

How to Optimize Performance for AI/Edge Computing

V1.0

Presenter: Chris Lien, BU Director, ATP Electronics Inc.

Agenda

- Market Trend of Industrial SSDs
(The Rise of 5G AIoT/Edge Computing)
- Strategy Consolidation for Product Positioning
- How to select the right product with the right partner

Market Trend of Industrial SSDs (The Rise of 5G AIoT/Edge Computing)

5G Trend

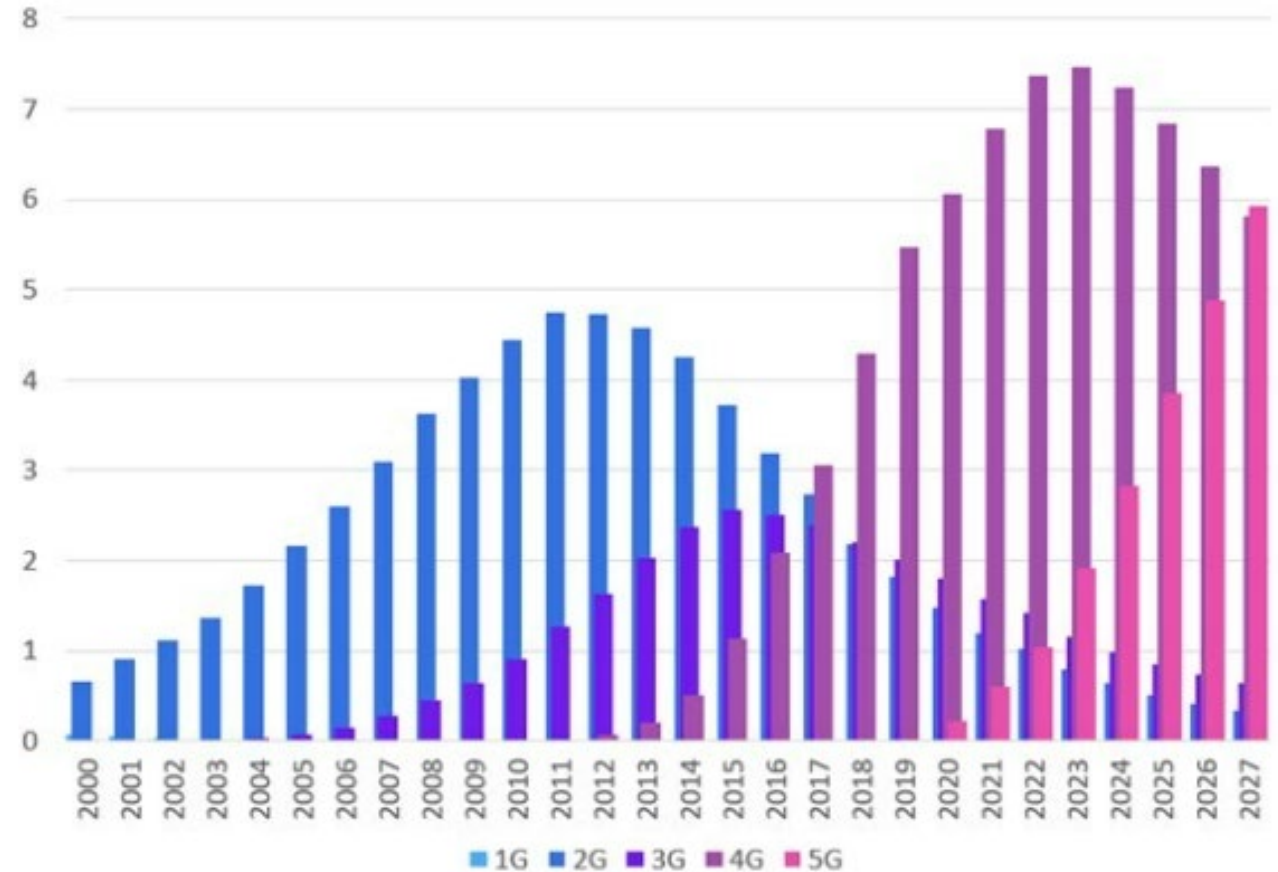
Different from previous generations (3G/4G), 5G has a new infrastructure.

