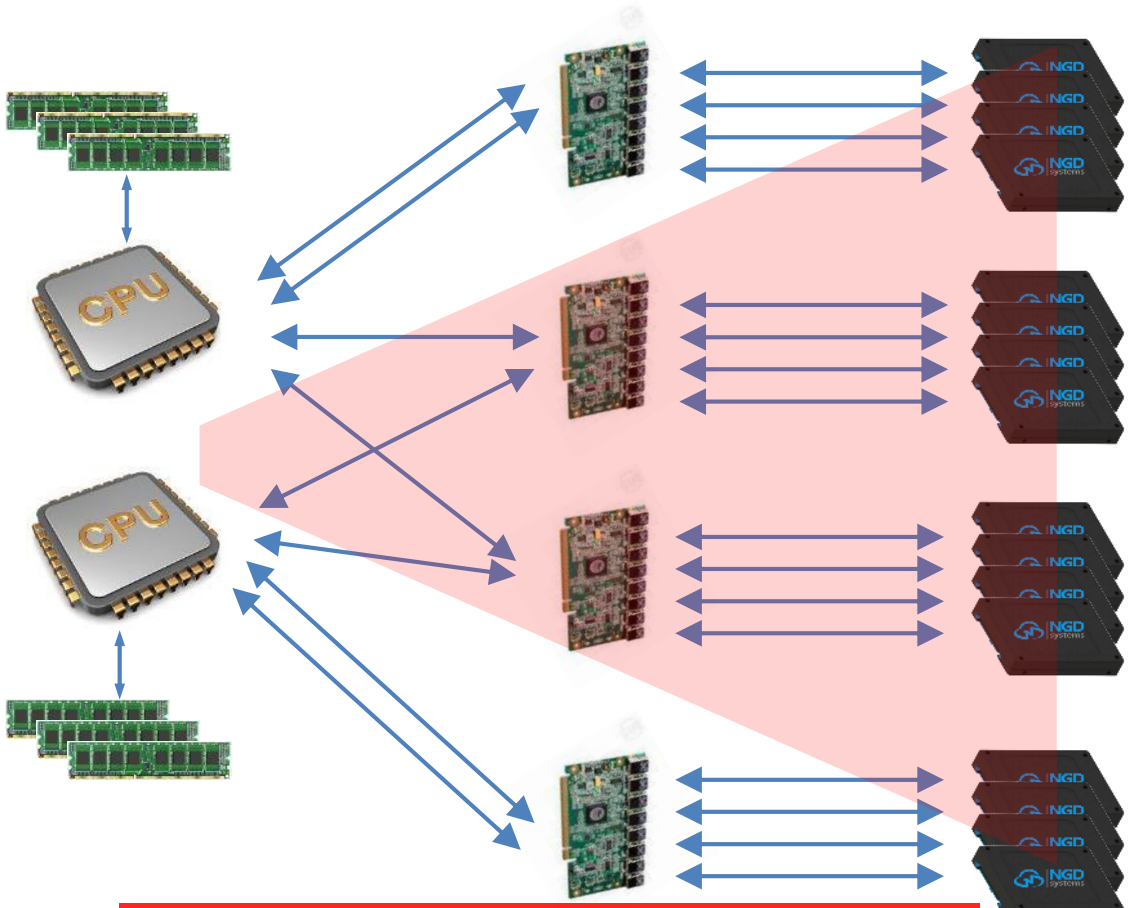
New Platforms add Lanes, Don't solve mismatch

- With more lanes, we add **maximum Storage**
- Time to **look at the strain** on a high capacity platform with 16TB+ per SSD

Ouch!

