

September 2024

PEAK:AIO, MONAI, and Solidigm: Revolutionizing Storage for Medical AI



Intro

Artificial Intelligence (AI) is transforming industries of all types, far and wide. Patient care stands at the forefront of this AI revolution in medical practice and research. The integration of AI into healthcare has ushered in new hopes and possibilities, enabling faster, more accurate diagnoses and treatment paths by learning from vast amounts of patient data. However, implementing AI in this sector is fraught with challenges, particularly regarding storage. The demand for storing and accessing massive datasets, including MRIs, X-rays, test results, and historical patient data, has never been greater.

The modern healthcare ecosystem relies on storing and retrieving data rapidly and efficiently, ensuring it is accessible to physicians, hospitals, and multiple teams. This data must be timely, accurate, and securely protected to enhance patient care and support ongoing medical research. Given the sensitivity and importance of this information, hospitals are increasingly turning to robust, high-capacity storage solutions that can meet these demands. This is where PEAK:AIO, MONAI (Medical Open Network for AI), and Solidigm come into play, offering a trifecta of technology designed to revolutionize how medical data is stored and utilized.

Who Are the Players?

Our key players are at the forefront of this intersection of AI and medical research:

- **Solidigm:** A leader in storage innovation, Solidigm offers some of the largest enterprise-class QLC SSDs on the market. These SSDs are crucial for managing the vast amounts of data generated by AI applications in healthcare and provide high density and efficiency at a competitive cost.
- **PEAK:AIO:** Specializing in high-capacity storage systems tailored for medical AI applications, PEAK has made significant strides in the field by integrating Solidigm's QLC SSDs with advanced AI tools from MONAI. Their storage solutions ensure that healthcare institutions can handle extensive data requirements while maintaining performance and efficiency.
- **MONAI:** MONAI is an open-source initiative created by King's College London and partners, including NVIDIA. MONAI is designed to accelerate the development and deployment of AI models in healthcare (particularly in medical imaging), while ensuring data privacy and security.

MONAI and PEAK:AIO: Revolutionizing On-Prem AI for Hospitals

ONAI's framework has brought about a significant change in hospitals, particularly in enabling the seamless integration of AI into clinical workflows. One of the most consequential benefits of MONAI is its ability to allow hospitals to utilize pre-trained AI models and further fine-tune them on-premises. This capability ensures that patient data can be input into AI-driven scans in real time while securely remaining within the hospital's infrastructure.

This approach significantly reduces wait times for radiology technicians and doctors, leading to quicker diagnoses and reduced patient anxiety. The technology improves patient experience through fast and accurate results, providing more efficient and effective care. PEAK:AIO's storage solution underpins the entire process, which leverages the dense and efficient Solidigm QLC SSDs. By keeping all operations compliant with privacy regulations and ensuring that data never leaves the hospital, PEAK: AIO's solution maintains the highest standards of patient confidentiality.

Efficient and Small: The Perfect Fit for Any Hospital

Another critical advantage of the PEAK:AIO and MONAI collaboration is the edge component, which ensures the solution can be deployed efficiently within any hospital environment. The small footprint of PEAK:AIO's storage systems, combined with their energy-efficient design, make these systems ideal for a wide range of healthcare facilities. Whether in a large metropolitan hospital or a regional clinic, the solution's efficiency meets the needs of healthcare providers without demanding extensive space or resources.

This capability allows hospitals to benefit from cutting-edge AI technologies without needing large-scale infrastructure changes. As a result, PEAK:AIO's solution is scalable and accessible, bringing advanced AI-driven healthcare to more patients and enhancing outcomes across the board.

Solidigm: Pioneering Innovations in Storage Technology

Solidigm has made significant strides in storage technology, particularly with introducing its enterprise-class QLC SSDs. Now in their fourth generation, Solidigm QLC SSDs are among the largest on the market, offering unprecedented storage density. The importance of QLC technology lies in its ability to store more bits per cell, translating to higher capacities and the ability to store more data over the life of the device. This presents a particularly compelling value proposition for industries like healthcare, where data generation is continuous and voluminous.



