SNIA CMSI | COMPUTE, MEMORY, AND STORAGE

Uniting Compute, Memory, and Storage

SNIA Webcast
June 2, 2020

Today's Speakers

Moderator:
Alex McDonald
NetApp
Co-Chair, SNIA Compute, Memory, and Storage Initiative

Presenter:
Eli Tiomkin
NGD Systems
Chair, CMSI Computational Storage Special Interest Group

Presenter:
Jonmichael Hands
Intel
Co-Chair, CMSI SSD Special Interest Group

Presenter:
Jim Fister
Director, SNIA Persistent Memory Enabling

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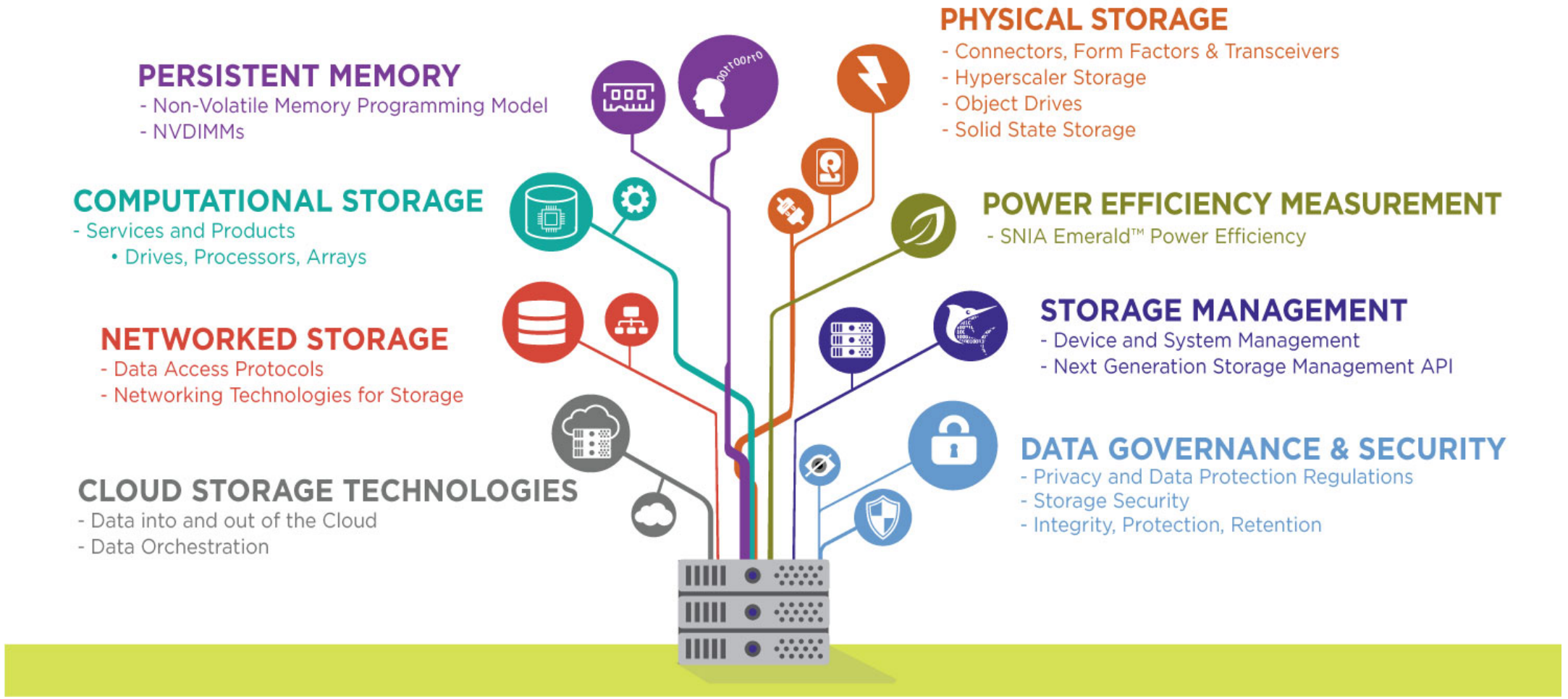
SNIA-at-a-Glance

185
industry leading organizations

2,000
active contributing members

50,000
IT end users & storage pros worldwide

SNIA Areas of Focus



Our Topics Today

- What is and why Computational Storage?
- Where is Solid State Storage headed?
- What can we now do with Persistent Memory?
- And finally,
  - Why did SNIA bring these activities together?
  - How can we all play nice?

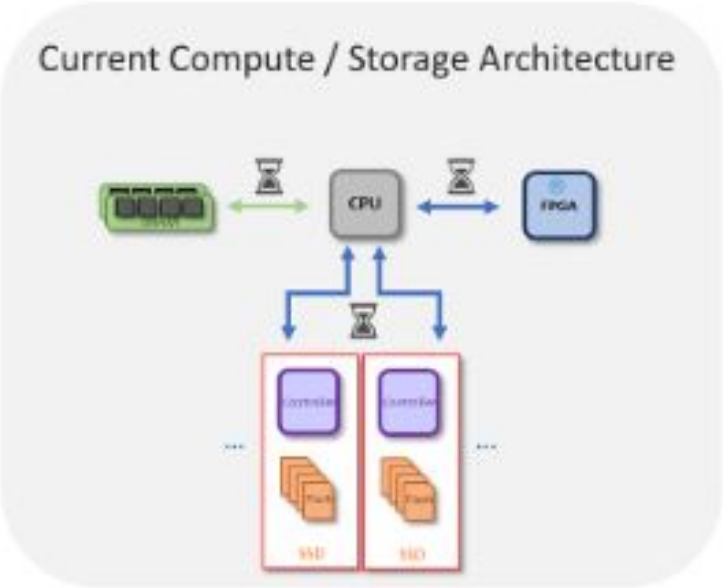
Computational Storage

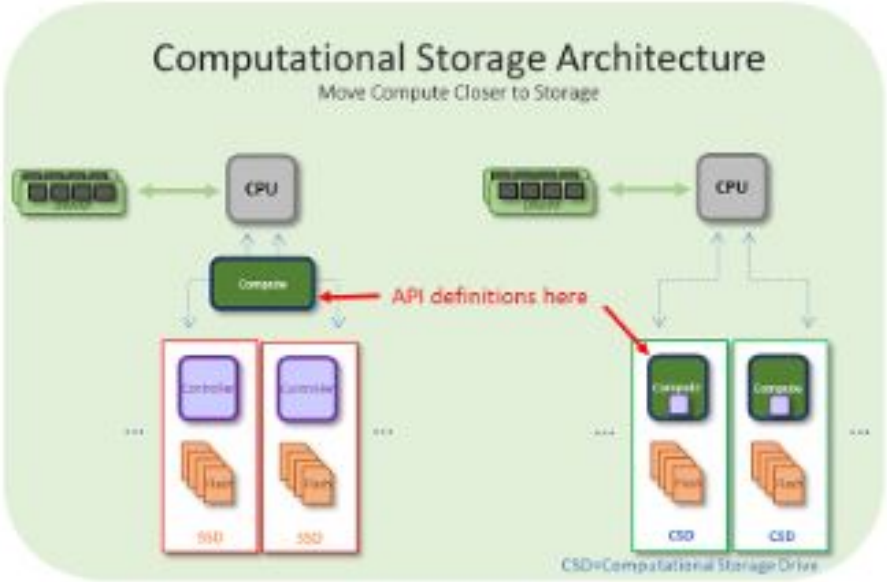
SNIA Computational Storage Technical Work Group

SNIA Computational Storage Special Interest Group

What is Computational Storage?

- Computational Storage is defined as architectures that provide Computational Storage Services coupled to storage, offloading host processing, or reducing data movement.