Moving to 5G, more applications, particularly these four listed below, depend on low latency and high reliable connectivity:

- V2V (Vehicle to Vehicle)
- V2I (Vehicle to Infrastructure)
- V2P (Vehicle to Pedestrian)
- V2N (Vehicle to Network)

Not every data will be calculated or stored after being sent back to Cloud servers. Edge Computing and its storage play more roles now.

Mobile subscriptions by technology (billions)

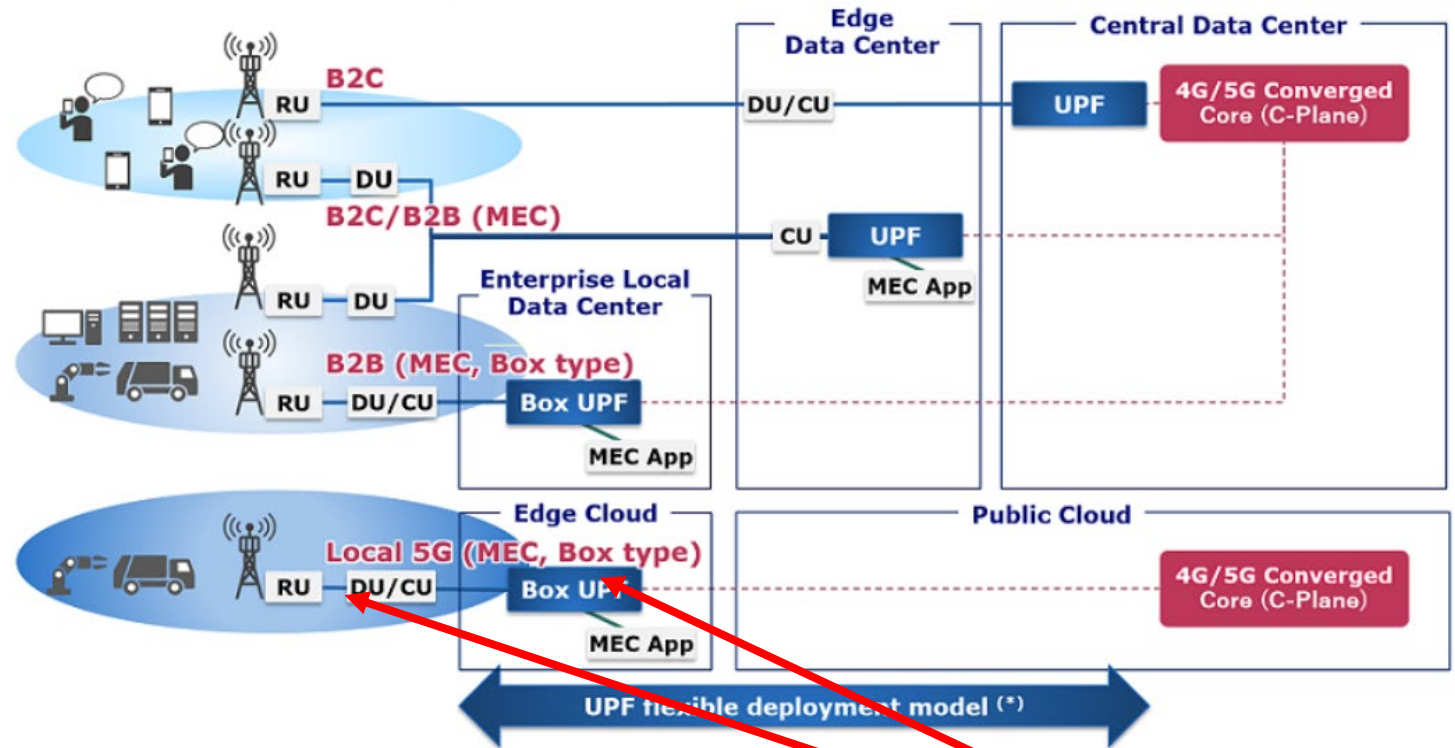


Source: Omdia

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Wide Temp Solution in 5G Infrastructure

Example of Network Architecture



(*) UPF flexible deployment model:

Containerized, Public Cloud / Edge Cloud or BoxUP (Box-type UPF) Type Approach

Key Highlight for BoxUP

- Handy to deploy closer to the RAN location and customer site in a secured way
- Support various platforms according to requirements
- Ensure software update from remote site