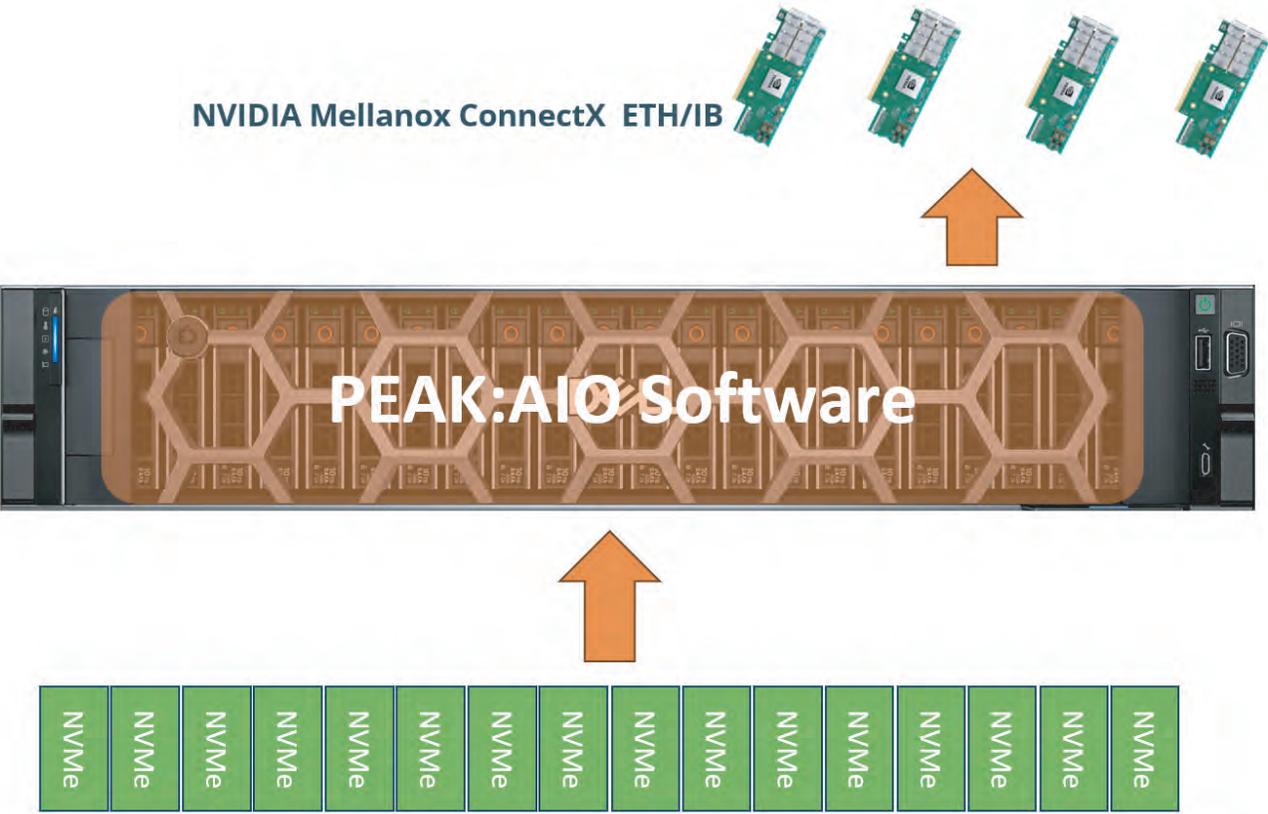
Solidigm's QLC SSDs are not just about capacity; they also offer a favorable performance-per-watt ratio, which is crucial for data centers managing AI workloads and even more so in edge scenarios. The balance between density, performance, and efficiency makes Solidigm's solutions particularly well-suited for medical AI applications, where the need to process and store vast amounts of data is constant. These drives have been instrumental in enabling PEAK:AIO to develop storage systems that cater primarily to the needs of the healthcare industry.