Many Factors Driving a Need for Computational Storage

Keys To Harnessing The Data Tsunami

Jonathan Salem Baskin Contributor ⓘ
Jun 13, 2016, 10:00am • 1,486 views • #BigData

AI Weekly: Computing power is shaping the future of AI

KHARI JOHNSON @KHARIJOHNSON MAY 18, 2018 7:14 PM

The Big Data Tsunami

Author: Matt Ferrari
Chief Technology Officer
ClearDATA

NEAR-DATA PROCESSING: INSIGHTS

Near-Data Computation: Looking Beyond Bandwidth

Published in: IEEE Micro (Volume: 34, Issue: 4, July-Aug. 2014)

the Analytical Scientist

Defying the Data Tsunami

Three motivating factors for using Edge Computing

IBM

Internet of Things blog

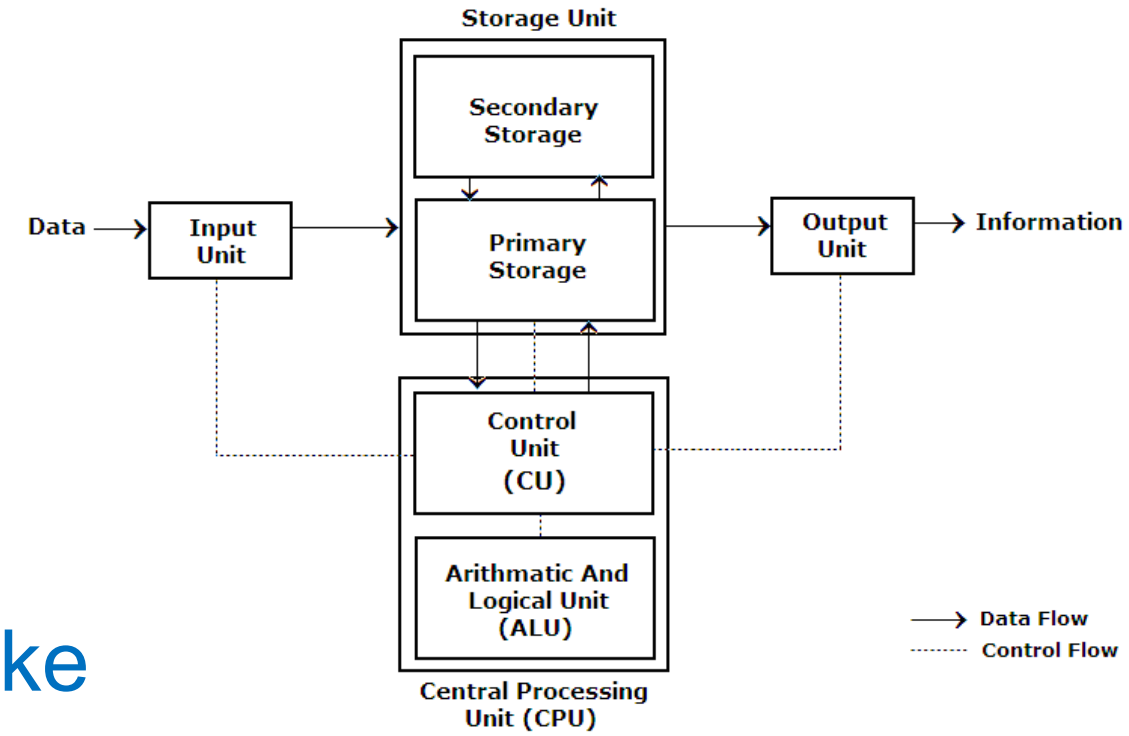
1. Preserve privacy

2. Reduce latency

3. Be robust to connectivity issues

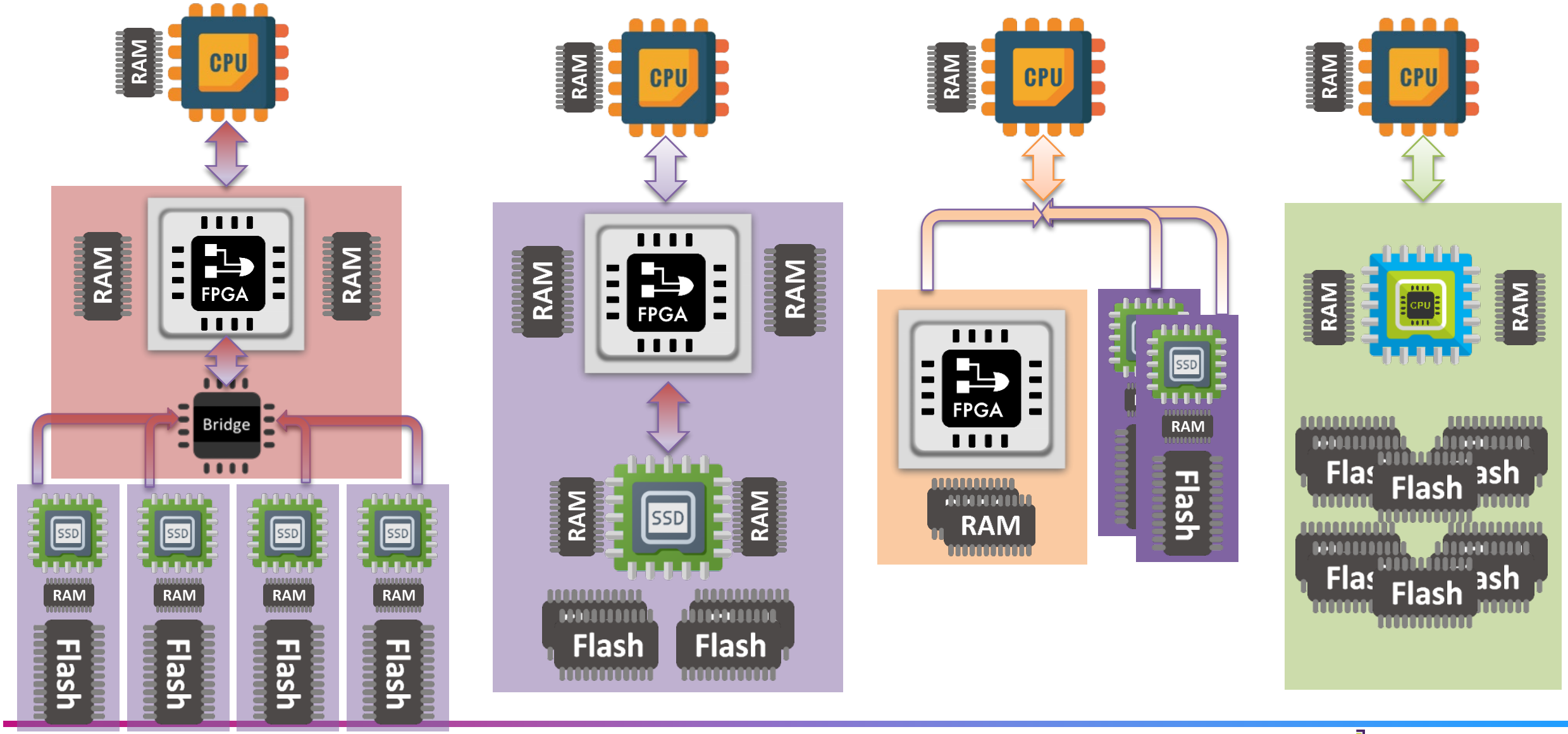
Compute, Meet Data

- Based on the premise that storage capacity is growing, but **storage architecture has remained mostly unchanged** dating back to pre-tape and floppy…



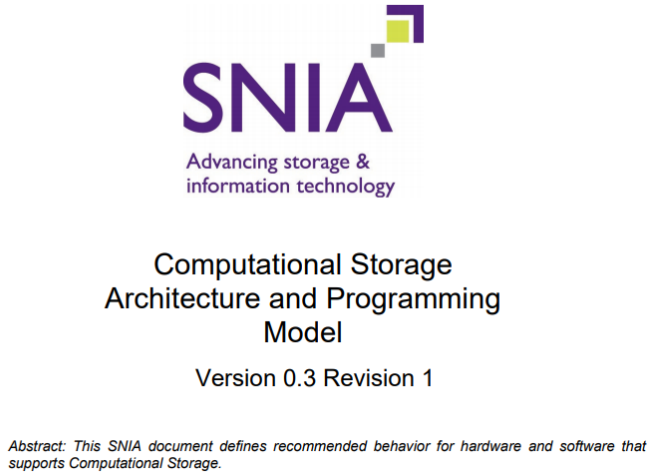
How would you define changes to take advantage of Compute at Data?

