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Liquid Cooling for SSDs: What's Next?

Live Webinar

July 23, 2026

9am PT/ 12noon ET

Today's Presenters

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Solidigm

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The SNIA Impact

200
industry leading organizations

2,000
active contributing members

50,000
IT end users & storage pros worldwide

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Logistics

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Agenda:

- Liquid cooling for storage
- Storage spec work with liquid cooling
- DLC Storage Industry Readiness

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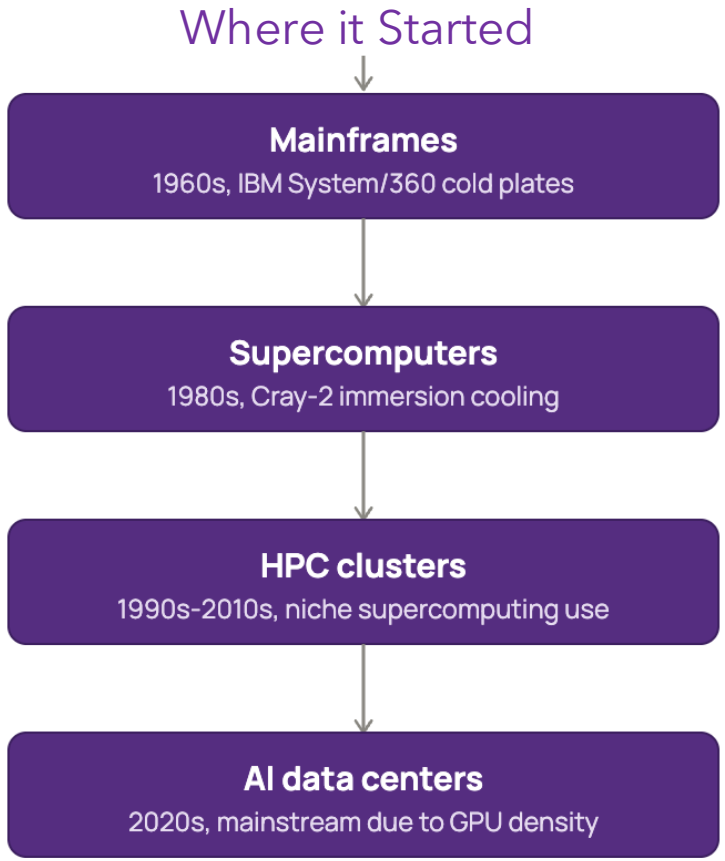
Liquid Cooling for Storage

Is Storage Driving this Transition?

- No, storage is not the driver of liquid cooling
  - GPUs, XPUs are driving the transition.
  - Fully liquid cooled system have power/cost benefits over hybrid liquid/air
  - Storage is along for the ride.
- However, storage can definitely take advantage of this.
  - Allows higher performance usages.
  - This is the only path to hit some of the higher throughputs (PCIe 7+)



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What Markets Are Pulling Direct Liquid Cooling Into Data Centers?

The driver is no longer “better cooling.” It is the need to unlock denser compute when power, space, water, and deployment speed are constrained.

DLC adoption follows markets where rack density is directly tied to business output.

TODAY’S ANCHOR

Hyperscale AI training

Purpose-built GPU campuses, high rack density, power limited growth.

FASTEST PULL

AI inference at scale

Always-on services, low latency demand, efficiency tied to margin.

EARLY PROOF

High performance computing

Scientific simulation, national labs, research clusters, mature thermal needs.

NEXT WAVE

Enterprise AI clusters

Private AI, regulated data, brownfield upgrades, mixed cooling reality.

GREENFIELD BET

Sovereign and neo-cloud AI

National AI capacity, regional cloud buildouts, modern designs from day one.

NICHE BUT HARD

Edge and modular AI

Remote sites, small footprints, harsh environments, local data processing.

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With So Many Ways to Cool Data, Storage is Now Cool Too!

Air-Cooled has long been the standard

Host system runs air across a device to transfer heat away from the device.