At Solidigm, we're focused on pushing the boundaries of storage technology to meet the demands of advanced AI applications like MON.AI. Our QLC SSDs offer unmatched density and power efficiency, which are critical for managing the immense data requirements in healthcare AI. Partners like PEAK:AIO are instrumental in bringing these capabilities to market, enabling institutions to harness the full potential of AI while ensuring data security, scalability, and operational efficiency. Together, we're driving innovations that are not only transforming data storage but also revolutionizing patient care. — Greg Matson, Senior Vice President of Strategic Planning & Marketing at Solidigm

We have conducted extensive testing and research on the [Solidigm QLC devices](#). These intense tests and deep reviews provide more information on their performance, endurance, and computational capabilities.

How PEAK:AIO Utilizes Solidigm to Address These Challenges

PEAK:AIO maximizes the use of Solidigm’s high-capacity drives, delivering the performance of a high-performance computing (HPC) cluster within a single 2U node. This optimization reduces the need for multiple storage nodes, reducing space, power, and costs while still meeting the high-performance requirements for AI workloads. For example, the 160GB/sec performance demonstrated in a single node would have previously required eight nodes and multiple switches to achieve similar results.





As AI projects grow, their storage needs expand as well. PEAK:AIO ensures that these demands are met without significantly increasing physical space or power consumption. This capability is essential for AI projects in environments with limited resources, such as small hospitals or research labs, where scalability and flexibility are crucial to continued operations.

With the increasing adoption of AI in healthcare, the need for data retention and compliance becomes more pressing, particularly when considering the ethical implications and risks of potential AI misdiagnoses.

The PEAK:ARCHIVE solution, developed with input from MONAI developers, directly addresses this need by providing a scalable and efficient method for archiving data, ensuring that it is preserved securely while remaining accessible when needed.

PEAK:AIO and Solidigm's collaboration continues to evolve, including ongoing innovations such as the use of Single Layer Cell (SLC) cache in PEAK:AIO's Gen 2 system to optimize write performance, reduce write amplification, and deliver long-term reliability in AI workloads. The partnership offers medical AI applications tailored storage solutions that handle the increasing complexity of data and the need for scalability without compromising performance.

Enhancing MONAI Deployments with Solidigm and PEAK:AIO

While MONAI primarily operates as a software layer on GPU servers and is not directly tied to storage solutions, it (like many complex software platforms) relies heavily on high-performance storage to function optimally. A helpful analogy provided by PEAK:AIO from traditional IT environments would be Oracle Database, which requires robust servers and a high-performance SAN for optimal operation. Although the SAN itself is not a part of the Oracle DB offering, its design and infrastructure are essential in ensuring the superior performance of the database.

Extending this concept to the partnership between PEAK:AIO and Solidigm, they have carefully crafted a solution to enhance MONAI deployments by providing storage that is not only tuned to meet MONAI's intensive I/O requirements, but also address larger challenges related to capacity, power consumption, and scalability. As AI projects grow in scale and complexity, these storage solutions become critical in ensuring that MONAI can handle the vast amounts of data in medical imaging and AI-driven healthcare workloads.

PEAK:AIO's collaboration with Solidigm allows MONAI deployments to overcome storage-related obstacles AI healthcare projects face. While MONAI itself is just one of many AI frameworks where PEAK:AIO's high-performance storage solutions add significant value, it serves as an excellent case study of how well the integration performs in a real-world AI vertical. In many ways, MONAI is representative of the types of challenges PEAK:AIO regularly addresses in AI-driven industries, where efficient storage, low power consumption, and scalability are paramount for success.

