

Deep Analyzer – Deep Insight into Solid-State Drive Issues and Problems

WHITE PAPER

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Summary

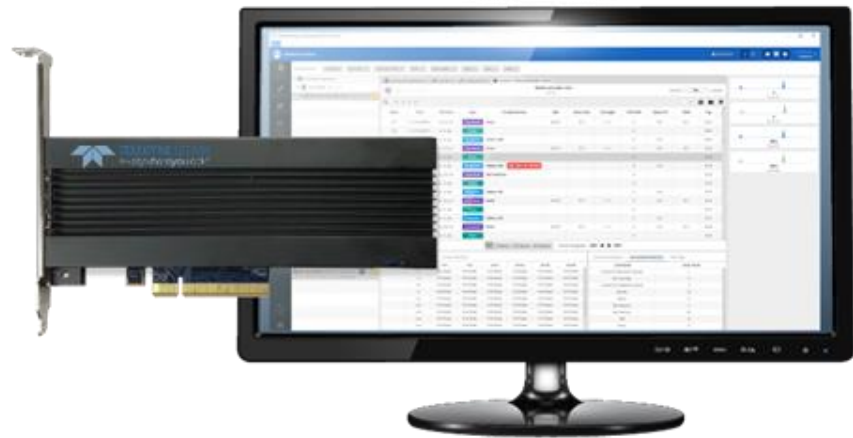
Customers have long been familiar with Teledyne LeCroy's OakGate SVF Pro with Enduro validation software. Now, with our patent-pending Deep Analyzer solution customers can derive even more benefit from SVF Pro.

Today, Analyzers can only capture and analyze short bursts (seconds/minutes) of trace data. In most instances, the Analyzer trace does not reveal the full picture, especially if the error occurs outside the trace window.

Teledyne LeCroy developed Deep Analyzer to capture and analyze longer intervals of data-up to days of analyzer data. The tool helps our customers discover “hard to find” performance and functionality challenges that they can proactively act on.

What is Deep Analyzer?

Deep Analyzer is a patent-pending deep analysis solution that works in combination with Teledyne LeCroy's OakGate SVF Pro/Enduro SSD validation platform. Deep Analyzer gives SSD validation engineers visibility into issues and failures that weren't possible before by capturing hours/days of protocol analyzer trace data and validating the data is correctly stored and securely erased.



Deep Analyzer and SVF Pro SSD Validation Software

LeCroy's OakGate SSD validation platforms allow users to stress drives with a broad range of protocol and PCIe resets, power cycles and dropped links. The tool helps users answer questions like:

- Does your drive correctly write data to NAND through these events?
- Is the integrity of a packet maintained with no partial writes to NAND?

With Deep Analyzer and the OakGate SSD validation platform, users can answer these questions to find the original failed write and the root cause of the error. New features in the software allow users to validate shorn writes, DIF information, trimmed blocks and write zeros. Deep Analyzer allows users to see the root cause of these types of problems and much more.

Additionally, while ensuring the integrity of the data is critical, so is securely erasing data. By utilizing Deep Analyzer engineers can now read the entire solid-state drive and search for “not” the expected secure erase pattern. Moreover, engineers can write the whole solid-state drive with a known pattern, then create a hot spot to force data into over provisioned NAND state, and then secure erase the drive. Deep Analyzer will show the NAND and LBA where the failure occurred.

Key Benefits

There are a number of benefits using Deep Analyzer in conjunction with OakGate test platform running SVF Pro / Enduro. We have listed the major benefits below.

- **Visibility into issues and failures that weren’t possible before.**

Customers can capture much more data – hours/days – depending on their configuration and data pattern. Deep Analyzer is ideal for customers running long automation tests. The tool can help identify and troubleshoot faults or trends that occurred during testing. Engineers can then act proactively to fix the issue.