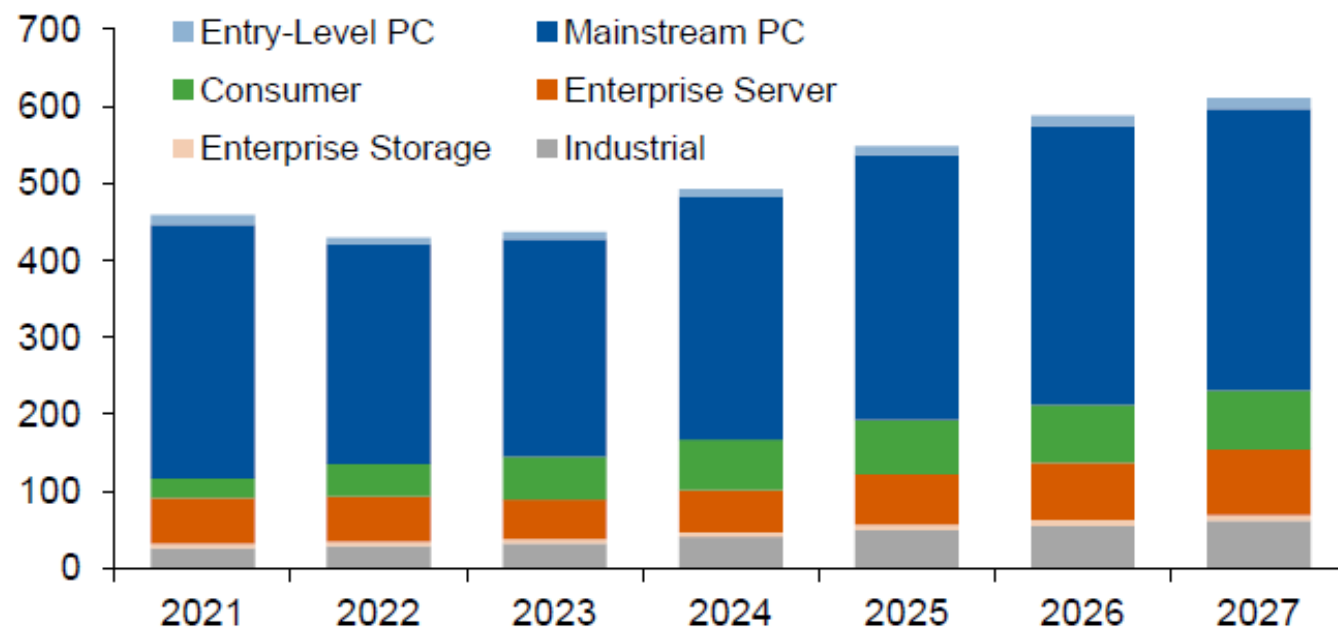


No air conditioning,
need **Wide Temperature**

RU= Radio units (not computers)
DU/CU = Computer servers
MEC = Edge Cloud = Computer servers

Solid State Drive Market Forecast

Units (M)



Source : Gartner, March 2023

SSD Type	2022		2027		2027	
	Units (M)	Revenue (\$B)	Units (M)	Revenue (\$B)	CAGR (Units)	CAGR (Revenue)
Industrial	28.5	\$1.1	62.1	\$5.3	16.9%	36.3%
Enterprise Server	59.0	\$14.4	85.1	\$26.4	7.6%	12.9%
Enterprise Storage	6.4	\$5.5	7.3	\$8.0	2.9%	7.9%