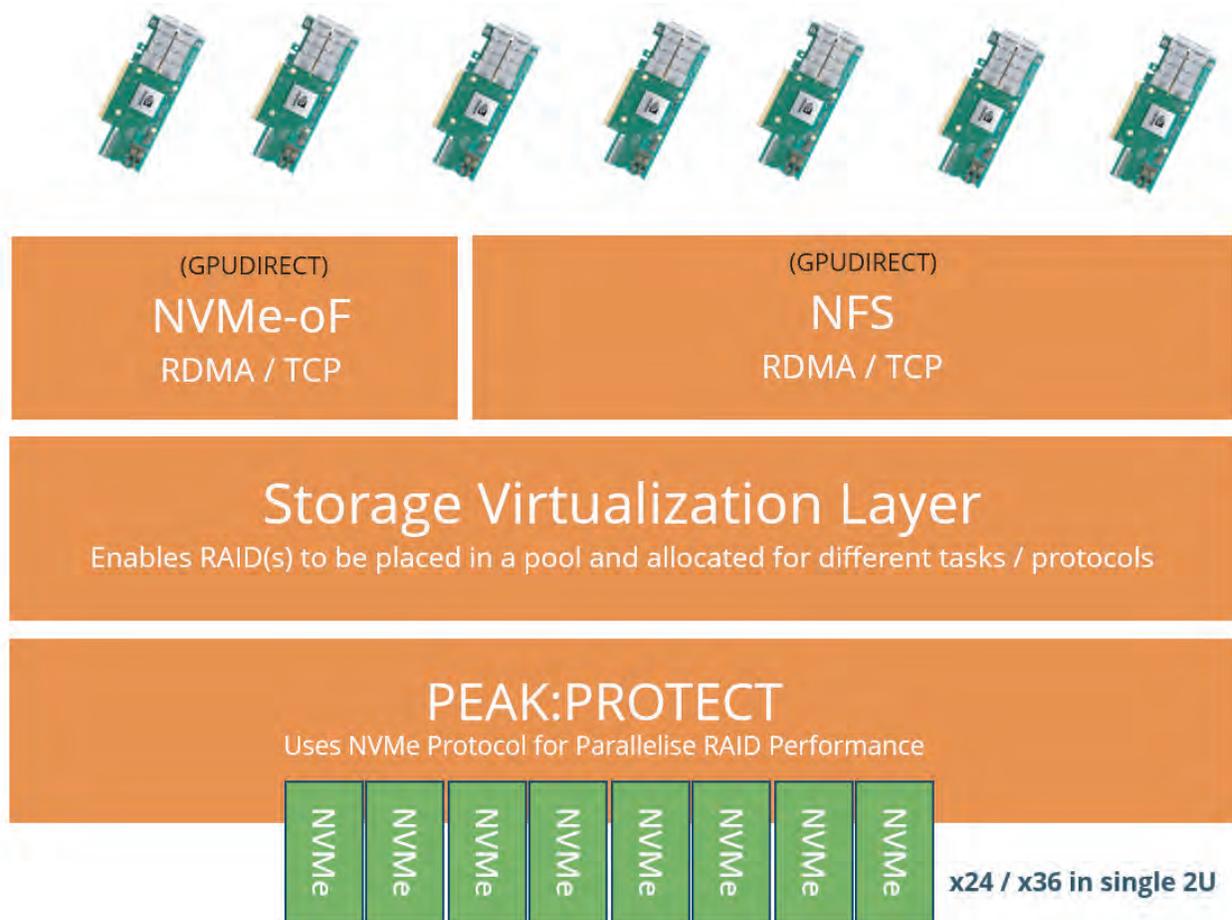
PEAK:AIO Storage System: Features at a Glance

Feature	Details
Capacity / Drives / Protection	30TB - 1.4PB RAW (Per typical 2U) 7.68TB/15.36TB/30.72TB/61.44TB Drives PEAK:PROTECT, RAID 0, 10, 5, 6, N+2
Performance (Bandwidth)	80GB/sec with 2xCX-7 40GB/sec with CX-6 Up to 160GB/sec max per 2U (scales per 2U)
Protocols	NFS3/4 (RDMA/TCP) NVMe-oF (RDMA/TCP) NVIDIA GPUDirect®
Interface	QSFP6/112 (NVIDIA ConnectX-6/7) 200Gb/400Gb (IB/ETH) per CX-6/7 Recommended: 2 x CX-X Supports up to 6 CX-8 Ready (800Gb per port)