Current Instances of Computational Storage



SNIA Computational Storage Technical Work Group

- 45 participating companies/202 member representatives
- Focus on definition list to ensure the TWG covers question on what computational storage is and what its products can be
- Drive to a scope and path to a universal usage model
- SNIA's Computational Storage Technical Work Group is developing a *Computational Storage Architecture and Programming Model* – defining recommended behavior for hardware and software that support computational storage
- Download the latest version – and make your comments at the SNIA Feedback Portal



45 Participating Companies - 202 Member Representatives

Computational Storage Special Interest Group

- 10 member companies
- Educating on benefits, use models, and implementations of computational storage and soliciting input on the Computational Storage Technical Work Group draft SNIA Computational Storage Architecture and Programming Model.
- Planned webcasts, videos, and presentations at virtual events

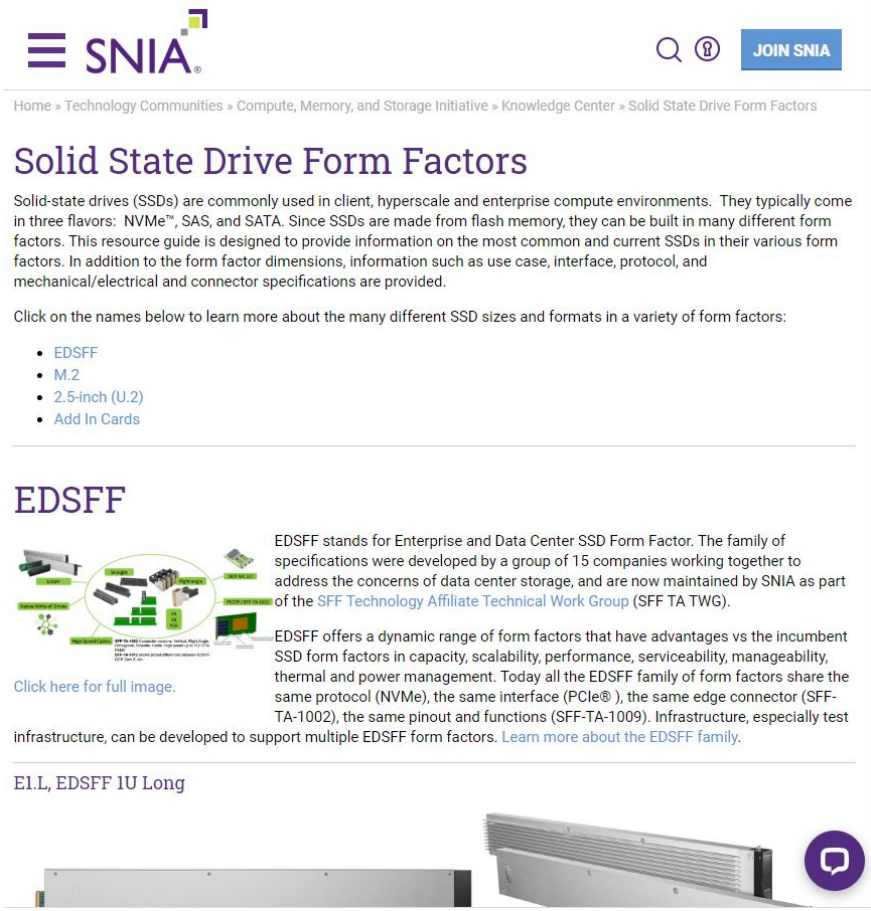
Solid State Storage

SNIA Solid State Storage Technical Work Group

SNIA Solid State Drive Special Interest Group

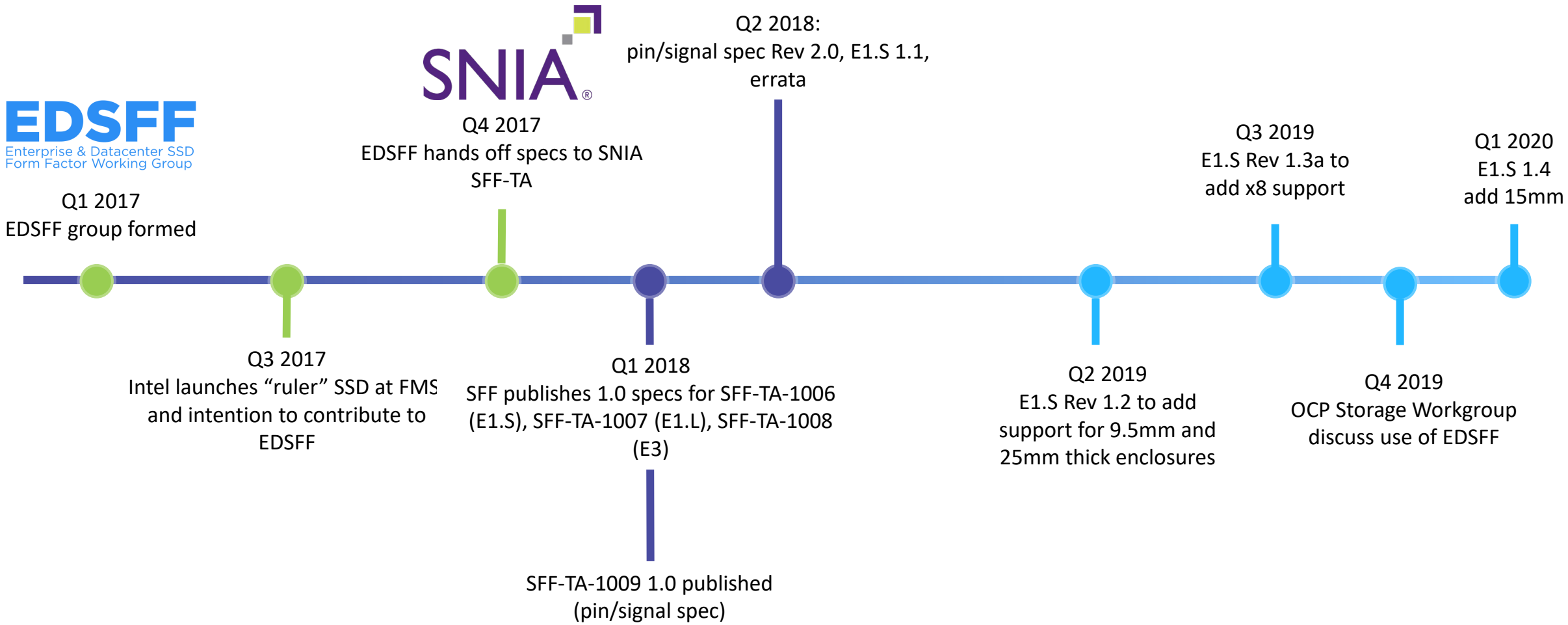
SNIA SSD Special Interest Group

- Expanding knowledge of SSD form factors and the optimum use of SSDs in enterprise, client, and application environments like hyperscalers via webcasts, videos, and presentations at virtual events.
- Close coordination with other standards organizations like NVM Express and SCSI Trade Association.



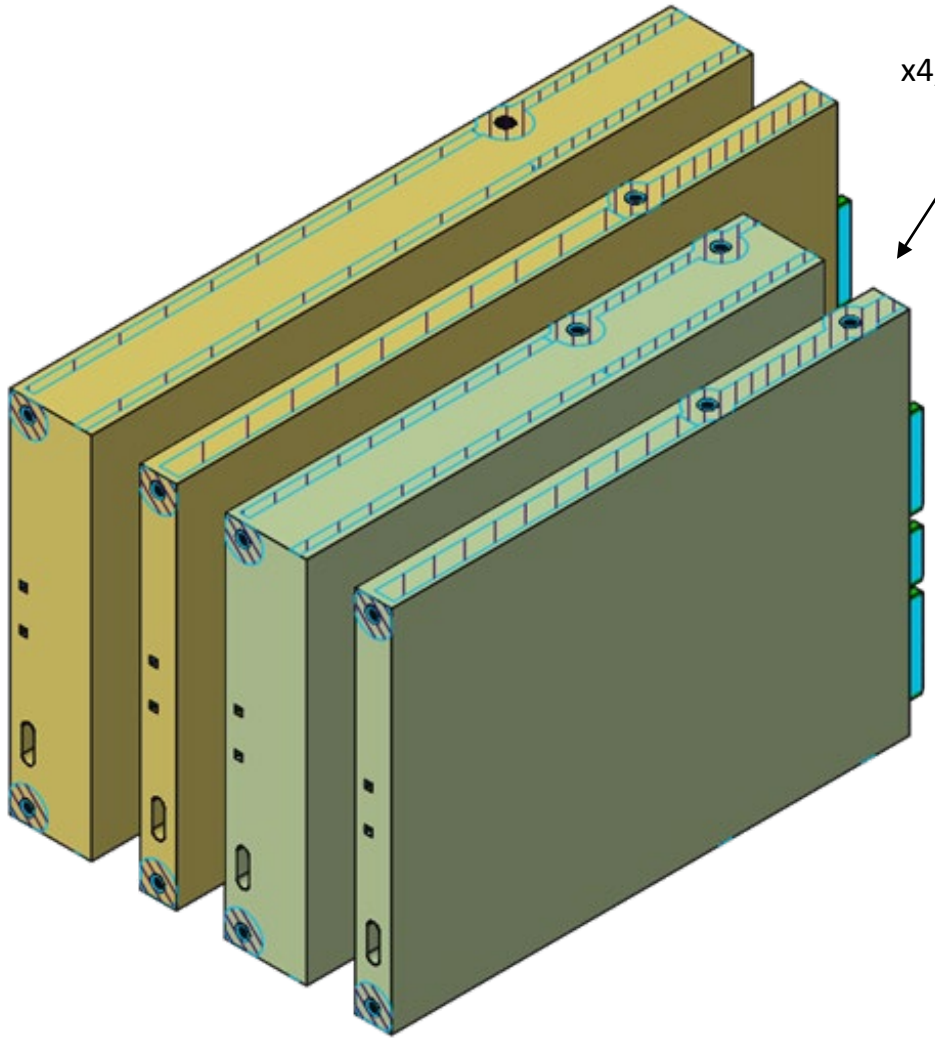
https://www.snia.org/forums/cmsi/knowledge/formfactors

