

WorkloadIntelligence™ Analytics and SVF Pro – A Winning Combination

WHITE PAPER

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Summary

Customers have long been familiar with OakGate SVF and LeCroy Analyzer tools. Our new Analytics tool allows customers to derive even more benefit from their existing tools.

Because most tools report data as averages and histograms some problems can be hard to identify and correlate. In addition, problems that span multiple layers can also be hard to identify and correlate. Analytics provides a means to deal with both of these issues.

Teledyne LeCroy has developed a suite of advanced software tools called WorkloadIntelligence™ that delivers on the promise of providing analytics and replay capabilities for testing SSDs with real-world workloads.

What are Analytics?

As the amount of data explodes rapidly, analytics have become an essential tool for the corporate workplace. Moreover, many companies are now using the insights gained from analytics as a competitive advantage.

Teledyne LeCroy recently released new analytics software called WorkloadIntelligence™ Analytics. The application allows users to import and correlate a range of real-world production workload traces (such as Linux block layer I/O traces or LeCroy Analyzer Traces). Users can review, analyze and synchronize data from the application layer to the physical storage layer. The analytics tool makes it simple to create advanced performance charts with an extensive selection of parameters. The Analytics dashboard enables the user to create canvases of built-in or custom high-performance charts of various parameters and correlations. These charts can represent a range of hundreds of millions of data points to a single data point depending on the selected time range. This charting flexibility and depth provides extraordinary insight into workload data never available before.

Analytics and Workload Replay in SVF Pro

Once a trace has been captured and displayed within Analytics, the analytics tool can output a replay file. Workload replay helps decision makers can effectively and accurately replay real world production workloads. The exact same baseline real world workflow can be played and replayed multiple times across multiple drives or firmware revisions. In addition, a deeper understanding of production workload behavior and performance is crucial to optimizing SSDs and storage systems. Another important benefit for using replay is that it does not require a physical infrastructure to reproduce the production workload. Accurate workload replay ensures the workload is reproduced with the same performance, throughput, response time, and I/O request order. Therefore, when using workload replay, the production infrastructure is not exposed to possible interruptions and performance impacts.

The two graphs below show the same workflow replayed twice against the same drive and it highlights the consistency with which the workflow is re-produced when replayed against a target drive.