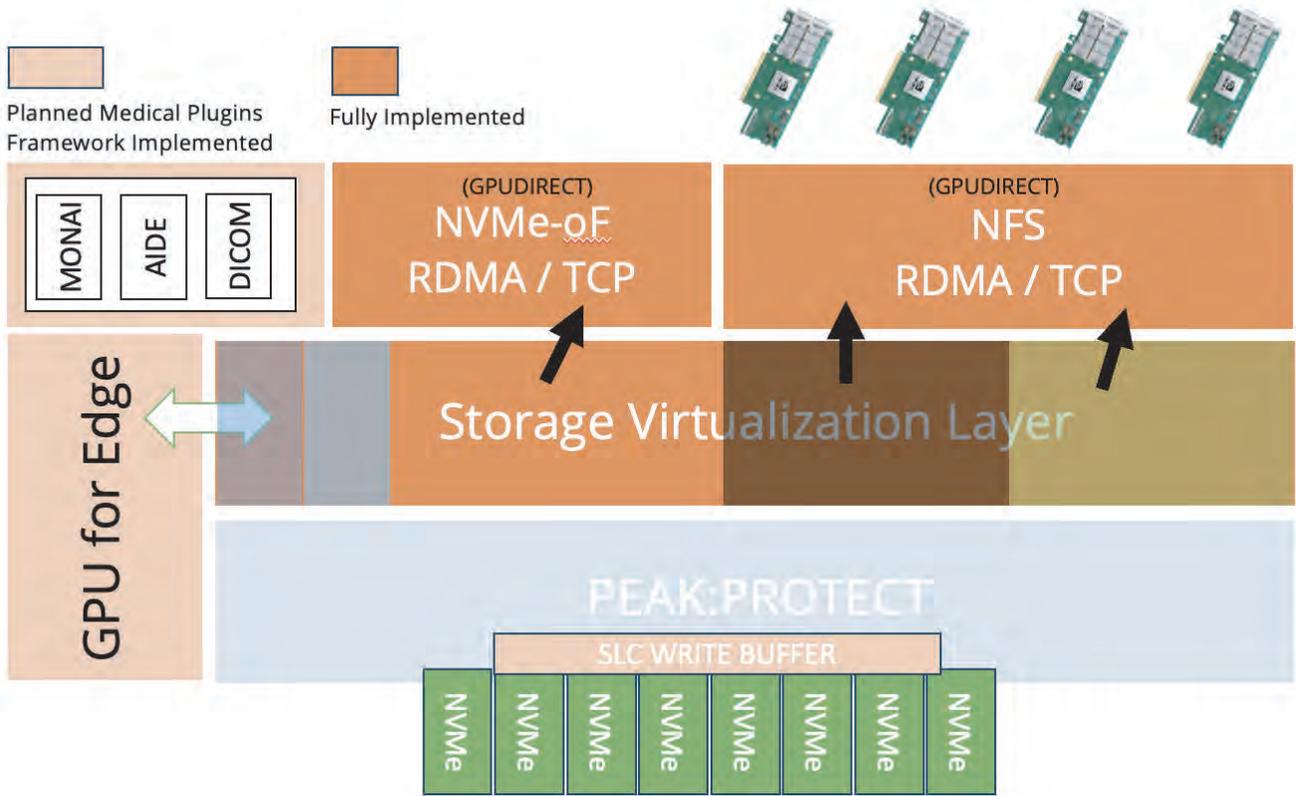
The PEAK:AIO storage system delivers exceptional scalability, performance, and reliability, making it ideal for demanding AI-driven healthcare environments. System capacities range from 30TB to 1.4PB of raw storage in a standard 2U chassis, providing flexibility that meets the variable data needs of medical institutions. The drives are available in 7.68TB, 15.36TB, 30.72TB, and 61.44TB capacities, offering a range of configurations to match different workload requirements. Additionally, PEAK:PROTECT supports multiple RAID levels (0, 5, 6, 10) and N+2 redundancy, ensuring data integrity and resilience.



Performance is a standout feature of the PEAK:AIO system, with bandwidth capabilities reaching 80GB/sec using 2x CX-7 adapters and 40GB/sec with CX-6 adapters. The system can achieve up to 160GB/sec per 2U chassis, scaling performance as more units are added. These performance figures are impressively attainable with a single host, showcasing the system’s efficiency and power.