- Fabrics help, but only to share loads, **not solving** who carries the weight of compute

Added CPU and still have a Bandwidth mismatch



media to compute bandwidth mismatch **>60X**

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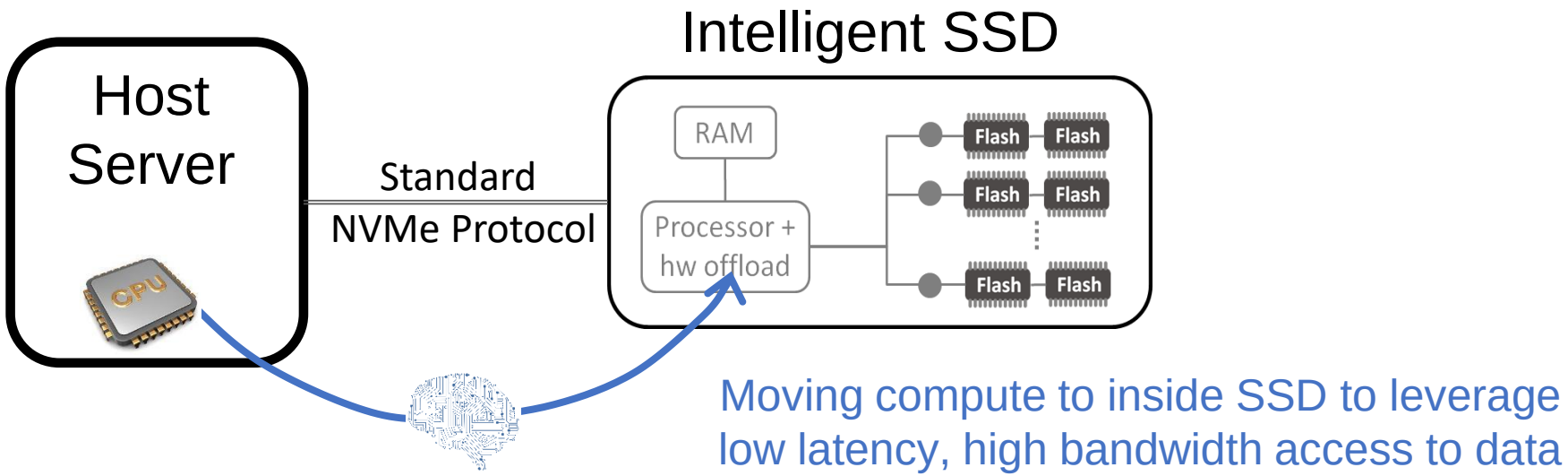
Move compute closer to data