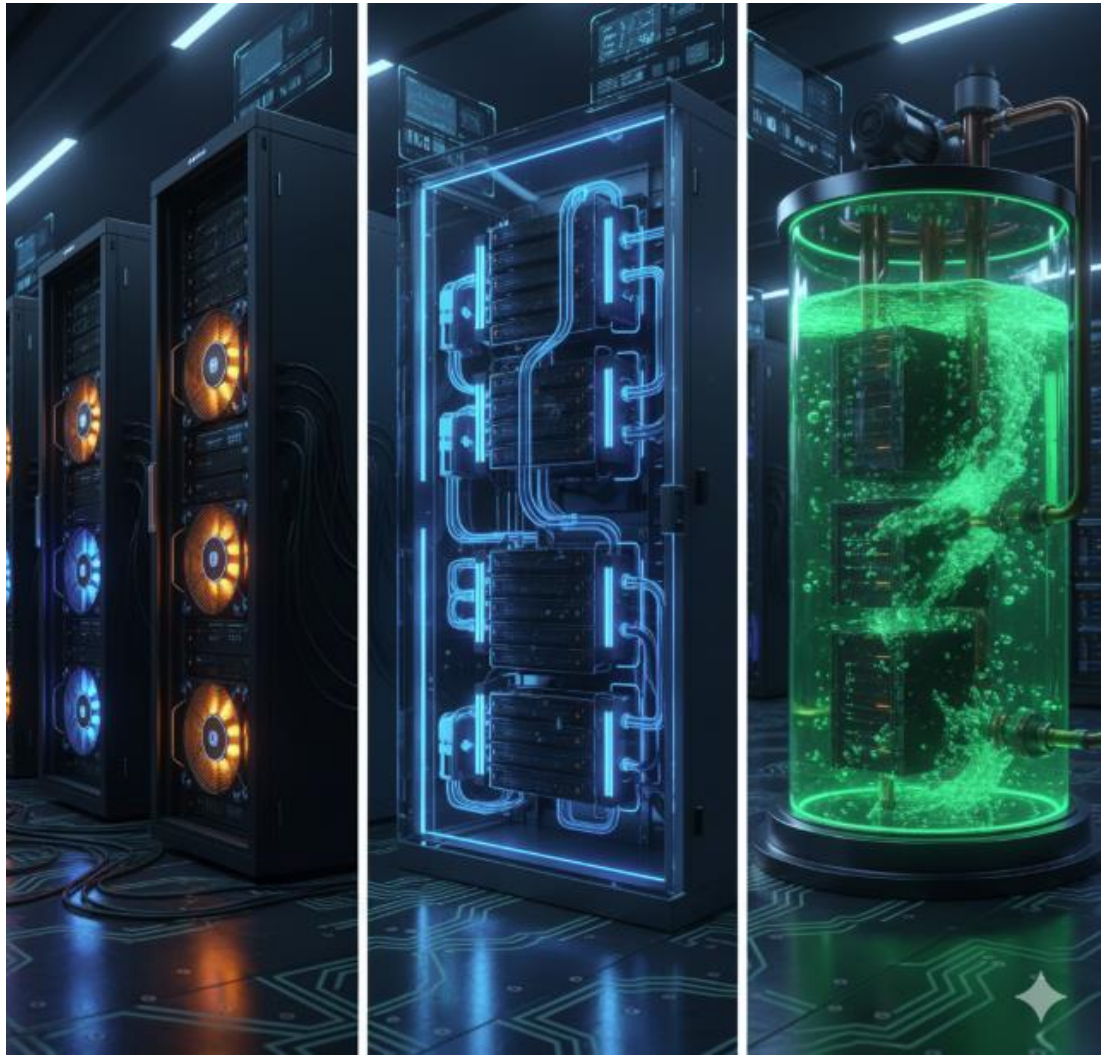
Direct Liquid Cooling (DTC and DLC)

Direct Liquid Cooling (DLC): Host system provides a thermal medium (e.g., cold plate) to contact the device for heat transfer

Direct-to-Chip (DTC): System provides access to the cooling liquid exchange. Device has the thermal medium built into it and connects to this liquid exchange

Immersive experiences are growing

Device is submersed into a non-air medium (e.g., a liquid). Some companies ship it as "Food Grade Lubricant"



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Tradeoffs of Each Method

Cooling Method	Air Cooling	Direct Liquid Cooling (DLC)	Direct-to-Chip Cooling (DTC)	Immersion
Cooling method	Convection	Conduction	Conduction	Convection
Thermal transfer	Poor	Good (1-sided) Better (2-sided)	Better	Best
Serviceability	Baseline	Hard (1-sided) Harder (2-sided)	Hard to Hardest	Harder
Implementation	Easy	Easy	Hard	Hard
Industry alignment	Aligned	Aligned	No Alignment	No Alignment