Regarding connectivity, PEAK:AIO supports advanced protocols such as NFS3/4 over RDMA or TCP, NVMe-oF over RDMA or TCP, and NVIDIA GPUDirect®, ensuring compatibility with high-performance computing environments. The system interfaces through QSFP6/112 with NVIDIA ConnectX-6 or ConnectX-7 adapters, supporting 200Gb or 400Gb connections, making it future-proof and ready for the most demanding applications. The recommended configuration includes two CX-X adapters, though the system supports up to six, offering unparalleled flexibility and scalability.



Initial Use of Solidigm in AI-Focused Storage Solutions

The collaboration between PEAK:AIO and Solidigm began with a focused effort on optimizing read performance for AI applications. During an SK Hynix-sponsored presentation with EMC3, the potential of using Solidigm's technology for AI-specific storage solutions was debated. At that time, Solidigm was keen on achieving success in the AI sector, and PEAK:AIO was positioned to deliver on this front, a goal they continue to pursue.

Initially, the focus was on developing an AI-specific archive solution that could meet the evolving needs of AI-driven research and applications. As AI models are increasingly created with the knowledge of their long-term utility, there is a growing requirement for the ability to trace decisions and models back through various stages of development. This need has been particularly evident in projects undertaken by the AI Centres or the NHS trials.

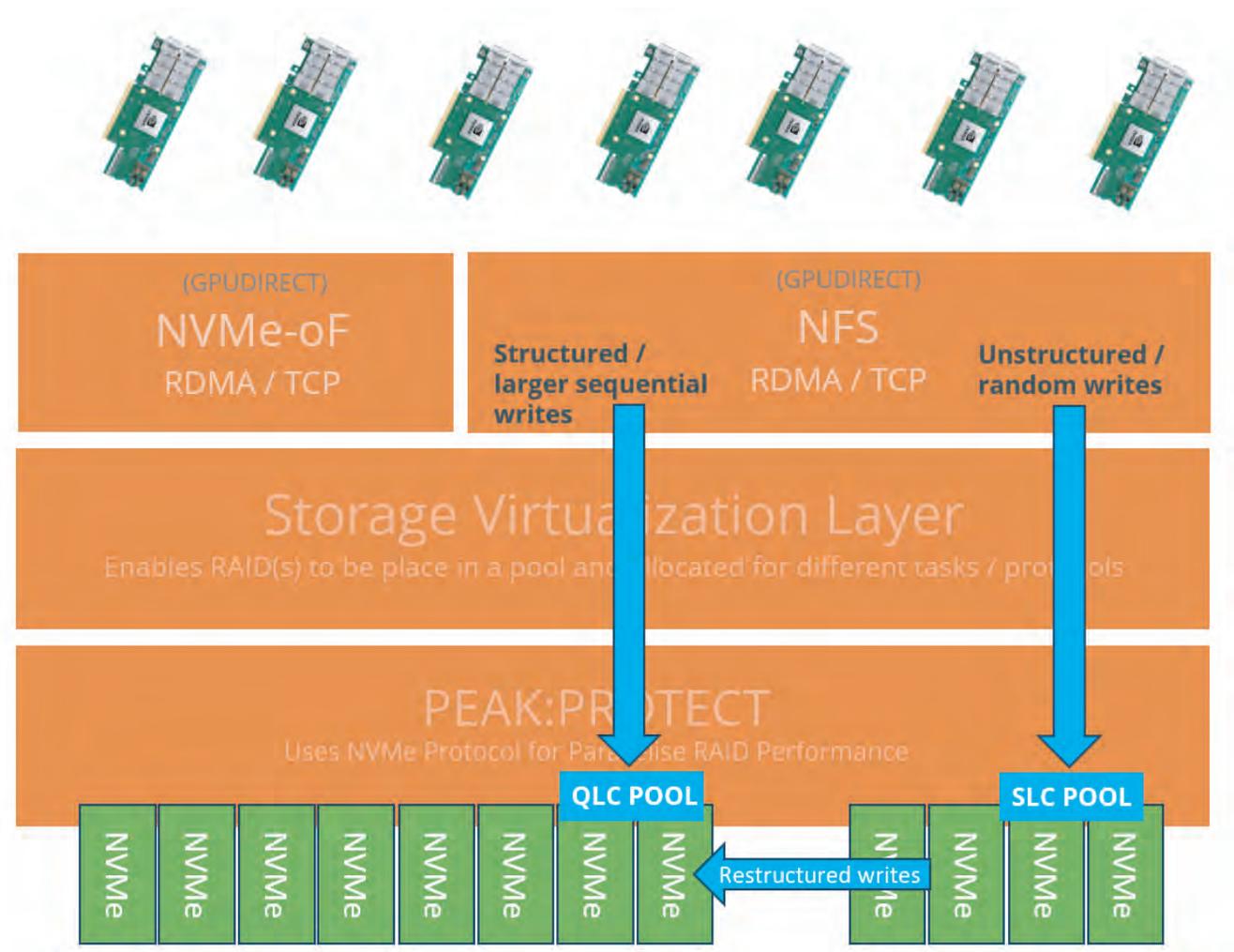
Through extensive collaboration with Professor Sebastien Ourselin, PEAK:AIO developed the PEAK:ARCHIVE solution. This solution, designed to handle AI-specific archival needs, is evolving into what will be known as PEAK:AUDIT. When these intelligent systems are merged this new model will help to ensure compliance with stringent healthcare standards and regulations.