- Reduce data movement across storage/network/memory/CPU for compute



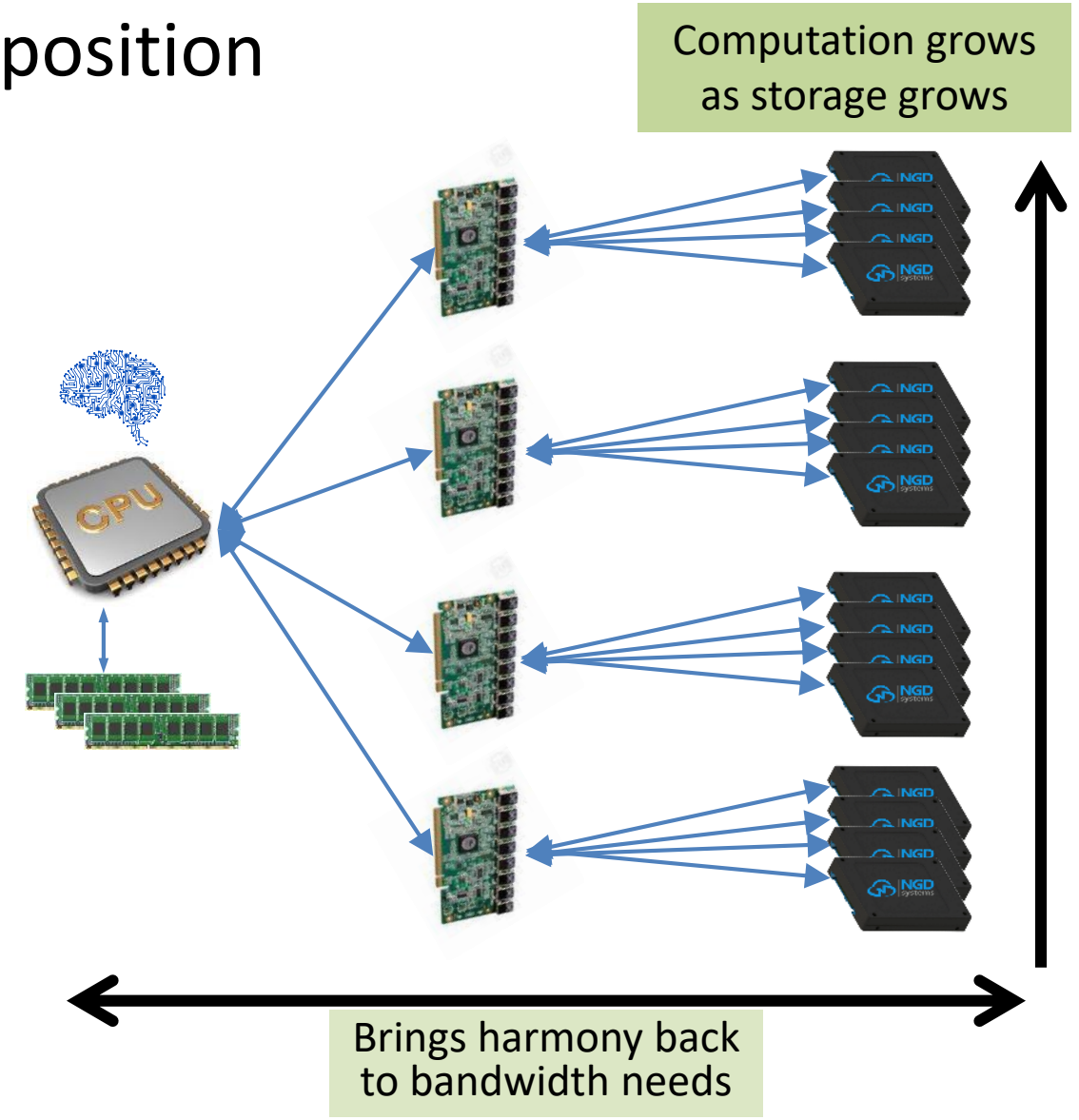
Moving compute to inside SSD to leverage low latency, high bandwidth access to data

<u>Key Attributes:</u>

- Maintain familiar methodology (no new learning)
- Use standard protocols and processes (no new commands)
- Minimize interface traffic (power and time savings)

Computational Storage Value Proposition

- **Simplify Design** by Maximizing CPU and Storage
- **Augment Computation** with In-Situ Storage saves CPU cycles
- **Scale up Storage** without CPU, Memory and Power costs
- **Align Bandwidth** through the use of intelligence in storage