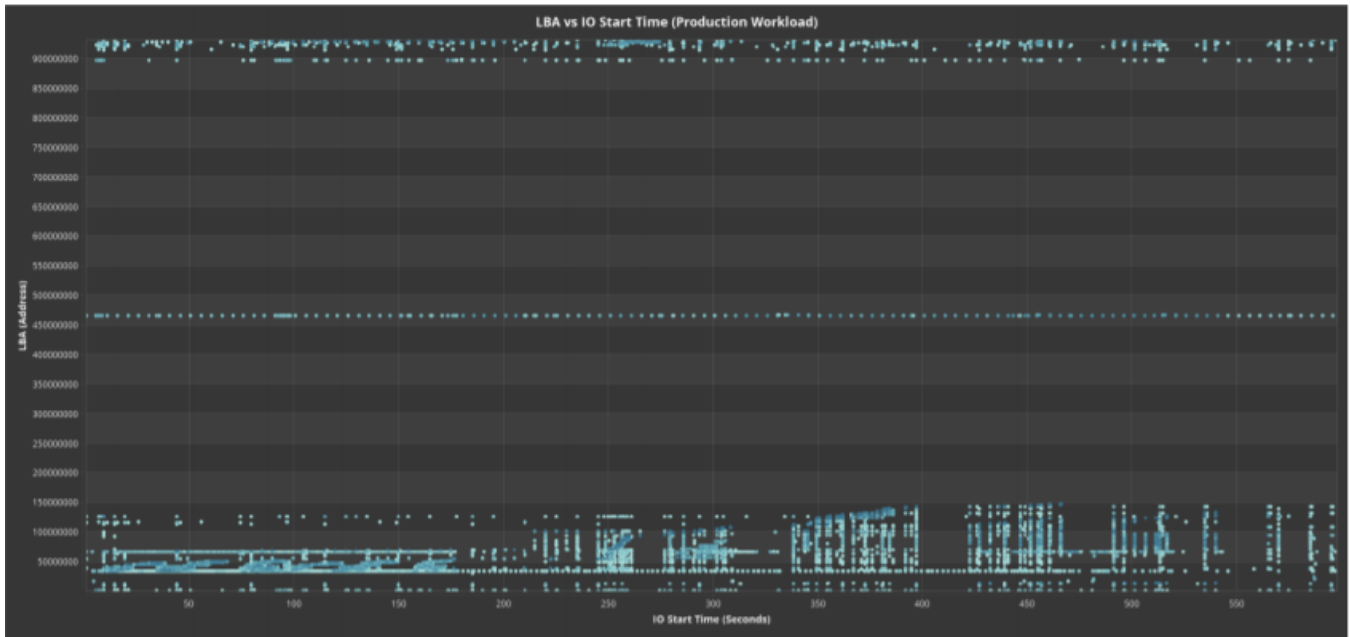


Figure 1 – LBA vs I/O Start Time – Original Production Workload Teledyne LeCroy Real-World Workload Comparisons on Industry SSDs

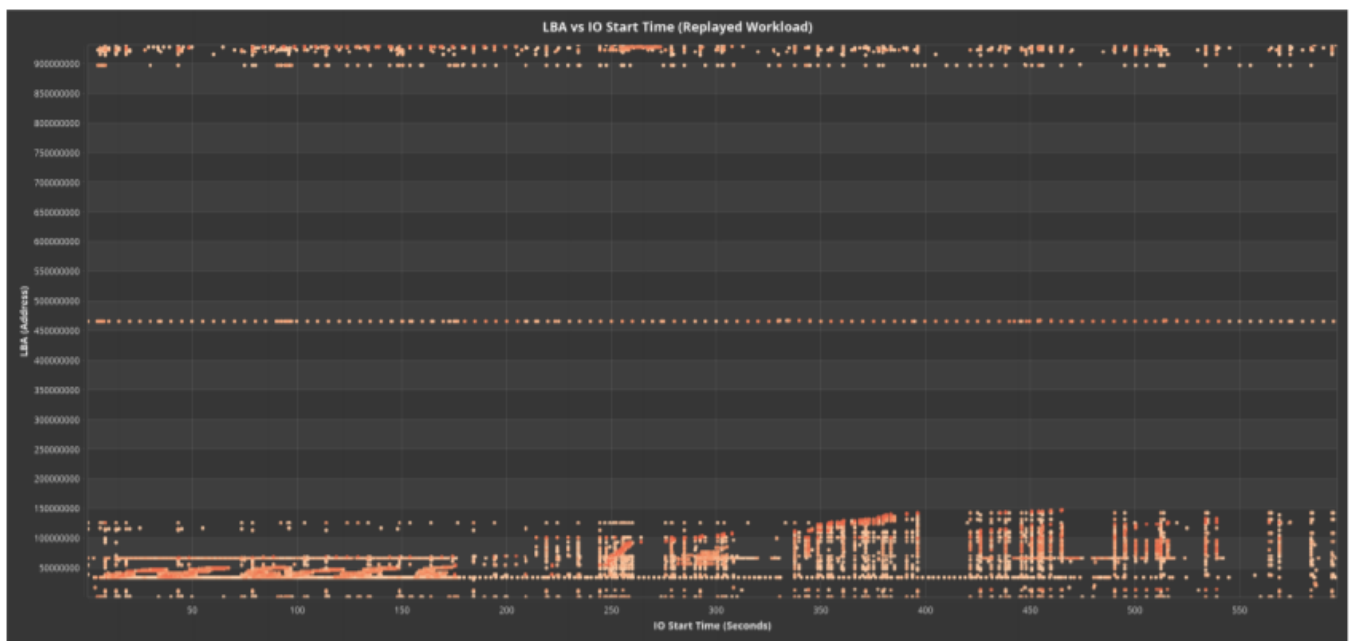


Figure 2 – LBA vs I/O Start Time – Replayed Workload

Pulling SVF and Other Data Types into Analytics

Sometimes SVF-Pro statistics delivered as averages and histograms hide correlations and IO's outliers. A histogram will show the outliers happened but provides no clue as to when it happened and what may have caused it. Nor can SVF Pro correlate a specific slow IO to a particular queue or IO size. Analytics provides an