PCIe SSD Attached Rate

■ PC SSD

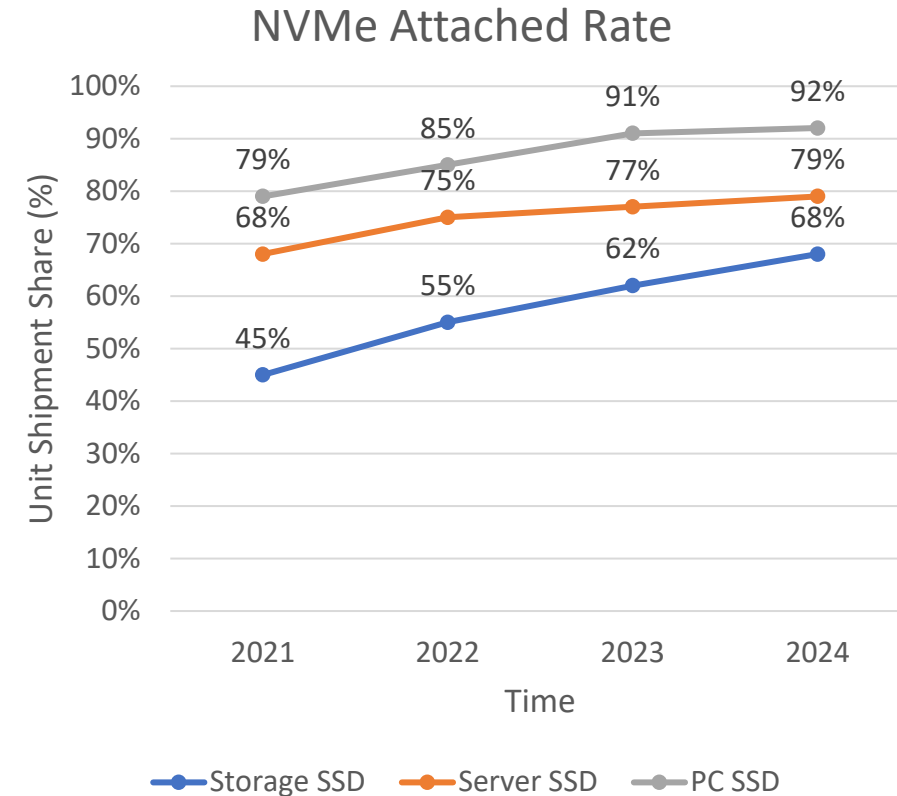
- PCIe Gen4 SSD to reach 90%+ in 4Q23
- PCIe Gen5 SSD cross over from Gen4 in mid-2024

■ Server SSD

- PCIe depressed in 2H22/2023 due to anemic Hyperscale; SATA resilient due to Server OEM & HCI
- PCIe Gen4 transition ongoing; Gen5 transition slow, likely late-2025/mid-2026 crossover, but hyperscale-dependent

■ Storage/Boot SSD

- Big portion to stay with SATA protocol
- Gen4 still transitioning, slower adoption that lags servers by 12 months or more
- Gen5 transition still 2-3 years away and will likely coincide with E3.S and E3.L form factor ramp



Combined ODT + SI + Thermal Simulation, Strategies and Solutions

Signal Integrity Simulation from Design Stage

3D NAND technology is moving from 64 to 176 or 232+ layers. Clock speed has tripled from 533 MT/s to 1.6 GT/s.

Its speed increase from PCI Express Gen3 to Gen4/5 led to increase in transfer rate. Maintaining signal integrity with the data path design on the PCB becomes even more critical.

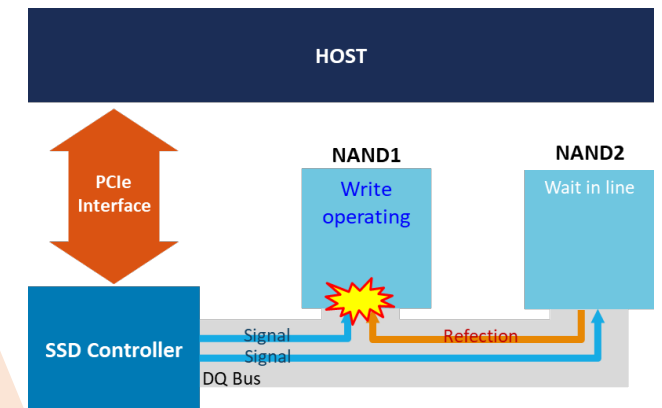
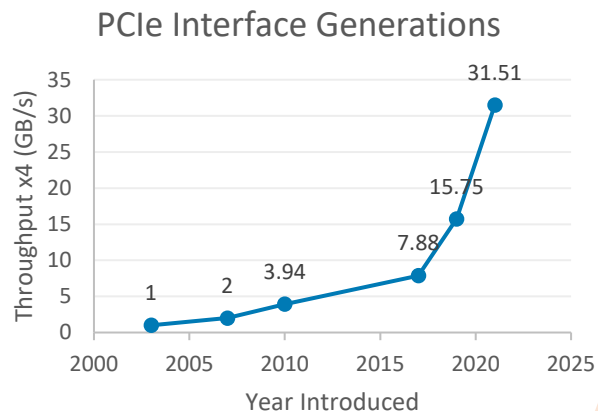
ATP

As an industrial SSD manufacturer, ATP is dedicated to building memory & storage solutions with customers, especially considering diverse applications and operating environments such as extreme temperatures, outdoor base stations, or fan-less equipment in industrial areas.