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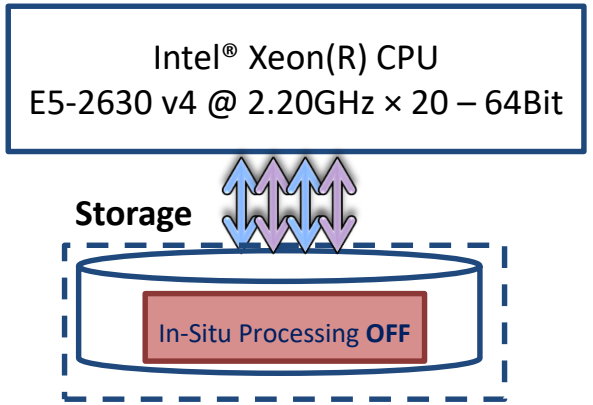
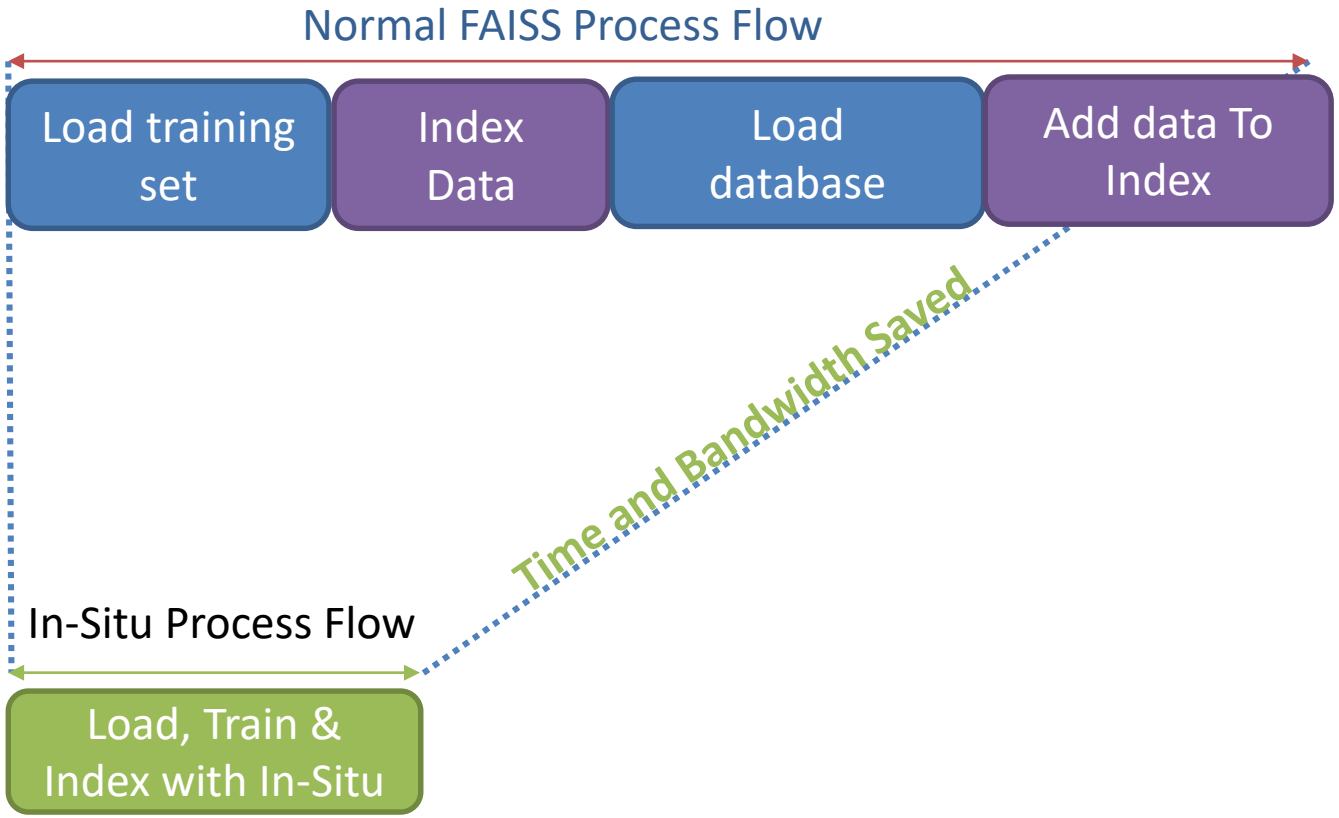
Showcasing FAISS Use Model with and without In-Situ

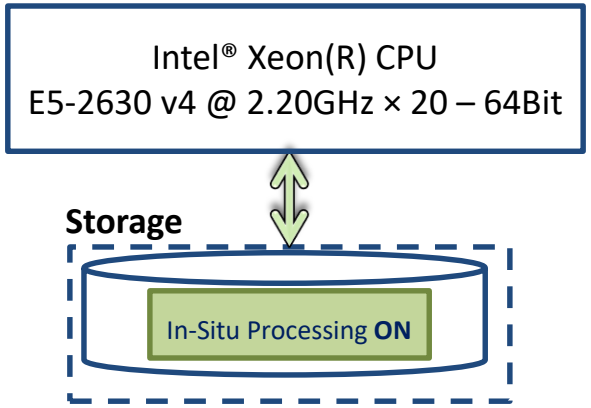
Top- HOST and In-Situ Disabled NGD Drive