enhanced way to measure and evaluate correlations that are otherwise hidden to the validation engineer. If you have an emerging problem with slow IO's, Analytics will allow you to see the specific IO's and correlate it with other events.

The correlations you can see are not just limited to data provided by SVF. With our ability to align data across layers, you can correlate power or physical data captured by your Quarch or LeCroy Interposer with higher level NVMe data seen within SVF Pro. Such data can be useful to uncover and highlight items such as queue depth and IO size impacts on power consumption. No longer do you have to eyeball data from different sources and try to visualize the alignment.

Quarch Power Data

The two graphs below show Quarch power data, specifically 12V and 5V current vs time. This data can be correlated directly with the workload I/O and other system processes to provide a clearer picture of how power fluctuates with given traffic. You can drill down and synch data to understand exactly what was occurring when a given power spike occurred. Or if you have put your drive into a low power state you can see the power state command and correlate that back to the actual power seen in the Quarch tool.

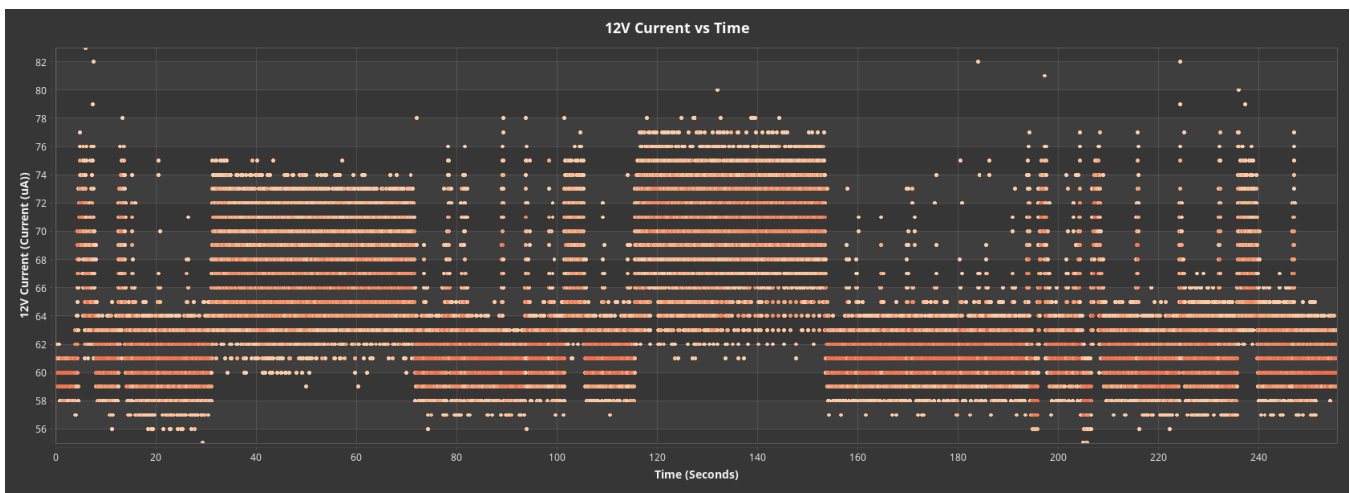


Figure 3 – 12V Current vs Time

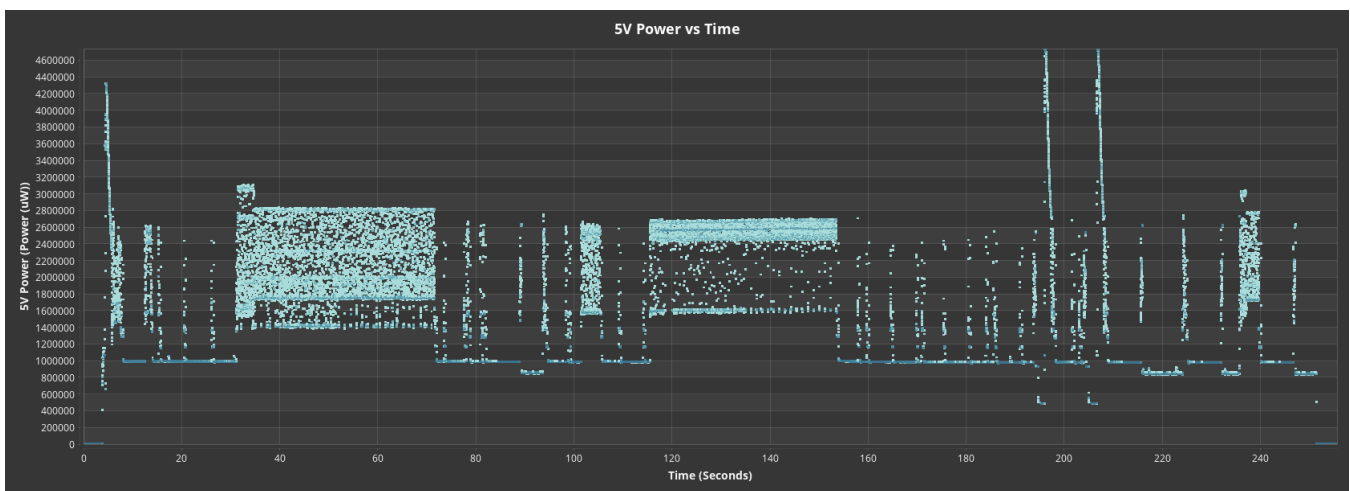


Figure 4 – 5V Current vs Time

Teledyne LeCroy Protocol Analyzer Data

The two graphs are from a Teledyne Protocol Analyzer NVMe over RoCE trace. This functionality will give the user the ability to trace from the NVMe software layer down through to the physical PCIe layer. This data will also be able to be correlated and aligned directly with the workload I/O and other system processes in the future. Again, with the combination of these tools vendors can do things not easily done today. For example, they can set queue priorities and verify those queues filled with the priority specified.