Advancements with Gen 2 PEAK:AIO QLC

Building on the success of the initial deployment, PEAK:AIO has continued to refine its storage solutions, particularly with the development of the Gen 2 PEAK:AIO QLC system. While this project has not been publicly disclosed, there have been significant advancements, particularly in optimizing the write path. This includes the integration of an SLC cache, which is more than just a simple front-end buffer. For example, large sequential writes can be directed straight to the QLC. In contrast, smaller, random writes are staged on the SLC, allowing for structured data handling that reduces write amplification and enhances overall write performance.



Although the Gen 2 system is not yet ready for production, the core technology has been licensed to a cloud provider for over two years and has proven stable and effective. The current focus is on transitioning this technology from merely accelerating front-end access to hard disk drives (HDDs) in cloud environments to creating a more dedicated QLC front-end. This approach would operate at the block layer, intercepting writes while ensuring that read operations remain direct unless the data resides on the SLC. There is also consideration of whether this technology could be offered as a cloud service in the future. However, there are hurdles to privacy regulation.



PEAK:AIO: Powering Medical AI with Scalable Storage Solutions

PEAK:AIO specializes in high-capacity storage systems optimized for medical AI applications. These solutions, powered by Solidigm QLC SSDs, offer a balanced combination of capacity, performance, and efficiency. They are specifically tailored to meet the data demands of modern healthcare institutions while ensuring secure and immediate access to patient information.

Designed with the future of medical AI in mind, PEAK:AIO's platform is scalable to accommodate the exponential growth of healthcare data. This scalability ensures that as data loads increase, the system maintains consistent performance and efficiency, preparing hospitals and research institutions for future challenges.

PEAK:Archive: Tuned for Medical Data

The marquee offering from PEAK:AIO is PEAK:ARCHIVE, a solution designed specifically for long-term data storage. While most storage solutions focus on the immediate retrieval and processing of data, PEAK:ARCHIVE is tuned for read performance, making it superior for storing historical medical data that may not be accessed frequently, but is nonetheless critical.

PEAK: ARCHIVE's design considers the unique needs of the medical field, where data must be preserved for years, if not decades. This solution ensures that historical patient data is stored securely and can be retrieved immediately. Integrating Solidigm's QLC SSDs into PEAK:ARCHIVE equates to larger datasets where performance does not suffer, and energy efficiency is maintained.

MONAI: The Future of AI in Healthcare

MONAI is an open-source initiative created by King's College London and other partners, including NVIDIA. MONAI was designed to accelerate the development and deployment of AI models in healthcare, particularly in medical imaging. Given the sensitivity of patient data and the strict privacy regulations, MONAI ensures that data does not leave the clinic, addressing one of the significant concerns in medical AI.