How FAISS works



Bottom- HOST and In-Situ Enabled NGD Drive



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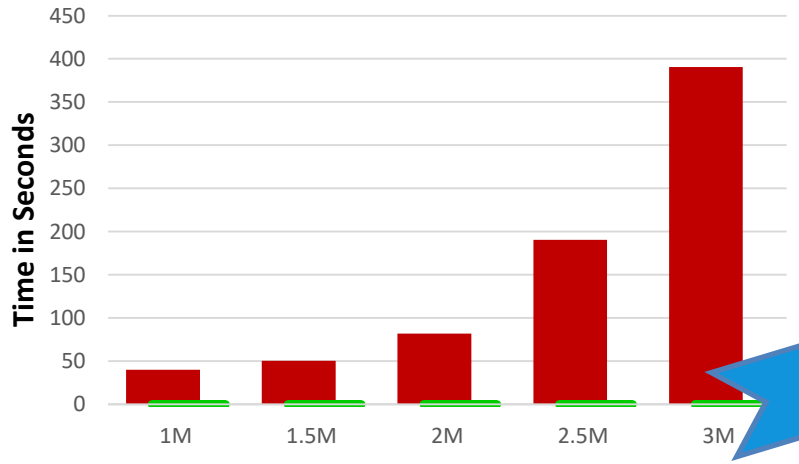
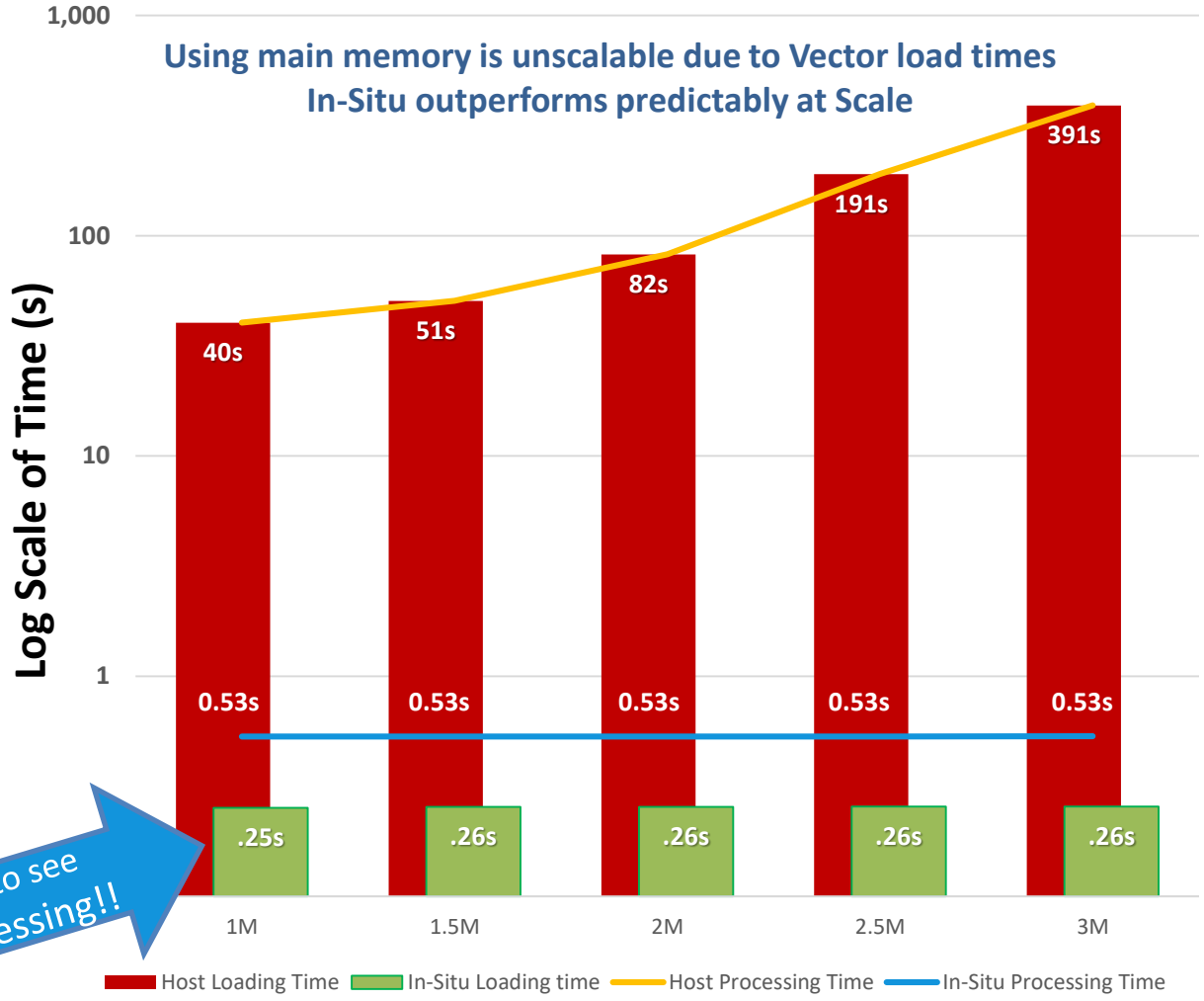
NGD Systems In-Situ Processing Shows Real World Results