EDSFF History



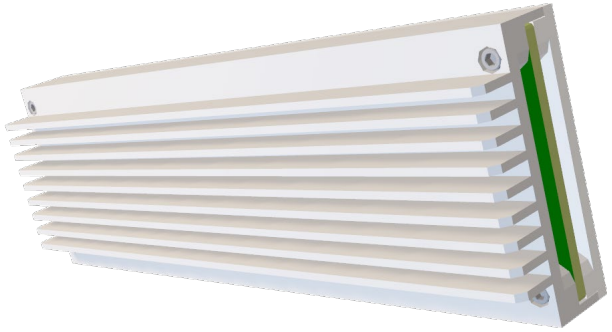
E3 - updated!! SFF-TA-1008

- E3 is a family of four form factors with a common 76mm height
  - E3 FH ¾ Length, 1x
    - 76mm x 112.75mm x 7.5mm
    - Supports up to 20W
    - Optimized for primary NAND storage in Servers
  - E3 FH ¾ Length, 2x*
    - 76mm x 112.75mm x 16.8mm
    - Supports up to 40W
    - Support for higher power devices like CXL based SCM
  - E3 FH Full Length, 1x
    - 76mm x 142.2mm x 7.5mm
    - Supports up to 35W
    - Support for higher capacity NAND storage
  - E3 FH Full Length, 2x*
    - 76mm x 142.2mm x 16.8mm
    - Supports up to 70W
    - Support for higher power devices like FPGAs and accelerators



Note* - A thick device will fit into two thin slots
- A short device will fit into a long slot

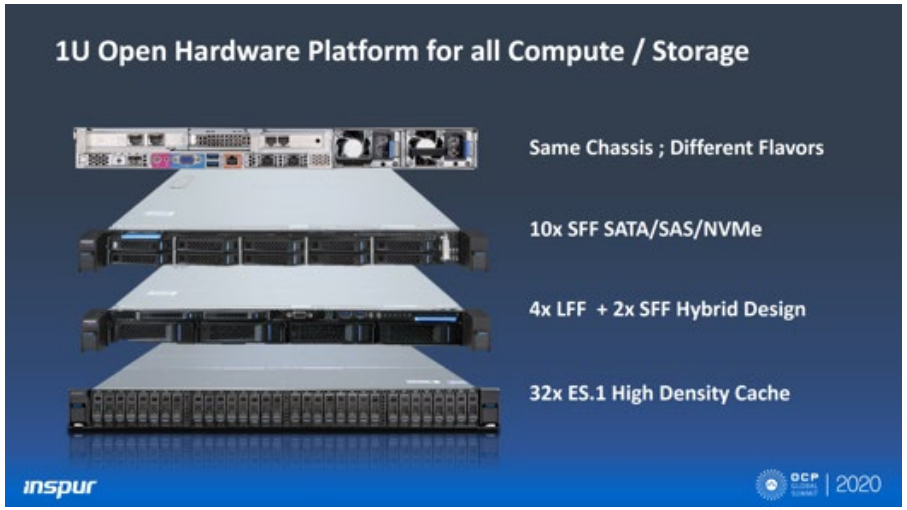
New – proposed at OCP, E1.S 15mm, SFF-TA-1006 1.4

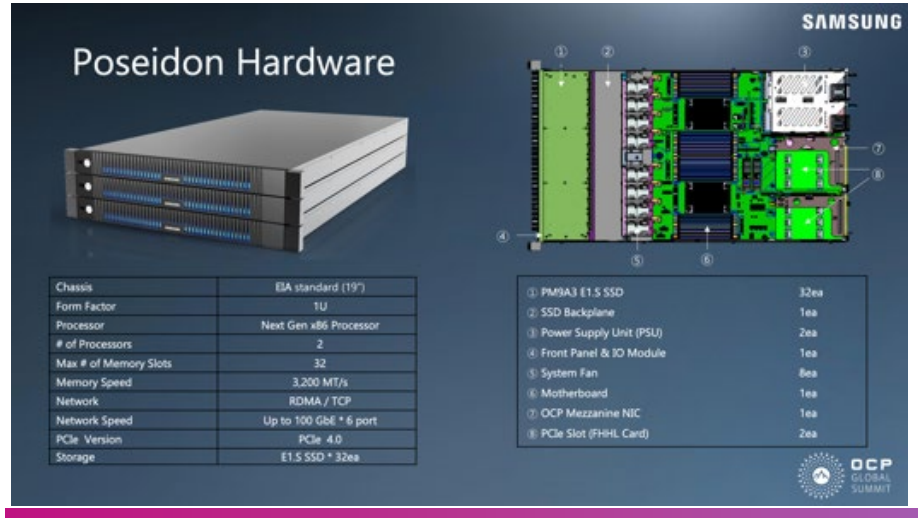


- E1.S new thickness at 15mm, up to 25-35W @ 35C, 24x drives in 1U server
- Higher performance than U.2 in smaller form factor
- Scales to PCIe 5.0, 3D NAND and storage class memory (e.g. Intel® Optane™ SSD)
- Performance, power, and thermals for mainstream SSD capacities (4, 8, 16TB) in the next 2-5 years