Industry moved to Direct Liquid Cooling for standardization

More detailed comparison available on the SSD SIG Liquid Cooling webpage

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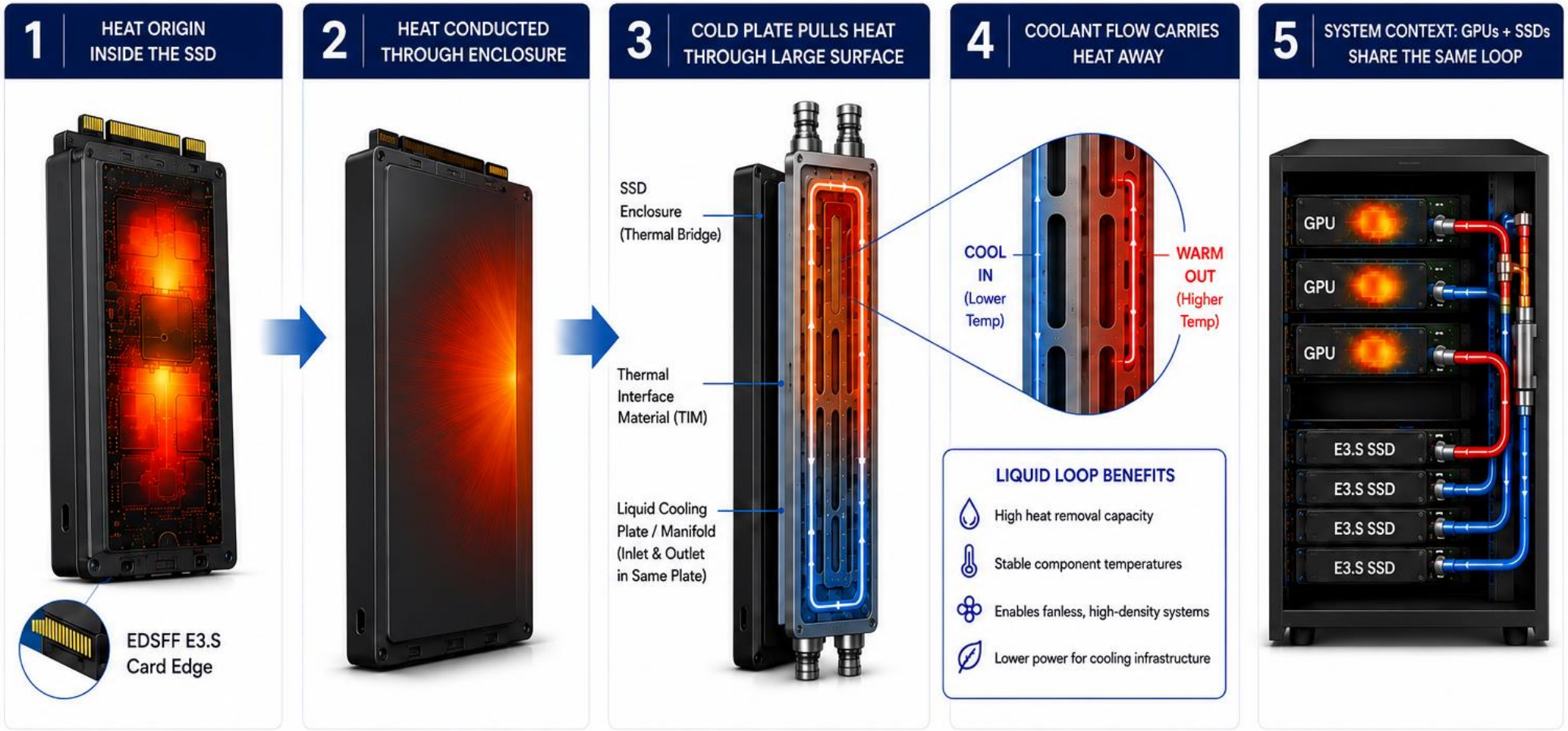
SSD as a Thermal Bridge