- Host Processing requires Data be pulled from storage into Memory
- In-Situ requires No data movement and returns stable results regardless of dataset size
- NGD Systems allows for dataset growth with predictable execution and response



Log Scale needed to see NGD In-Situ Processing!!



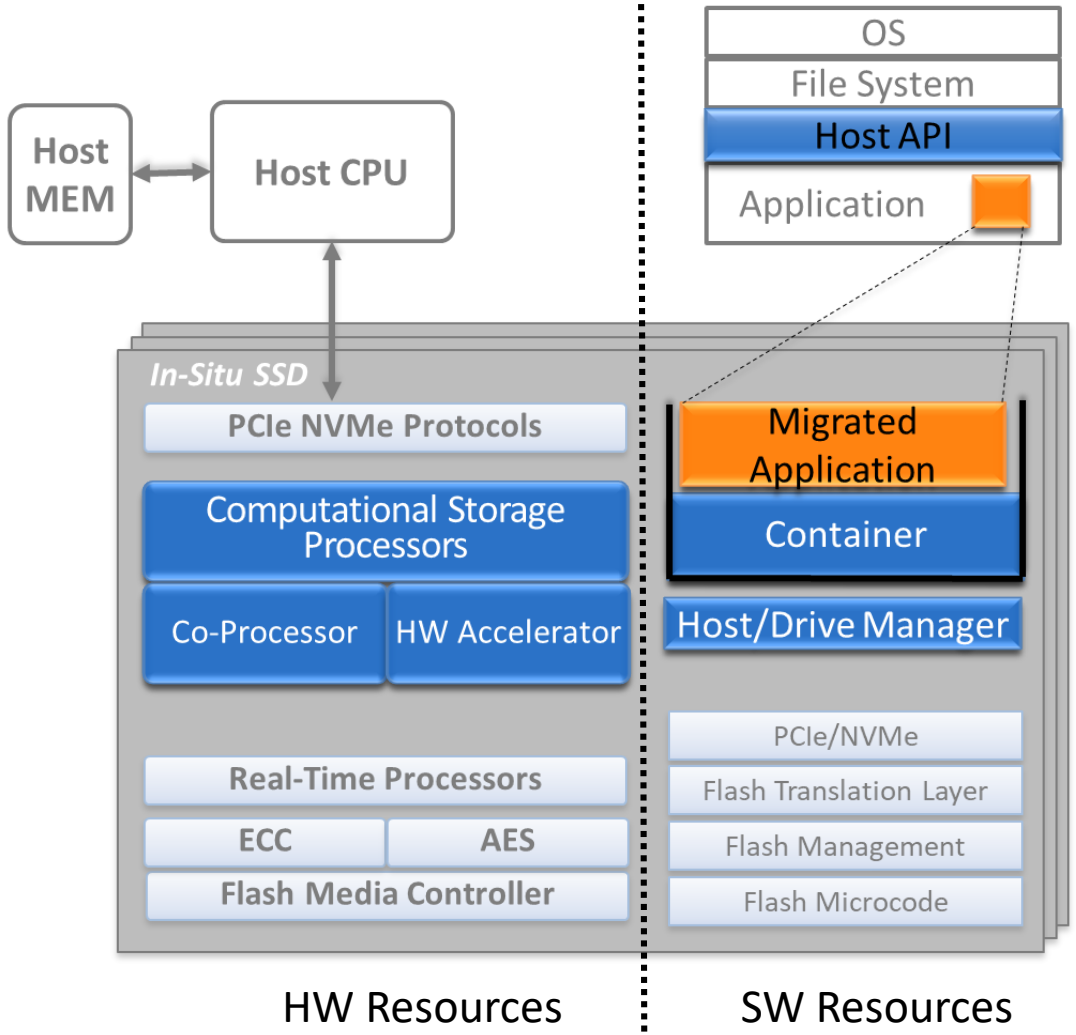
The Newport In-Situ Processing SSD Platform Controller