To provide reliable and stable data transmission and storage, **Signal Integrity (SI)**, **On-Die Termination (ODT)** and **Thermal** simulation technologies are introduced into the hardware and firmware development process.

With the increased transfer rate and various applications, huge amounts of data are communicated and stored daily into memory devices formed with multiple NAND chips.

Engineers need to pay keen attention to the signal interference between chips and data paths.

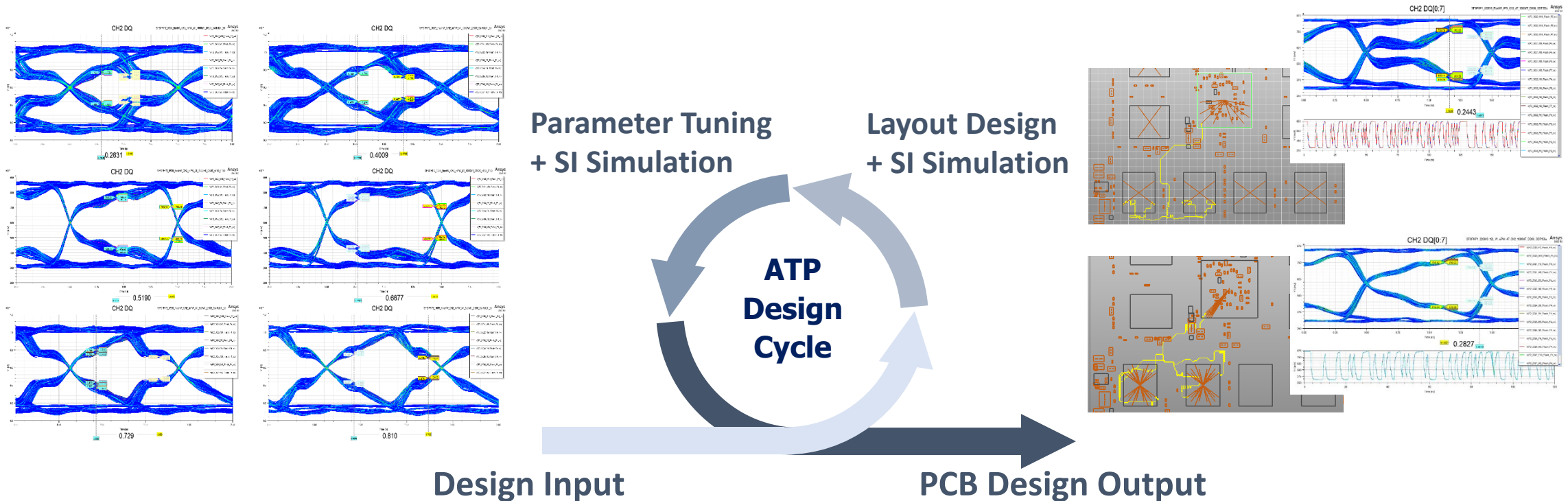


Signal Integrity Simulation from Design Stage

“WE BUILD WITH YOU” is ATP’s motto, which emphasizes close collaboration with customers right from the start.

To demonstrate this commitment, ATP performs signal integrity simulation during the design stage.

By optimizing each signal trace on the printed circuit board of higher-capacity storage devices, better signal integrity could be observed with its sampling time through SI simulation results. A better design of different form factors could be offered readily.