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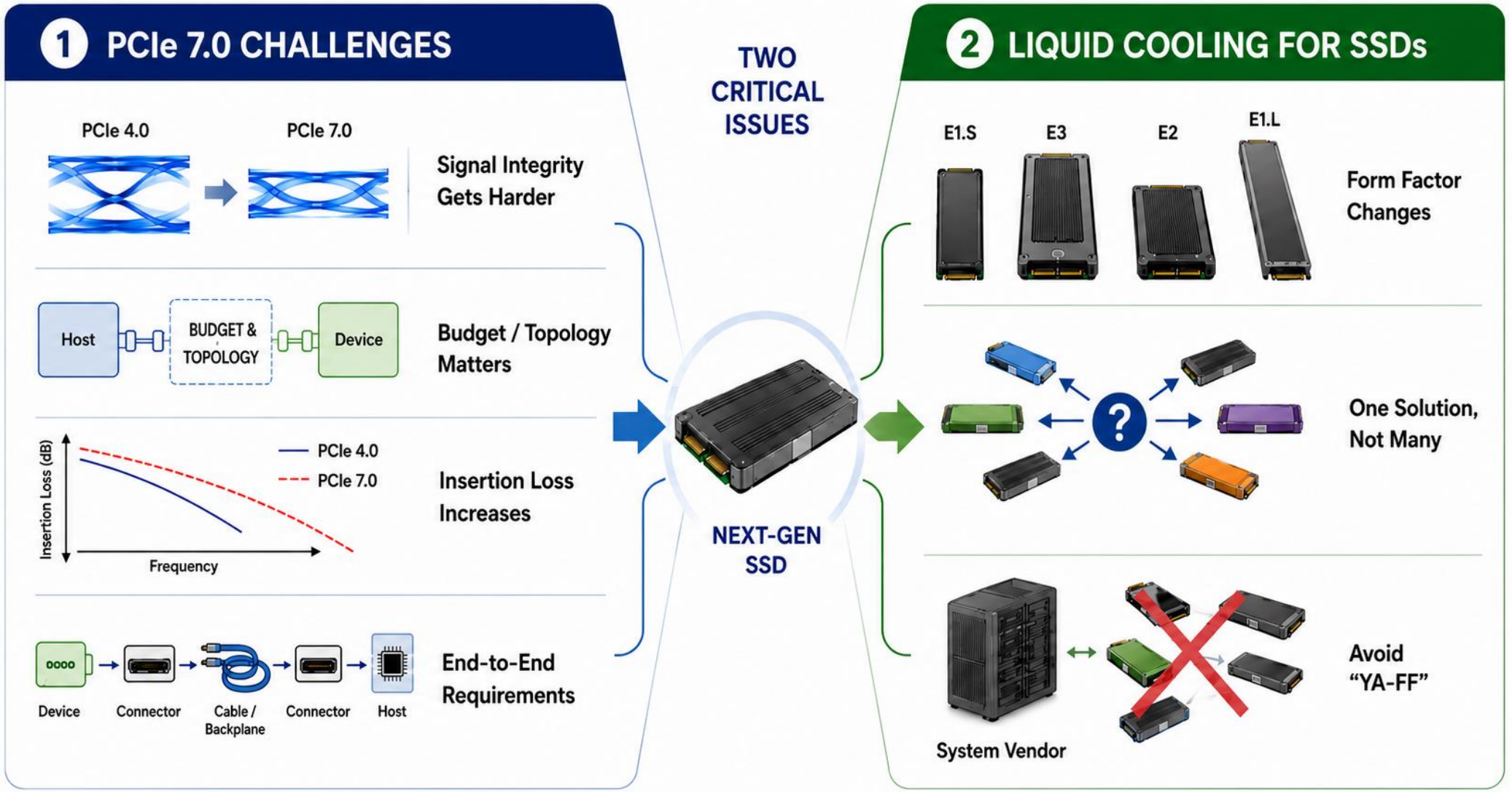
Direct Liquid Cooled (DLC) SSDs - Challenges