It's an NVMe SSD at the core

- No impact on host read/write
- No impact on NVMe driver
- Standard protocols

But then there is MORE (Patented IP)

- Dedicated compute resources
- HW acceleration for data analytics
- Familiar programming model
- Extremely Scalable



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Computational Storage Solutions

PATENTED NGD Systems Solutions

- In-Situ Software
- **Patented Firmware**
- **Management Algorithms**
- **Optimized Hardware**
- **Silicon Architecture**

20 Granted Patents On SSD Technology Innovation

Starting with a Solid Foundation of ASIC Design

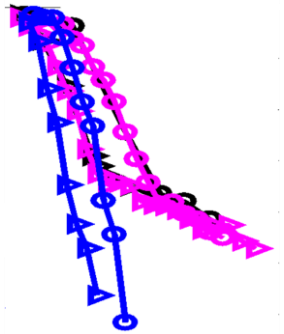
New Technology Advancements in ASIC Design

Creating a Solid Infrastructure

SSD HW Designed for optimized Power and capacity

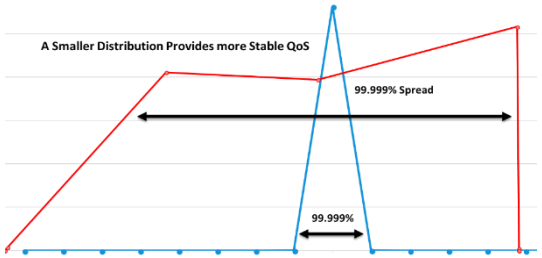
Enabling an Optimized Ecosystem

3D NAND Agnostic with Error Floor Free LDPC ECC



Creating a Sustainable Product Platform

Optimized Drive FW to ensure consistent READ/WRITE Performance



New Benchmarks Coming to the Market

PATENTED
NGD Systems Solutions

- Patented Firmware
- Management Algorithms
- Optimized Hardware
- Silicon Architecture

In-Situ Software Defined

Hardware acceleration

Quad-core 64-bit application processor

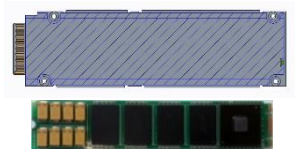
Full Fledged on drive OS

Light Virtualization

Setting NEW Industry Benchmarks

Energy density (**W/TB**)	**10x**
Cost reduction **($/GB)**	**4x**
Volumetric density (**TB/in³**)	**5x**