MONAI's open-source framework allows flexibility and customization, enabling healthcare institutions to tailor AI models to their needs. The platform is designed to work seamlessly with existing healthcare systems and provides a robust infrastructure for deploying AI in clinical settings. PEAK:AIO's storage solutions are optimized for MONAI and ensure that the vast amounts of data required by AI models are readily available and processed efficiently.

NVIDIA and MONAI: A Partnership in Innovation

NVIDIA's partnership with MONAI integrates GPU-accelerated computing, crucial for training intricate AI models. The synergy between NVIDIA's hardware and MONAI's software forms a robust toolkit for creating healthcare AI applications. However, the efficiency of these tools heavily depends on the underlying storage infrastructure, in which PEAK:AIO and Solidigm play a significant role.

Training the next generation of AI models – models that can help provide insights to researchers and clinicians alike – can be I/O intensive. Even with the breakthroughs in accelerated computing, if pixels stored on disk cannot be moved to the GPU at high velocity, the entire model training process slows considerably. Solutions like PEAK:AIO with Solidigm QLC SSDs that specialize in secure, high-volume, enterprise-grade storage connected using GPUDirect that can enable more model runs in less time.” -Brad Genereaux, Global Lead Healthcare Alliances, NVIDIA.

Leveraging the advanced storage capabilities of PEAK:AIO systems ensures that healthcare institutions can avoid AI workload bottlenecks due to data access speeds. The collaboration between PEAK:AIO, MONAI, and NVIDIA represents a holistic approach to deploying AI in healthcare, with each player bringing their strengths to the table to solve complex problems.

Business Benefits and Improved Patient Outcomes

Integrating PEAK:AIO's storage solutions with MONAI's AI models and NVIDIA's hardware offers significant business benefits for healthcare providers. The ability to quickly and accurately process and analyze large datasets leads to faster diagnoses, more personalized treatment plans, and, ultimately, better patient outcomes. This can reduce patients' wait time for results, enabling quicker, more intelligent decision-making and treatment initiation in hospitals.

Moreover, PEAK:AIO's solution's scalability means that healthcare providers can continue to expand their AI capabilities without worrying about storage limitations. As AI becomes more integrated into clinical workflows, the need for reliable and scalable storage will only increase, making PEAK:AIO's solutions a critical component of future healthcare infrastructure.

One of the most significant advantages of this technology is its potential to improve patient experiences. Hospitals can provide a higher standard of care by ensuring that data is readily available and processed efficiently. This enhances the patient experience and contributes to better overall outcomes. With AI-driven diagnostics and treatment planning, patients can receive the care they need faster, with more accurate and personalized treatment options.

“PEAK:AIO has consistently set the benchmark for AI storage solutions, driving innovation across the industry. Their latest collaboration with Solidigm pushes even further and allows us to deliver unprecedented performance while overcoming the industry's toughest challenges—power, density, and cost. It's a game-changer that enables our clients to achieve much more, with less cost and in less space.” – Elan Raja, CEO of Scan Computers



Conclusion

The collaboration between PEAK:AIO, MONAI, and Solidigm marks a significant advancement in medical AI. By combining cutting-edge software-defined storage technology with powerful AI models and hardware, these companies enable healthcare providers to efficiently store, process, and analyze vast amounts of data. This is not just about meeting the current demands of the healthcare industry; it's about preparing for the future, where AI will play a central role in patient care.

As healthcare data increases in volume and complexity, the need for robust, scalable, and efficient storage solutions will become more critical. PEAK:AIO's innovative approach, supported by Solidigm's QLC SSDs and MONAI's AI framework, ensures that healthcare institutions are equipped to handle these challenges head-on. The result is a more efficient healthcare system that can deliver better patient outcomes, both now and in the future.

The collaboration between these three industry leaders is paving the way for the next generation of medical AI. Addressing the storage challenges inherent in this field enables faster, more accurate diagnoses, improved patient care, and a healthier future for all.

[Solidigm SSDs](#)

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