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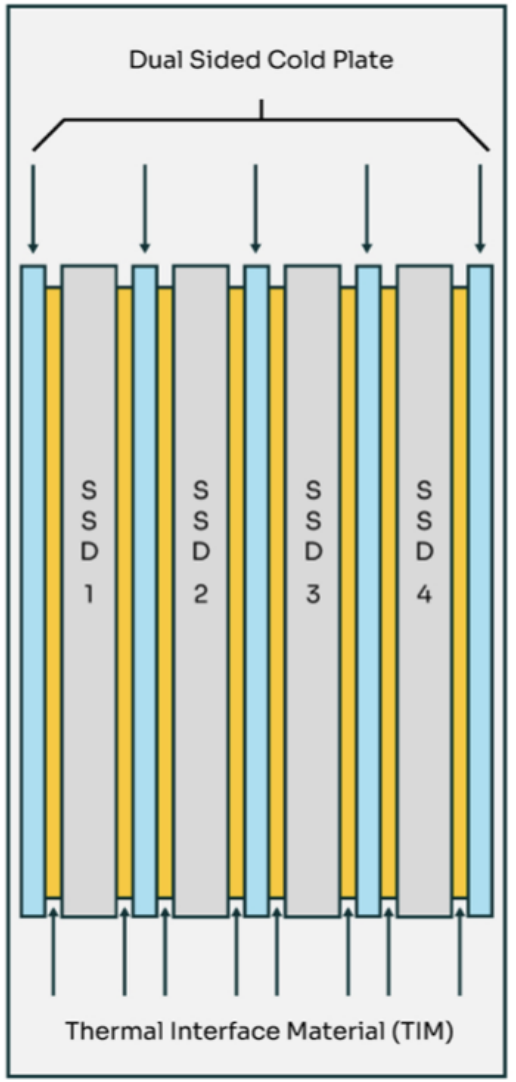
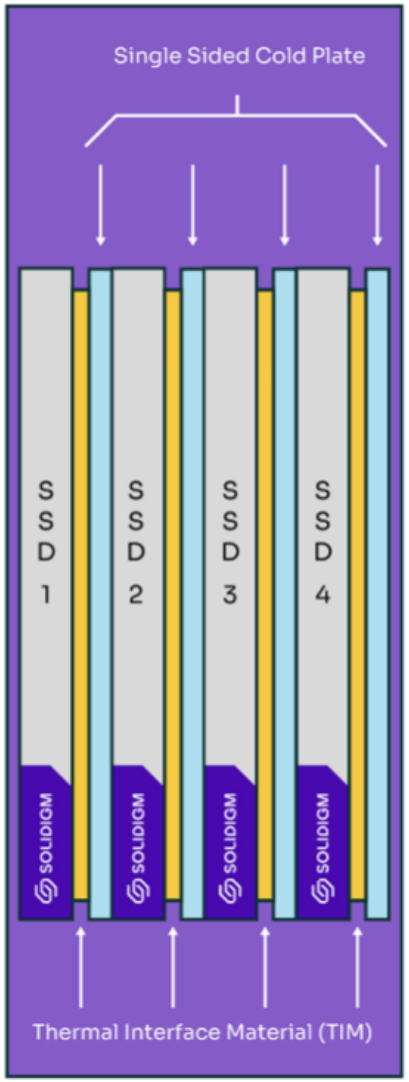
Unique Challenges Exist for “Removal” Needs

- Many platforms have space constraints
- Designing for “single-sided” is a key enablement of deployment
- Unique challenges to get ‘properly cooled’
  - Single-sided components
  - Dual-sided cooling innovation





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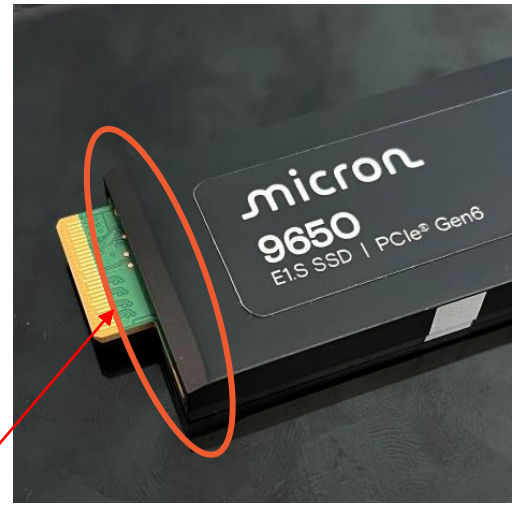
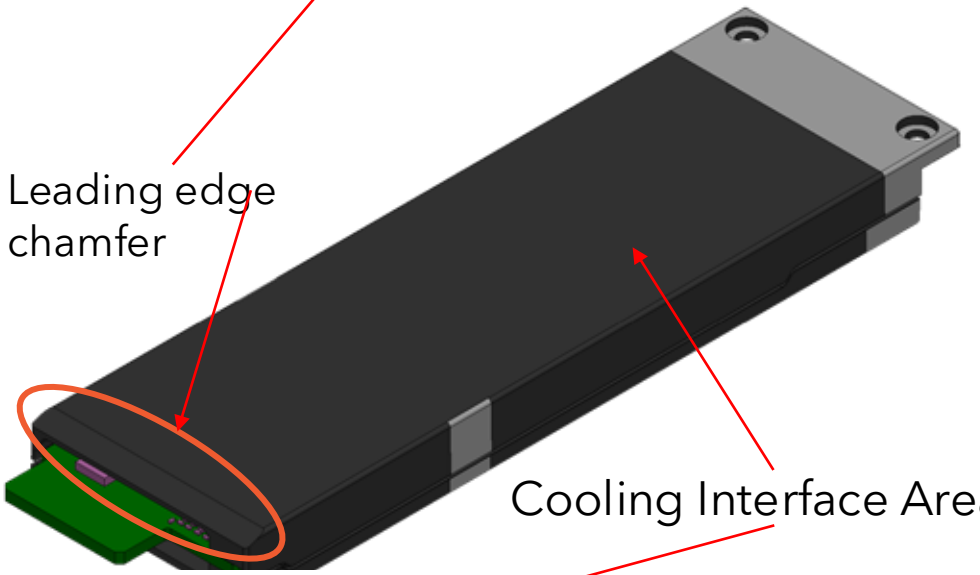
Storage Specification Work with Liquid Cooling