EDSFF Platforms

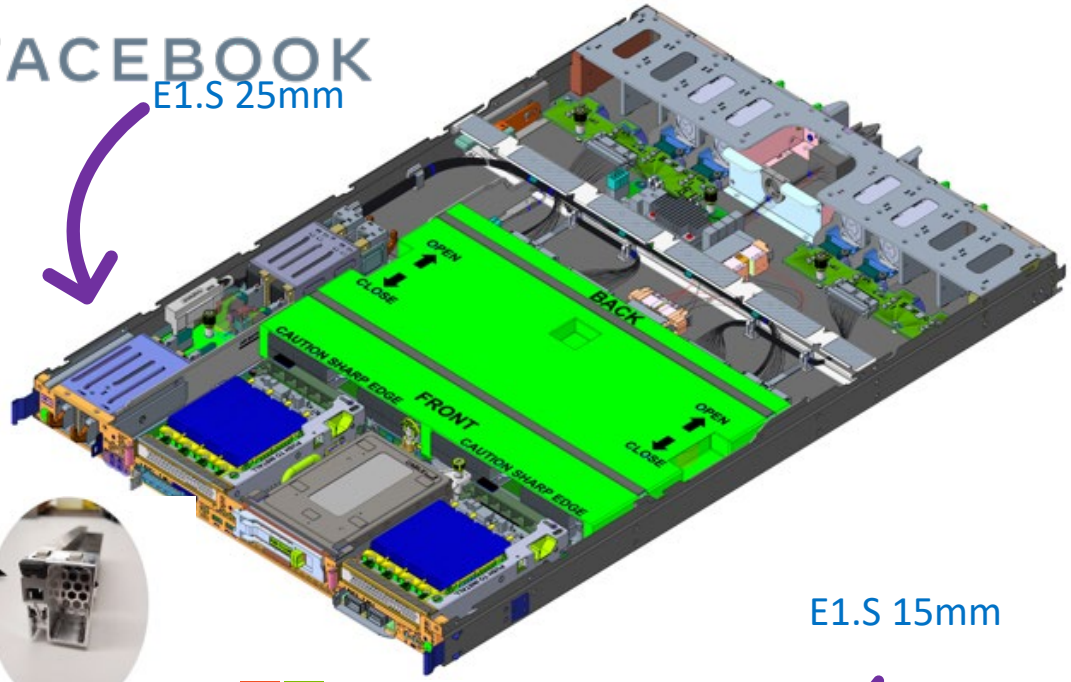
inspur 浪潮



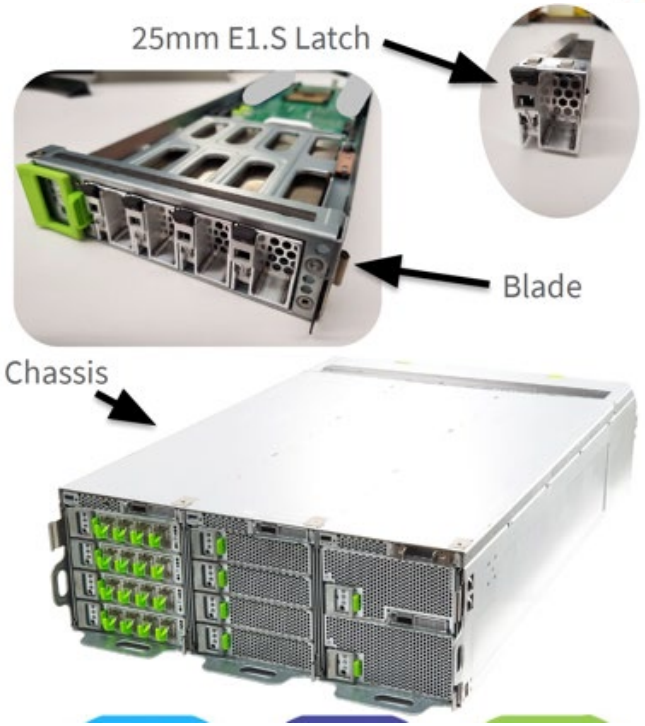


FACEBOOK

E1.S 25mm



Yosemite V3



Microsoft

E1.S 15mm

E1.S SSD Vendor Ecosystem in FB presentation

Comparison Metrics: T-inlet and Flowrate
- How do Designs Compare @ fixed 20W SSD PWR

STORAGE

	Width	SSDs / Platform	CFM/SSD	T-inlet "max air temp allowed"	dP SSD (in-H2O)	Platform CFM	PWR/SSD*	Total SSD PWR	Air T-rise
A	9.5	32	2.4	45	.62	76.8	20	640	16.3
B	15	24	3.6	57	.5	86.4	20	480	10.8
C	25	16	6.0	62	.24	96	20	320	6.5

Example:

- "Design A" allows a 45C T-inlet @ 640W total SSD power (or equivalent IOPs). A result of high total power and lower platform airflow is a 16C increase in air temp to downstream thermal subsystems.
- Alternatively, "Design B" allows a modest 480 SSD Watts (IOPs), it can support a T-inlet of 57C, and

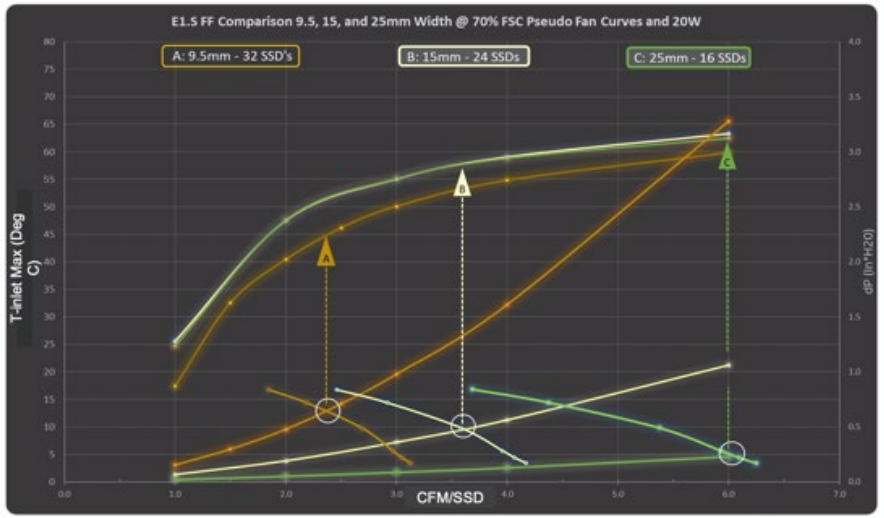
- Metrics provide understanding of an SSD form factor's ability to scale capacity, performance and cooling when integrated to a platform.
- It also provides insight to which form factor may benefit a platform thermally and or achieve fan power efficiency targets.

E1.S 9.5, 15, and 25mm Width Platform Response - @70% Fan Speed; 20W

STORAGE

- **This graph shows where 3 different SSDs operate (CFM) in same platform**
  - A: 9.5mm @ 2.3 CFM
  - B: 15mm @ 3.6 CFM
  - C: 25mm @ 6.0 CFM
- **Shows T-inlet allowable of the 3 SSD widths in context of the fan curves**
  - A: 9.5mm = 45C T-inlet
  - B: 15mm = 57C T-inlet
  - C: 25mm = 62C T-inlet
- **Allows key metrics such as total platform CFM for respective designs**

	SSD	Platform
A: 9.5mm	32 @ 2.3 CFM	= 77 CFM
B: 15mm	24 @ 3.6 CFM	= 86 CFM
C: 25mm	16 @ 6.0 CFM	= 96 CFM



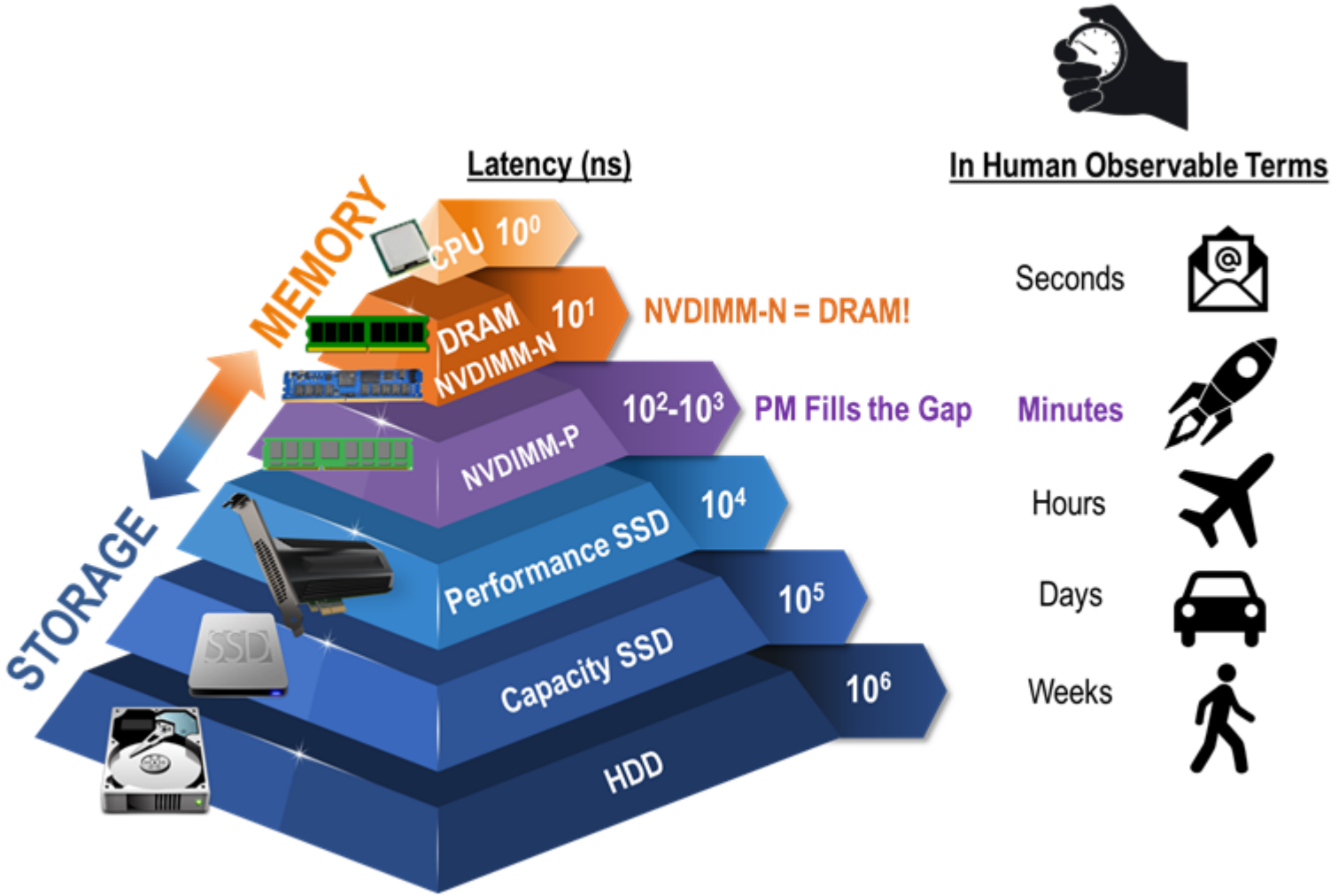
Persistent Memory

SNIA Persistent Memory Programming Technical Work Group

SNIA Persistent Memory & NVDIMM Special Interest Group

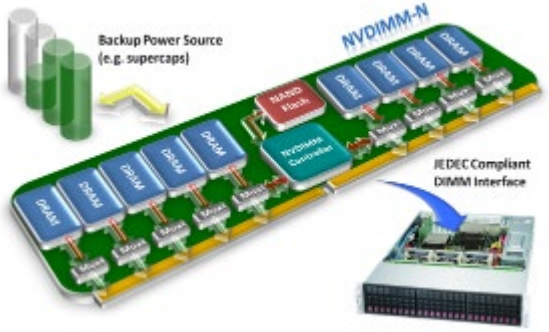
What is Persistent Memory?