- **Detailed insight into issues and/or failures through real-time protocol analysis.**

Protocol analyzers are ideal for identifying reproducible errors that occur during test and validation. Customers can easily review and analyze I/O traffic, frame and command statistics, and error conditions. Additionally, they can quickly search for problems and isolate I/O and error conditions. Traces can easily be saved and loaded for an on-demand analysis.

- **Seamlessly integrated with our test and validation platform SVF Pro / Enduro.**

Deep analyzer is seamlessly integrated with the existing SVF Pro protocol analyzer. There is no need to learn a new analyzer tool. Customers also get the benefit of SVF Pro new features including integrated help where users can instantly call up the help file at any point or place in the analyzer application.

Deep Analyzer Workflow

The Deep Analyzer workflow is highlighted below - **see figure 1**. Once analyzer trace data is captured using Deep Analyzer, users can use the protocol analyzer to review error state identification, error statistics collection and statistics on the types of commands sent and received. Users can isolate an I/O or error condition by using simple search on designated conditions specified LBAs, low level events, command types, sizes and tags.

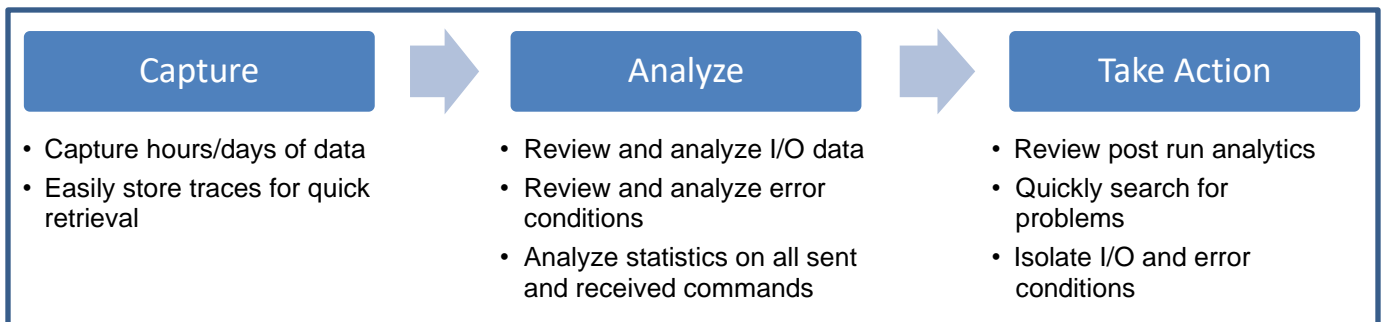


Figure 1 – Deep Analyzer Workflow

Using Deep Analyzer

Using the Deep Analyzer has the following appliance requirements.

- **Supported Teledyne LeCroy OakGate Appliances:**
 - Expandable Desktop Appliance (OGT-DE200-G4)
 - 3U Rackmount Appliance (OGT-R300-G4)
- **Licensing:** Must be licensed to support the Deep Analyzer
- **Software:** Enduro Controller Application, powered by SVF Pro v4.1.1, or later
- **Operating System:** CentOS 7.4, or later
- **Slot:** One available Gen3 PCIe x8 slot (for the Deep Analyzer AIC)

Setting up the Deep Analyzer in SVF Pro / Enduro

Using the Deep Analyzer in SVF Pro / Enduro is straightforward. Just enable the function at the controller level and select the size of the analyzer buffer (currently up to 2TB) – **see figure 2**. Start the protocol analyzer as you normally would.