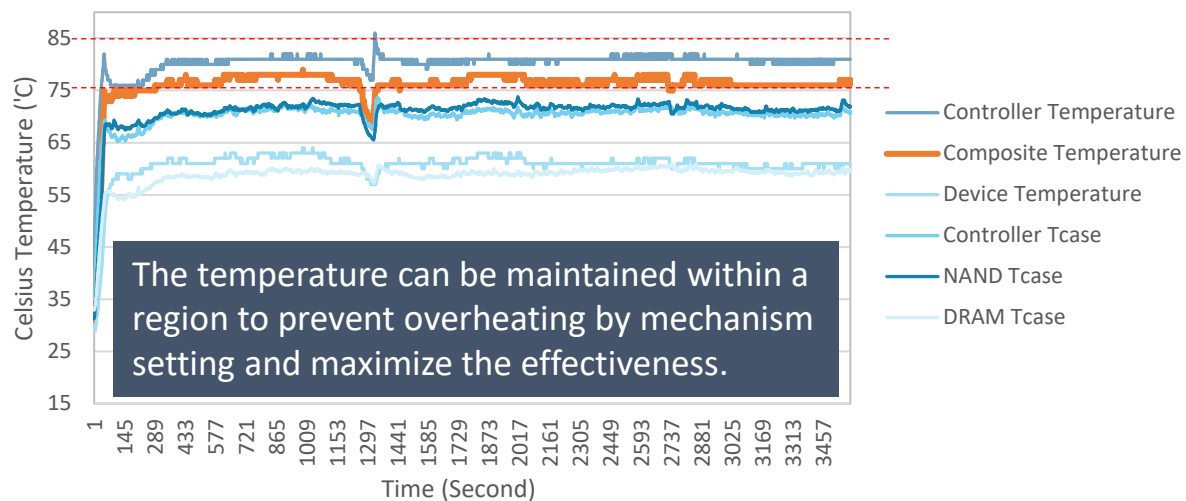


Heat Environment Adaptivity

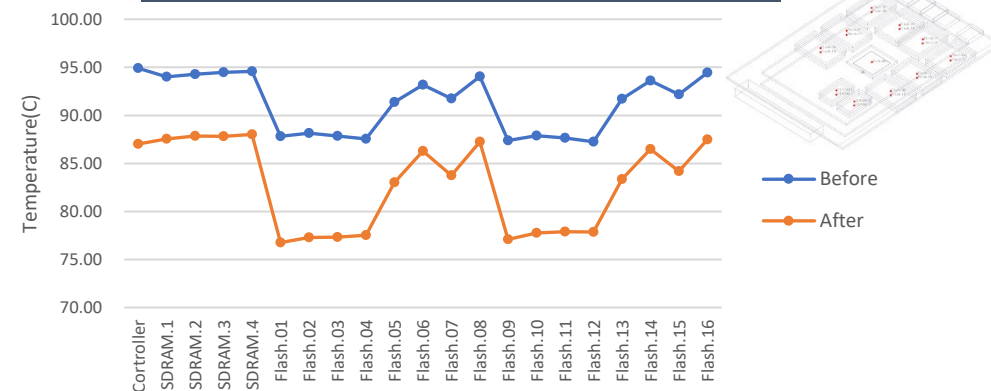
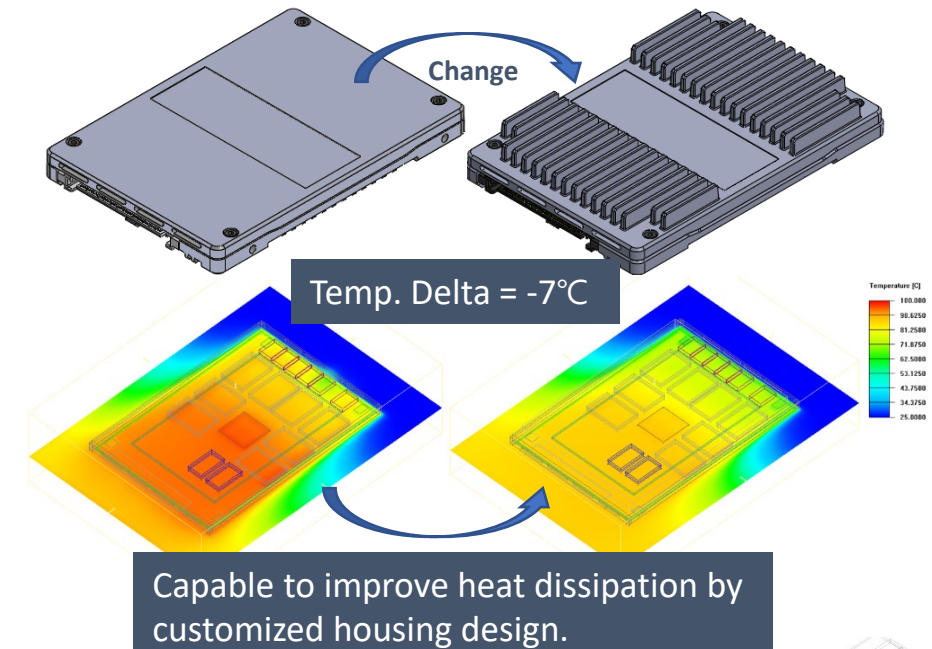
Cadence and Ansys Simulation are pure hardware simulation based on full speed operation (worst-case scenario)

Though the Temperature is higher, with sufficient cooling system helps distribute the heat.