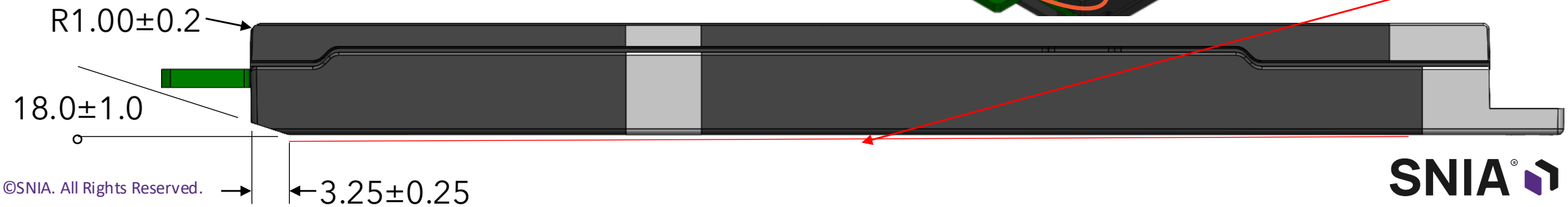
E1.S (SFF-TA-1006)

Rev 2.0: https://members.snia.org/document/dl/26956

1. Defined “Cooling Interface Area” on secondary side for 9.5mm
   - Supports air-cooled and direct liquid cooling
   - Mating surface between device and cold plate.
2. Add leading edge chamfer on secondary side and leading-edge radius on primary side
   - Aids with insertion
3. Flatness and roughness specs on Secondary side
   - Flatness: < 0.12 mm
   - Roughness: <1.6 um
   - Improves cooling efficiency between device and cold plate
4. Added max pressure (138 kPA) supported on Cooling Interface Area
   - Prevents damage when force applied







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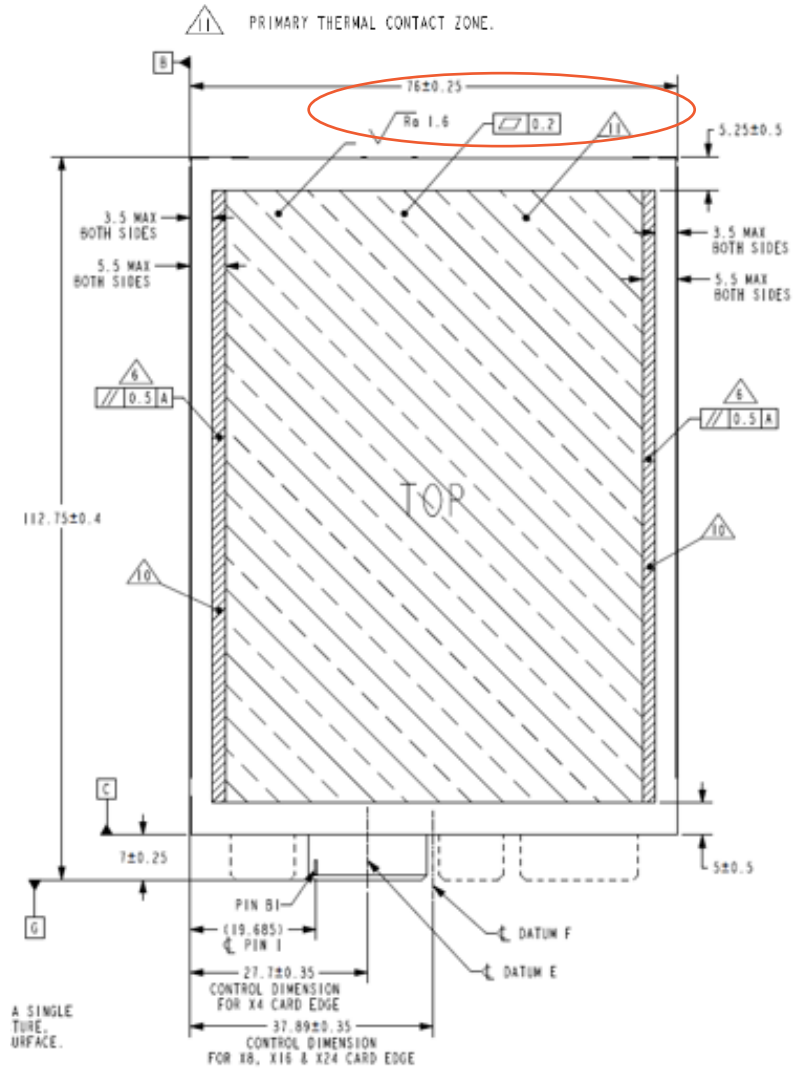
E3 (SFF-TA-1008)