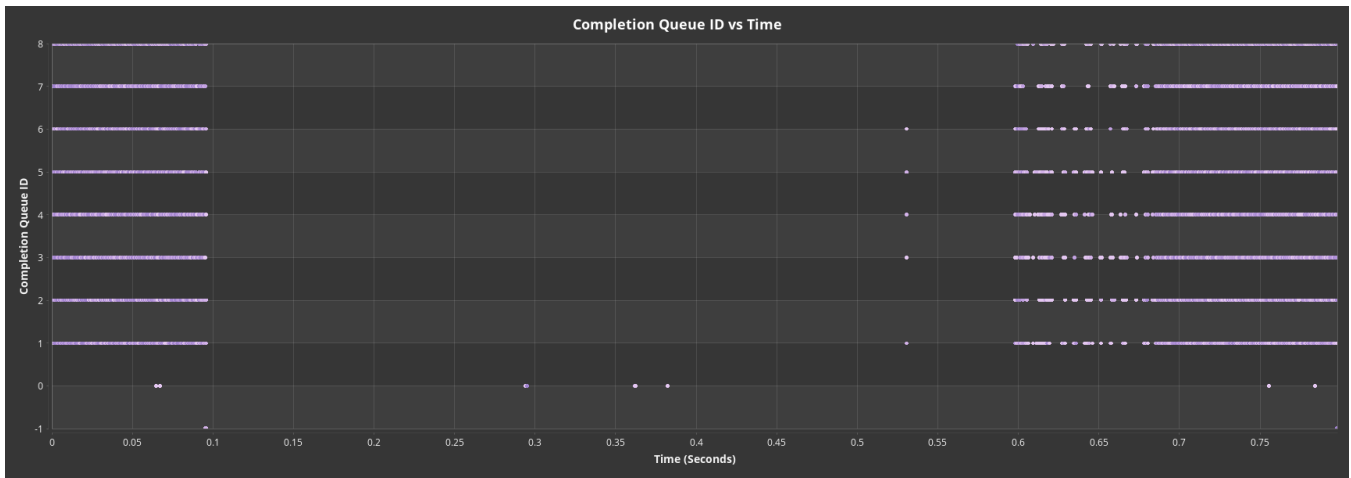


Figure 5 – Completion Queue ID vs Time

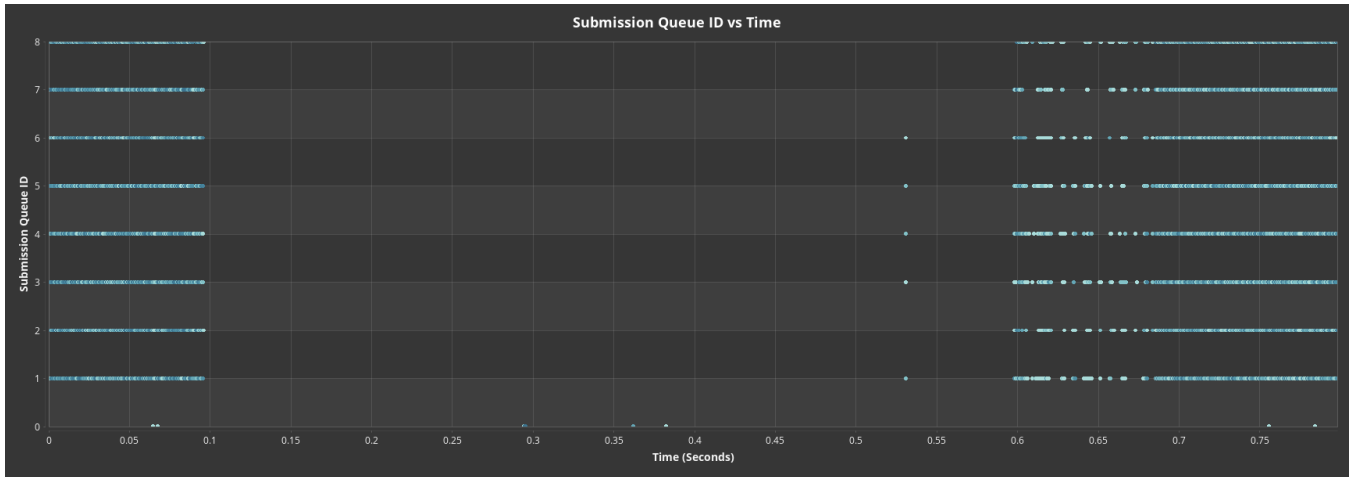


Figure 6 – Submission Queue ID vs Time

Summary

Teledyne LeCroy's suite of advanced software tools called *WorkloadIntelligence*™ combined with our industry leading SVF Pro/Enduro validation platform provide customers an unprecedented end-to-end visualization of their storage infrastructure.

Key Benefits:

- Allows vendors to compare performance variation across versions of their drives
- Ability to see individual IO's allows troubleshooting at a deeper level hidden by averages
- Capability to trace from the software layer down through to the physical layer
- Can see capabilities such as filling priority queues not available in SVF Pro

Additionally, OakGate continues to work cooperatively with its enterprise, data center and SSD customers to ensure its suite of *WorkloadIntelligence*™ tools delivers on the promise of providing analytics and replay capabilities for characterizing real-world workloads.

For more information on Teledyne LeCroy products, visit <https://www.teledynelecroy.com/oakgate>.

For a demonstration of our industry leading analytics and validation solutions contact us by email at oakgate_marketing@teledyne.com