■ Apply thermal throttling mechanism



■ Adjust housing design

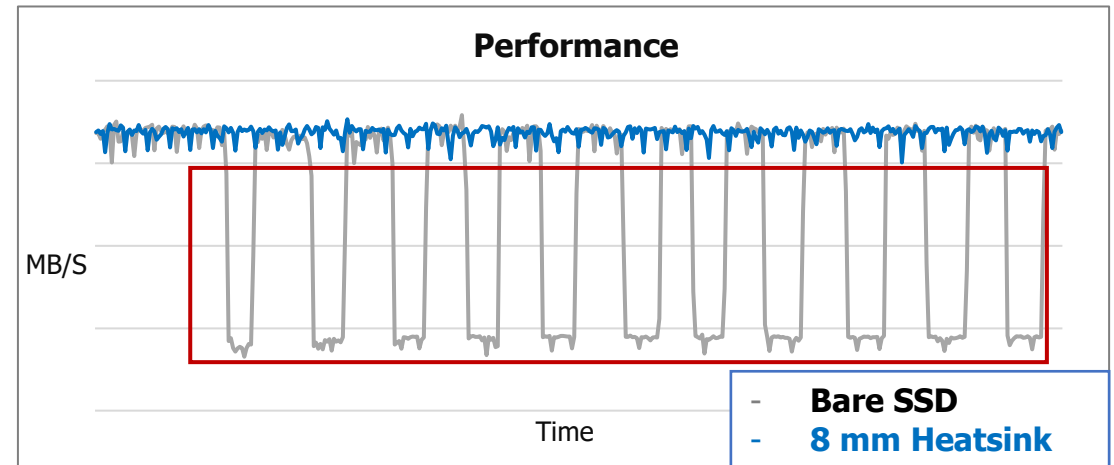
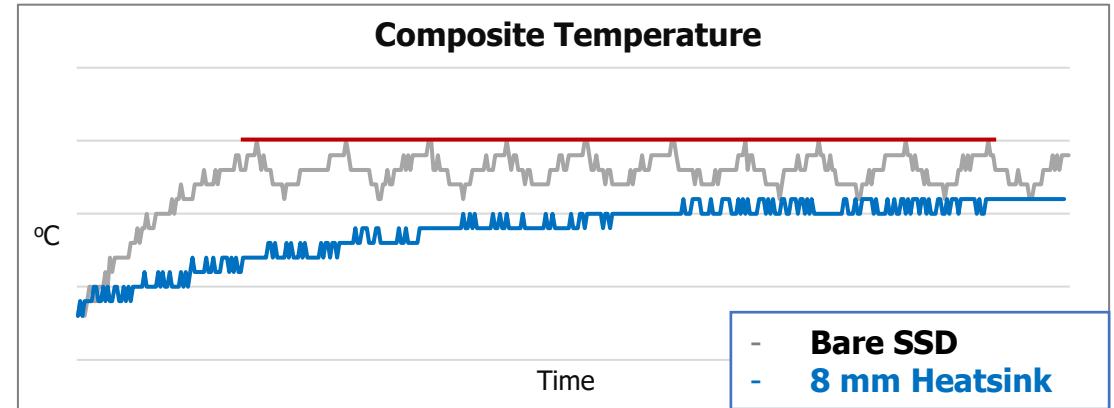


Gear/Equipment: What You Wear Keeps You Cooler

When the composite temperature keeps increasing, the SSD repeatedly slows down to cool it.

The 8 mm heatsink can dissipate heat complemented by airflow support.

The maximum composite temperature of the NVMe SSD is reduced, and the performance is steady with optimized FW algorithm.



(Ta: 55°C & Airflow: 600 LFM*)

Test results can vary by case/ configuration

* LFM: Linear Feet per Minute

Conclusion

Capacity/Temperature/Performance/Thermal Considerations

- 5G/Edge Computing requires higher performance and capacity
- Wide Temperature SSDs have a bigger market share in specific applications
- PCIe Gen4 SSDs are starting to ramp up in Industrial applications
- To ensure sustainable performance, it is important to have a Thermal Plan for PCIe Gen4 SSDs, especially if they are installed in systems with limited airflow and are deployed in harsh environments.



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