- Persistent Memory is non-volatile, byte addressable, low latency memory with densities greater than or equal to Dynamic Random Access Memory (DRAM). It is beneficial because it can dramatically increase system performance and enable a fundamental change in computing architecture. Applications, middleware, and operating systems are no longer bound by file system overhead in order to run persistent transactions.

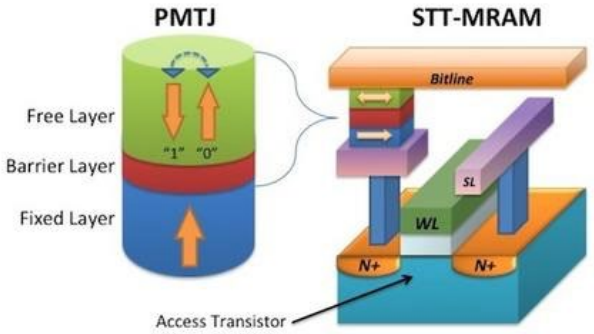


Many Existing and Emerging Memory Types

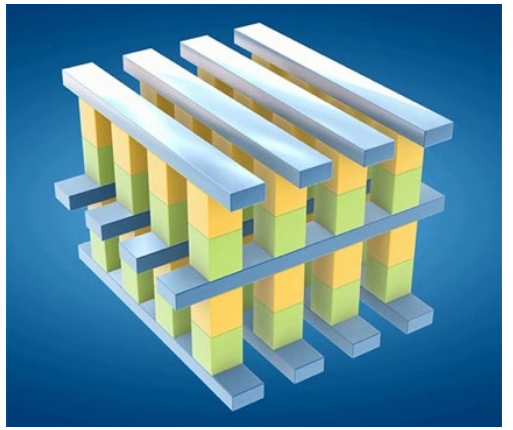
NVDIMM-N



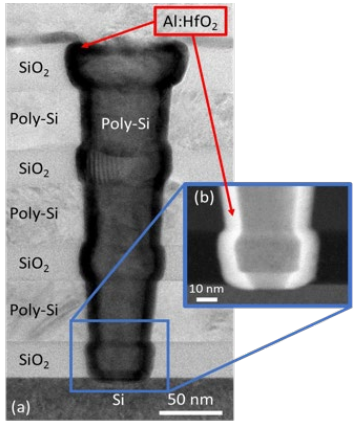
MRAM



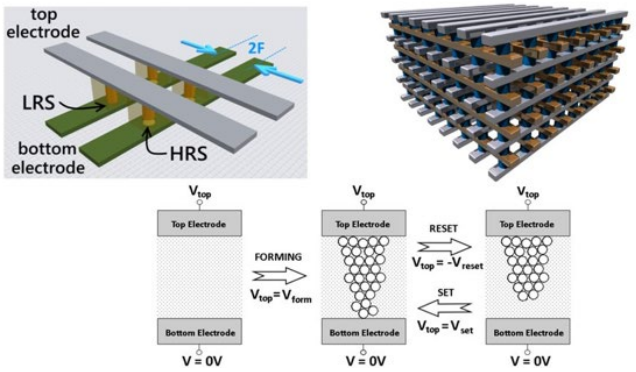
PCM



FRAM



ReRAM



And They Are All Persistent!

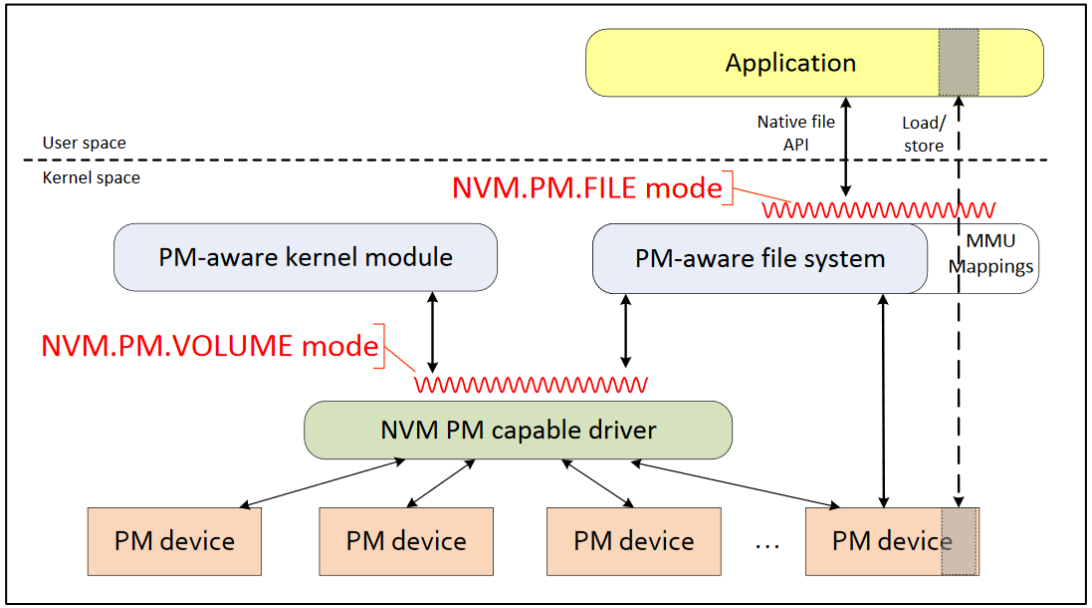
Check out the SNIA Webcast – What a Year It Was - and Where We Need To Go in Emerging Memory

PM Needs Support

- Hardware (JEDEC, Others)
  - Supporting early development
  - Ongoing requirements
  - Form factors, interfaces
- Software support (SNIA, Others)
  - O/S support
  - Open source libraries
  - Application program support

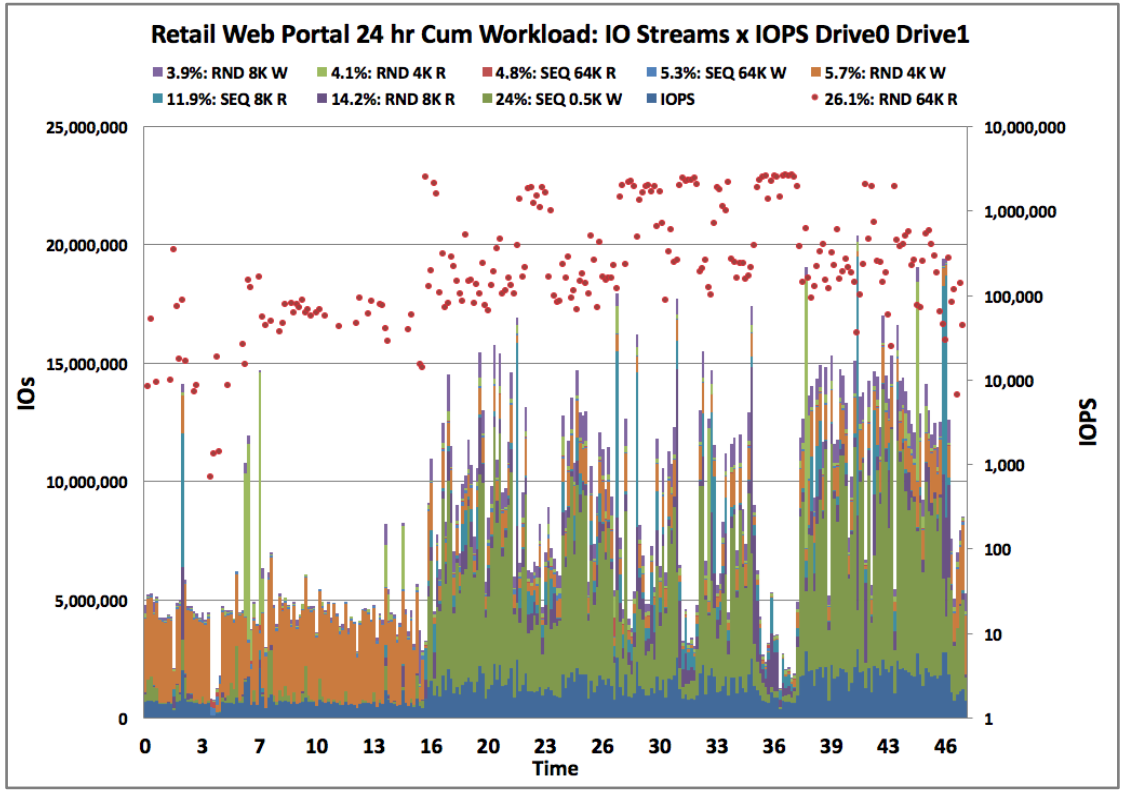
SNIA Persistent Memory Programming Technical Work Group