Rev 3.0: https://members.snia.org/document/dl/26716

1. Defined “Cooling Interface Area” on top side for 7.5mm E3.S and E3.L
   - Supports air-cooled and direct liquid cooling
   - Mating surface between device and cold plate.
2. Label on **bottom** side only
   - Improves cooling efficiency of SSD and label durability
3. Flatness and roughness specs on top side
   - Flatness: < 0.2 mm (E3.S), < 0.25 mm (E3.L)
   - Roughness: <1.6 um
   - Improves cooling efficiency between device and cold plate
4. Added max pressure (103 kPA) supported on Cooling Interface Area
   - Prevents damage when force applied



E2 (SFF-TA-1042)

- In development:
  - Details at https://members.snia.org/document/dl
- What is going into this specification:
  - Cooling Interface Area and opposing support area
  - Flatness/roughness requirements for the Cooling Interface Area
  - Pressure supported by the enclosure
  - Define chamfer edge to lead-in (connector) side of the enclosure
  - Other adjustments for DLC if needed
- A draft specification expected soon

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Thermal Characterization Specification (SFF-TA-1023)

- Recently reopened
  - Details found at https://members.snia.org/document/dl/58773
- What is going into this specification for DLC:
  - Thermal curves
  - Reference test fixtures (cooling, pressure)
  - Other items as needed
- This is needed!
- A draft specification expected soon

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DLC Storage Industry Readiness

Micron 9650 SSD is Liquid-Cooling Ready

- AI servers already utilize liquid cooling for the CPU/GPU
- Many AI servers will use liquid-cooled storage for PCIe® 6.0 data rates
- Micron has available support for liquid cooling, which increases power for the most demanding workloads

Additional announcements coming soon

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Co-Designed Solution Presented and Enabled in SNIA

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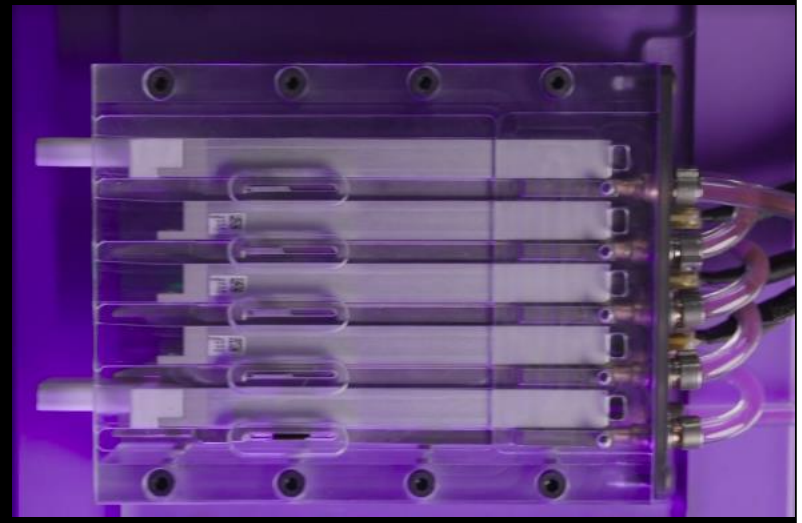

Sponsored definition change for SFF-TA-1006

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KIOXIA Status

KIOXIA Direct Liquid Cooling SSD Status

(as of 7/23/26)

KIOXIA

- KIOXIA was a co-sponsor of the SFF-TA-1006 2.0 specification for E1.S 9.5mm and the SFF-TA-1008 spec for E3.S enabling direct liquid cooling (DLC)
- Planning for 2026 launch of both E1.S 9.5mm & E3.S form factors
- Collaborating closely with the industry and customers to ensure smooth qualifications and launch
- Continuing support for additional standardization for DLC on SSDs

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Samsung PM1763 Supports Liquid Cooling