20 Granted Patents On SSD Technology Innovation



EDSFF/M. 2 Up to 16TB

U.2 15mm Gen3 x4 up to 32TB

FHTQL AIC Gen3 x4 up to 64TB

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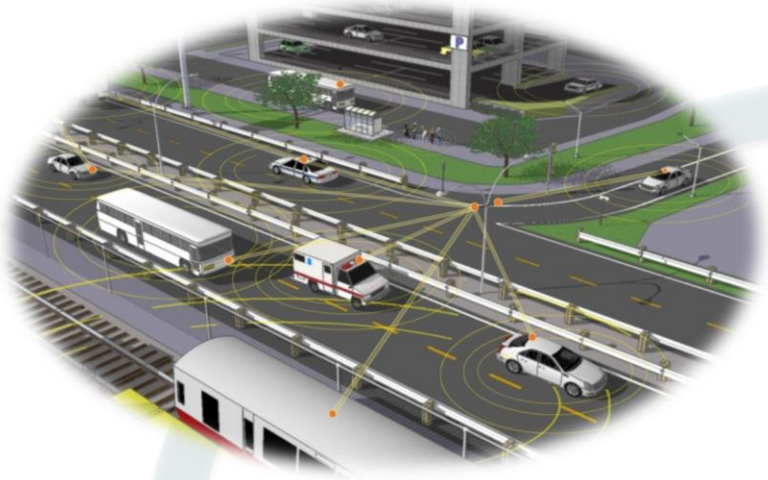
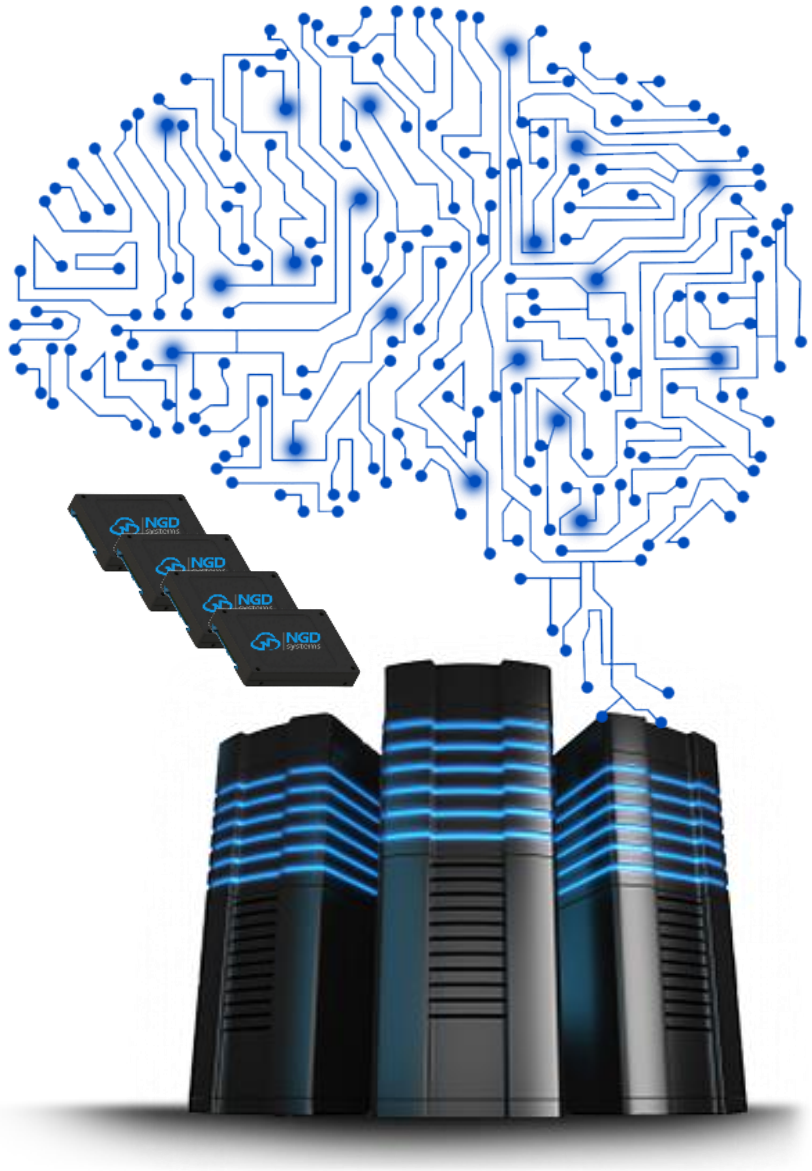
Managing Data Growth at the Edge



In-Situ Processing

Process Massive Amount of Data
Manage Limited bandwidth
Limit System Power Needs



NGD systems

Bringing Intelligence to Storage

Thank You

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