



Applying Innovation and Efficiency to Power World-Class Genomics Research in the DoD

TVAR Solutions & Dell Technologies: A Case Study

A world-class Defense Department genomics research facility chose TVAR Solutions to help it modernize to a powerful, highly scalable compute and storage solution from Dell Technologies. Here is our story.

The Challenge

Many government agencies conduct cutting-edge research that requires technology that is not only highly advanced, but also highly scalable. One example is a leading genomics research facility within the Department of Defense.

In 2015, this agency began standing up a genomic sequencing lab that would regularly ingest, analyze, and store many petabytes of data—all of it highly sensitive because it was personally identifiable information (PII) and health data. To understand the scale of compute and storage required, consider that this facility sequences and conducts research on more than 25,000 whole human genome samples a year. To put this into context, a single human genome yields roughly 1 terabyte of raw data. That data ultimately is processed and refined down to about 20 percent of that amount for research and long-term storage—nevertheless, that translates into extremely large volumes of data that must be rapidly ingested, analyzed, and archived smartly and securely. To accomplish this, the defense agency needed storage that could:

- Scale quickly (accommodating tens of petabytes)
- Quickly and efficiently handle large individual files (e.g., 200 to 300 gigabytes each) as they're being written
- Intelligently and automatically tier and manage data throughout the full data lifecycle
- Operate with minimal staff administration

This defense genomics lab contracted with TVAR Solutions to advise them and deliver a solution that would stand up to the large compute requirements and long-term storage

needs of a modern genomic sequencing facility. The client already knew it wanted to employ Illumina sequencing platforms to handle the genomic processing and analysis workloads and Dell servers and storage solutions—which were recommended by Illumina—to handle the compute, tiered storage, archiving, backup, and recovery functions.

In teaming with TVAR Solutions, the client was seeking a reliable partner to help determine the precise details of that supporting infrastructure; see its delivery and implementation through to the end; ensure the entire technology stack (including a large, tape-based cold storage solution from another vendor) was integrated, optimized, and automated; identify and quickly resolve any installation challenges that came up; and, finally, make sure that all technical requirements were met or exceeded.

The Solution

TVAR Solutions' approach to the project was to design a solution tailored to the current and future needs of a world-class genomic research facility. TVAR Solutions' goal was not to come up with a solution that had a certain amount of storage capacity and a certain amount of compute capability—rather, it was to work in collaboration with the other vendors (Dell and Illumina) to develop a solution tailor-built for life sciences and next-generation genomic sequencing and be able to explain to our client why our solution was the most optimal for their needs and longer-term ambitions. TVAR Solutions wanted a solution that blended innovative technologies with cost-effective features and design.

Also critical to its approach was working not only with the client's data center staff but also with their research teams so that TVAR Solutions had a deep understanding of the end users' needs as well.

For a complex, long-term project like this, TVAR Solutions understood from the start that the client required a trusted, long-term partnership, not simply a supplier. As a result, TVAR Solutions held meetings at regular, frequent cadences with the client and with the other industry partners to make sure they were all in lockstep as TVAR Solutions developed and implemented a whole, integrated solution for the customer.

Ultimately, TVAR Solutions delivered to the client a 200-node high-performance computer cluster with 24 petabytes of Isilon storage — phased in over five years. The storage component is comprised of three performance tiers: a high-performance tier that ingests the genomic sequencing data for analysis and processing; a medium-term storage for aging data; and a large, long-term retention layer where data is held for future access. In addition, TVAR Solutions incorporated a 15-petabyte object-based tape repository from another vendor as a cold archive. A cloud-based solution was not an option because of the sheer volume of data involved and the prohibitive network and financial resources that would have been required to transport that data into the cloud and then access that data once in the cloud.

Specifically, the compute solution consisted of 200 Dell PowerEdge C6320 servers while the storage solution was comprised of 19 Isilon X410 nodes, 12 Isilon NL400 nodes, 12 Isilon NL410 nodes, and 72 Isilon A2000 nodes. The networking solution was comprised of both Dell and Cisco products. Because of the intelligent automation and enterprise data management features embedded in the solution, a single person manages all of the compute, all of the Isilon storage, and all of the tape.

Since the deployment of that solution, Dell has developed additional technological and efficiency improvements for the next-generation Isilon product line — it is much denser, capable of storing 1 petabyte of data in four rack units. As a result, TVAR Solutions is now working on another initiative with the client to consolidate four racks of Isilon storage down to two racks to provide even more storage space while reducing the client's existing rack footprint by 50 percent. This will also reduce the amount of power and cooling draw required.

The Results

Within five years of the project's implementation, this defense organization became one of the top five sequencing facilities in the world in terms of the quantity of samples being sequenced. The lab has generated many tens of thousands of whole genome sequences across more than a hundred research studies sourced from various National Institutes of Health and Defense Department organizations and has led groundbreaking COVID-19 research.

A key outcome for TVAR Solutions is that it has established a trusted, long-term partnership relationship with the client in the six years since the effort began. TVAR Solutions attributes much of its success to open and honest communications with the client and other project partners, not only during the sales process, but throughout all stages of the purchase order, planning, installation, implementation, follow-up, and beyond.

A telling indicator of this trusted relationship occurred in 2018 when the client was procuring the final portion of the 72 Isilon storage nodes for the facility. The client sole-sourced the procurement, arguing that "TVAR is the only responsible source that can provide this system for reasons, including but not limited to: 1) unique knowledge of [the client's] environment (sequencing, analysis, IT hardware, storage hardware) that was acquired during [the client's] previous storage infrastructure engineering, design and implementation phases, 2) the storage solution is highly customized requiring detailed knowledge of [the client] and is not available 'off the shelf,' 3) unique ability to develop a storage expansion plan including data migration from old cluster to the new cluster and during an equilibration phase during environmental modifications, 4) unique ability to provide oversight and management of both the current cluster and the new storage solution."

Why TVAR Solutions & Dell

TVAR Solutions has a close partnership with Dell, in part, because many on the TVAR Solutions team have previously worked for Dell, EMC, or other companies now affiliated with Dell Technologies. Our expert knowledge of Dell Technologies solutions and great working relationships with personnel in sales, engineering, implementation, product development, product support, and other functions across the Dell organization have led TVAR Solutions to become a proud Federal Partner with Dell Technologies.