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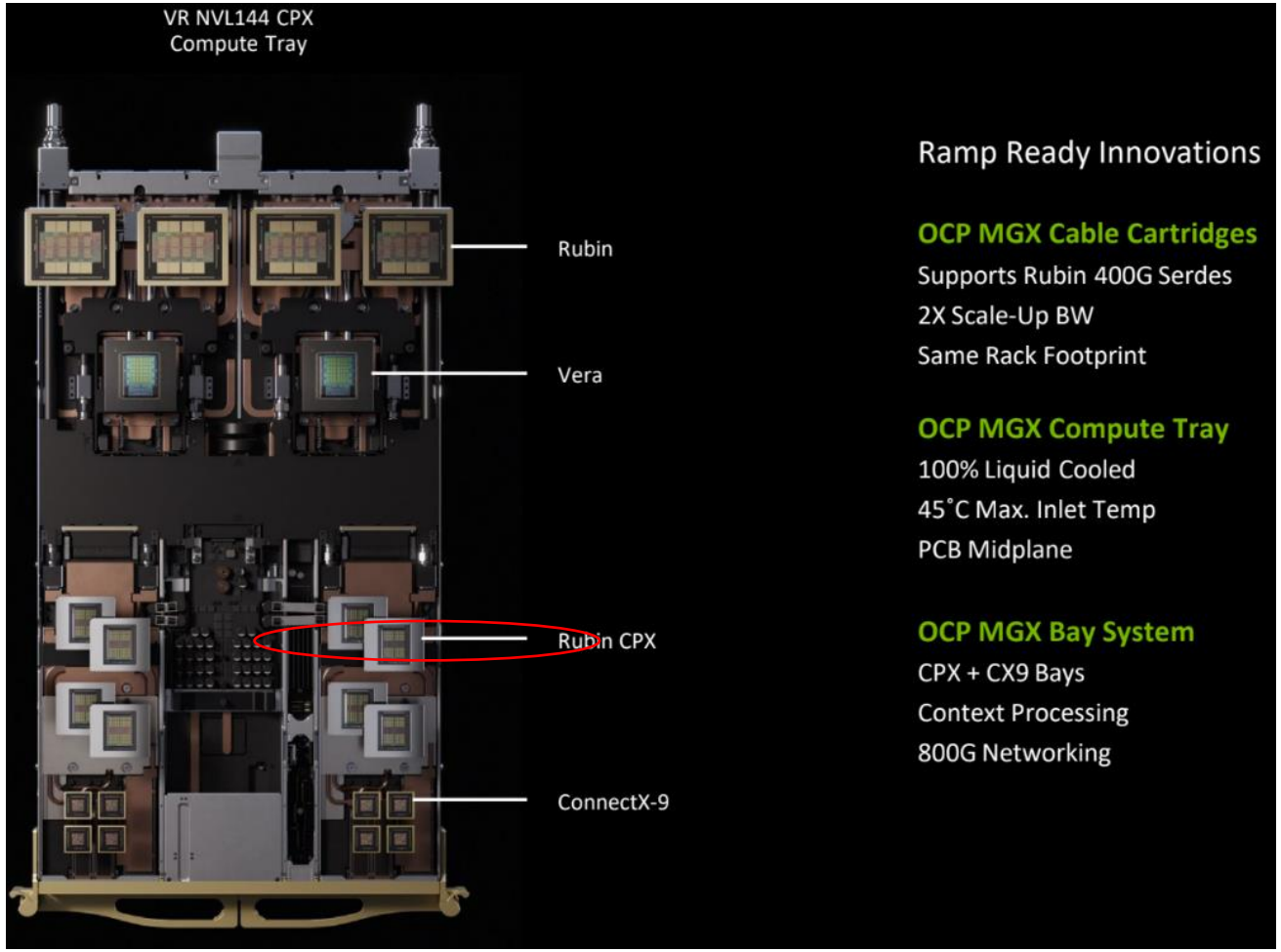
NVIDIA NVL144 CPX Announcement

NVIDIA announced a 100% liquid cooled compute tray

- 100% would include any storage components in this system



Source: https://www.opencompute.org/events/past-events/2025-ocp-global-summit

Summary

Conclusions

- Direct Liquid Cooling is here for storage!
- Host-defined cold plates, SSD defined surfaces is standardized
- Industry currently offers systems, cold plates, and SSDs designed to support direct liquid cooling

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We are continuing work on ensuring future data will continue supporting the evolving industry needs

For more information:

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https://www.snia.org/member_com

Learn more:
https://www.snia.org/liquidcooling

Read the specs from SNIA SFF:
https://www.snia.org/sff/specifications

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