- Developing a Persistent Memory Programming Model describing the behavior of a common set of software interfaces that provide access to non-volatile memory (NVM)



SNIA Solid State Storage Technical Work Groups

- SSD drive and SSD system work groups
- Expertise in the area of SSD performance and behavior
- Solid State Storage Performance Test Specifications
  - SSDs
  - Persistent Memory
  - Real World Performance



Retail Web Portal 24 Hr Workload: IO Streams & IOPS

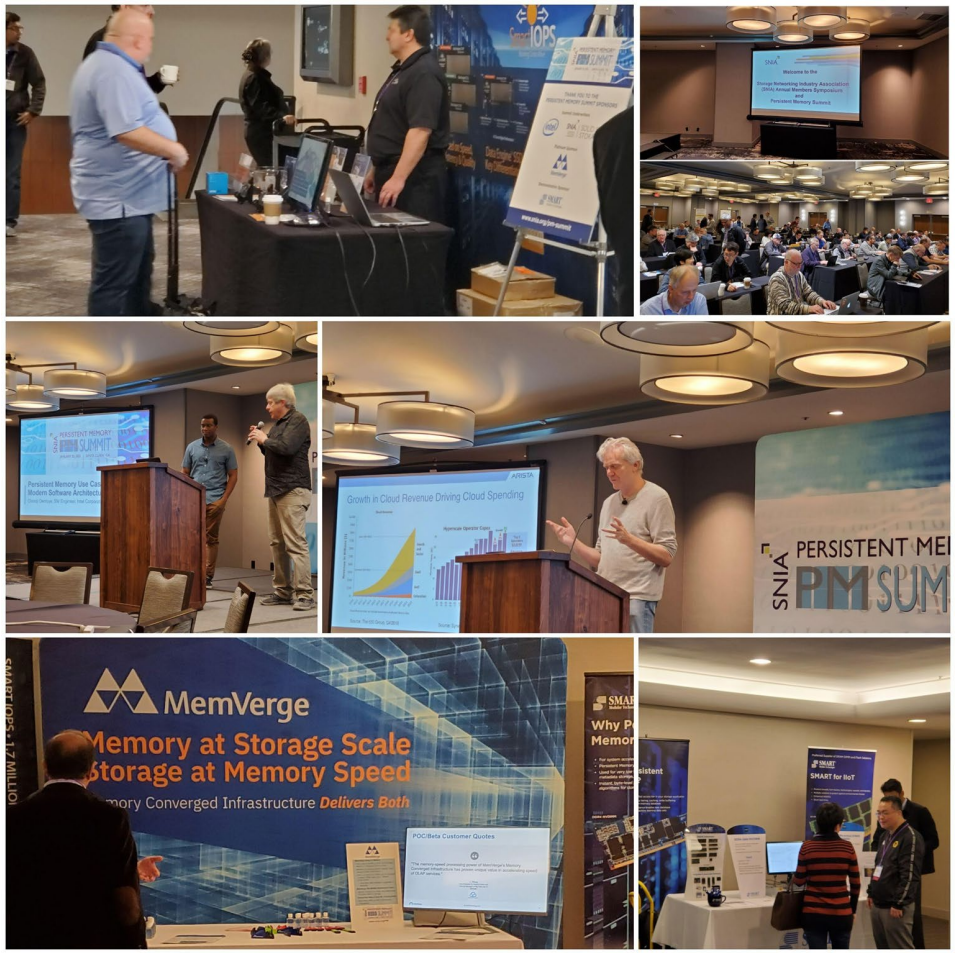
SNIA Persistent Memory and NVDIMM SIG

snia.org/pm

- Formed to accelerate the awareness and adoption of Persistent Memories for computing architectures
- Activities
  - Educate on the types, benefits, value, and integration of Persistent Memories
  - Communicate usage of the SNIA NVM Programming Model developed to simplify system integration of current and future PM technologies
  - Influence and collaborate with middleware and application vendors to support Persistent Memories
  - Develop user perspective case studies, best practices, and vertical industry requirements
  - Coordinate with industry standards groups and promote industry standards related to PM and NVDIMM
  - Synchronize and communicate a common Persistent Memory taxonomy

2020 – A Very Exciting Year for Persistent Memory!

- SNIA Persistent Memory Programming Model expanding https://www.snia.org/forums/cmsi/nvmp
  - PM Hardware Threat Model
  - PM Remote Access for High Avail White Paper
  - PM Atomics and Transactions White Paper
- SNIA 2020 Persistent Memory Summit a success
  - Videos and slides at snia.org/pm-summit
- SNIA Persistent Memory & NVDIMM Special Interest Group is leading a program training software developers on programming persistent memory



Keys to Programming Persistent Memory

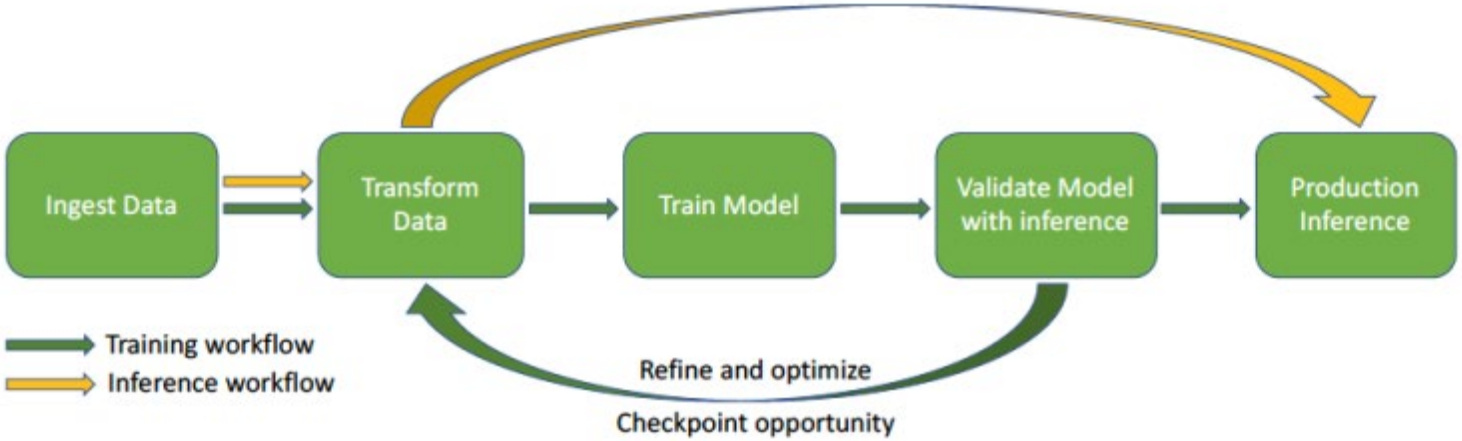
- Consistent Windows/Linux architecture model
- Variety of open-source tools and libraries
  - Persistent Memory Development Kit (PMDK)
  - Direct programming models
  - Multiple open-source file systems
- SNIA Hackathon program a success and continuing
  - 300+ software developers trained on PM programming
  - Cloud PM systems available to program today
  - Contact pmhackathon@snia.org for details

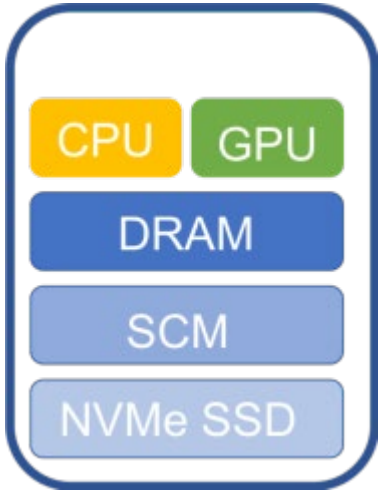
SNIA 2020 PERSISTENT MEMORY HACKATHON

pmhackathon@snia.org

PM Evolution:
Why Persistent Memory in AI / ML?

- Challenge: Reducing overall time to discovery and insight based on Data Intensive ETL and Checkpoint Workloads
- Demanding I/O and computational performance for GPU accelerated ETL
- Varying I/O and computational performance driven by bandwidth and latency





What Do

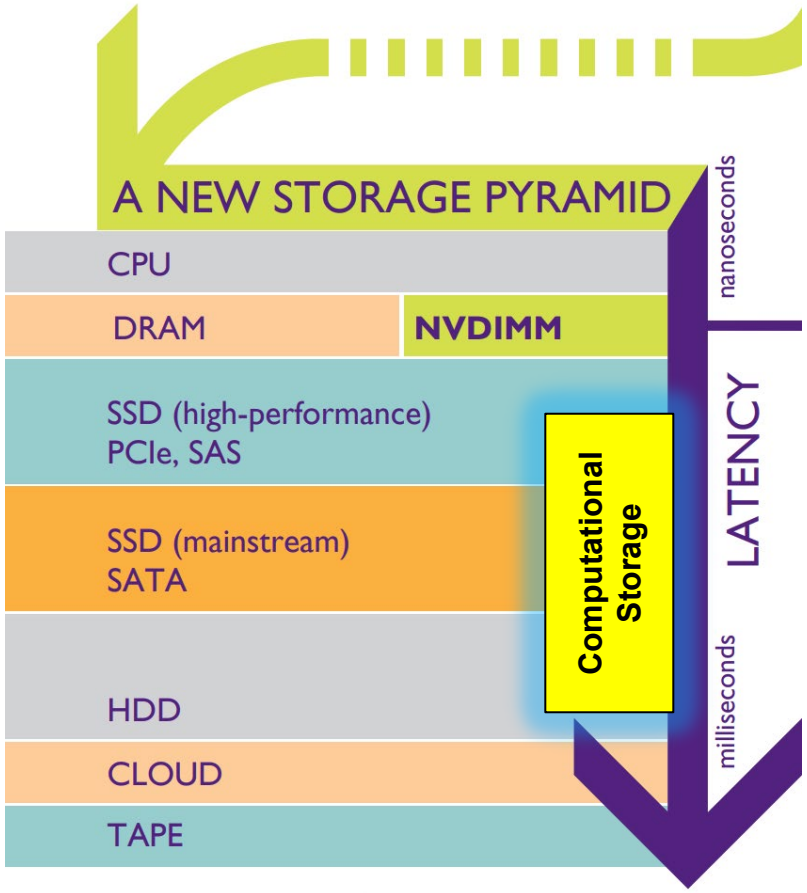
Computational Storage
Solid State Storage
Persistent Memory

Have In Common?

- Enormous developments in solid state memory, including NAND, and other emerging memories enable new architectural concepts such as persistent memory
- At the same time, semiconductor scaling has slowed, while demand for processing has increased
- We need to go beyond dedicated CPU technology to create adjacent processing technologies to off-load CPUs and provide low latency results
- This has led to an industry drive to combine processing with memory and storage, and to create new compute architectures and software to analyze and exploit the explosion of data creation over the next decade.

Important Intersection of Compute, Memory, and Storage – *Playing Nice Together Is Needed*

- ✓ Solid state storage has been an important SNIA technology and education area for over a decade
- ✓ Gathering of use cases and education on persistent memory has been a part of SNIA work for six years
- ✓ And a new computational storage work area launched in late 2018
- All this has led to the evolution of the SNIA Solid State Storage Initiative into the SNIA Compute, Memory, and Storage Initiative
- Recognizes this fundamental opportunity to combine storage, memory, and compute in new, novel, and useful ways
- Brings together technology, alliances, education, and outreach to better understand new opportunities and applications



SNIA CMSI – Where Compute, Memory, and Storage Come Together

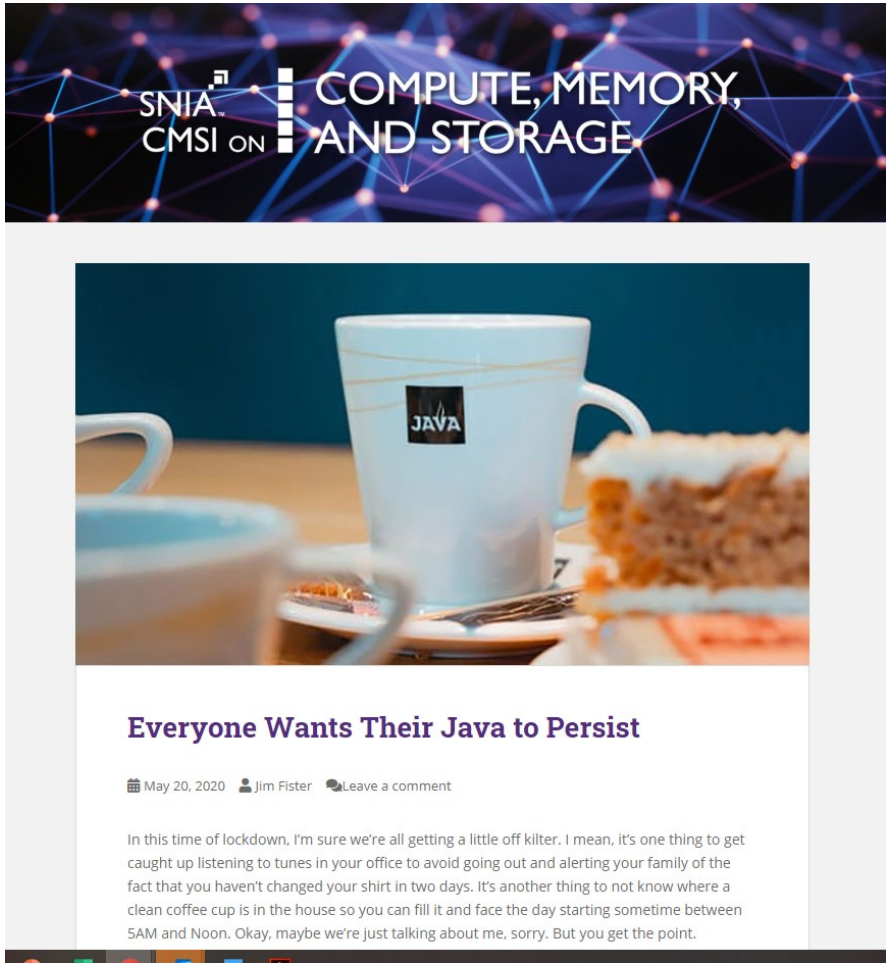
- Technical work
  - Architecture and programming specifications in computational storage and persistent memory
  - Architecture and application specifications in SSD form factors, PM and SSD performance
  - Joint activities with other alliances – NVM Express, JEDEC, OpenFabrics Alliance, Open Compute Project
- Outreach and evangelization
  - SNIA webcasts on usage, applications, and futures
  - SNIA video library playlists for education and sharing
  - Presentations and networking at virtual and physical events
  - Developer education through tutorials, hackathons, and technical symposia

Where To Find Out More

- Website resources
  - www.snia.org/computational
  - www.snia.org/pm
  - www.snia.org/sssi
- Twitter
  - @sniasolidstate
  - @sniacomputation
- Blog
  - SNIAComputeMemory&Storage
- Videos
  - https://www.youtube.com/user/SNIAVideo/playlists
- Educational materials
  - https://www.snia.org/educational-library
- Joining SNIA and the Compute, Memory, and Storage Initiative
  - https://www.snia.org/member_com/join-SNIA

Finally, Thanks for Watching Our Webcast

- Please rate this webcast and provide us with feedback
- A link to this webcast and the PDF of the slides are posted to the SNIA Compute Memory and Storage Initiative website at https://www.snia.org/forums/cmsi/knowledge/articles-presentations
- You can also find this webcast and many other videos and presentations on today's topics in the SNIA Educational Library
- A Q&A from this webcast will be posted to the SNIA CMSI on Compute, Memory, and Storage blog: www.sniasssiblog.org



Questions?

Thank you!