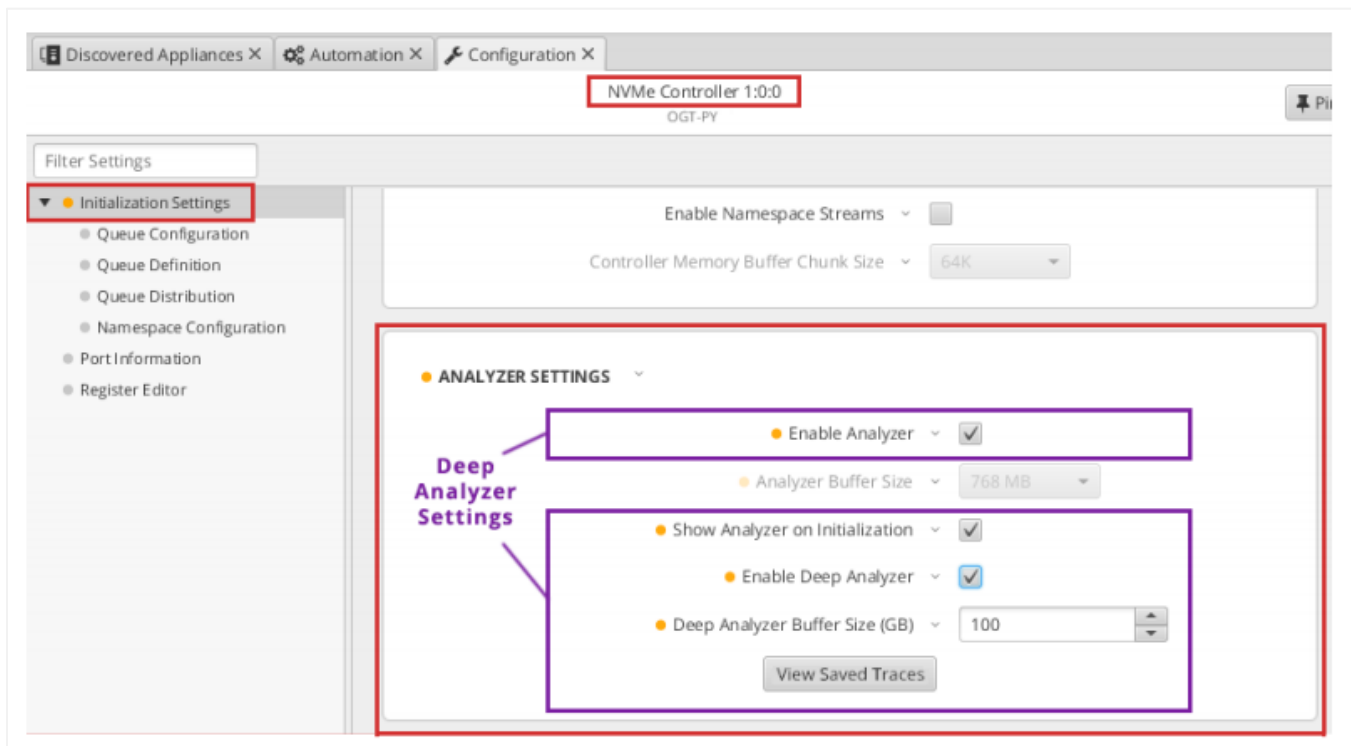


Figure 2 –Deep Analyzer Initialization Settings

Key Use Cases for Data Integrity and Security

Use Case	Today with SVF Pro v4.5 and greater	With Deep Analyzer and SVF Pro
Data Validation	With SVF Pro, a user can capture seconds/minutes (analyzer window) of data validation errors with the integrated protocol analyzer. However, it will most likely <u>not</u> capture the corresponding write that created the validation error which could have occurred outside the short analyzer window.	With SVF Pro and Deep Analyzer the user has the ability to capture hours/days of analyzer data-expanding the analyzer window-and can now capture data validation errors and the corresponding write that created the validation error.
Atomicity	Like for the data validation use case, a user can only capture seconds/minutes (analyzer window) of atomicity errors with the integrated protocol analyzer. However, it will most likely will <u>not</u> capture the corresponding write that created the read atomicity error.	With SVF Pro and Deep Analyzer and the larger analyzer window, the user has the ability to check for atomicity and can now go back and find the write causing the atomicity error.
Secure Erase	With SVF Pro, a user can prefill the drive with a known pattern and create hot spot to force use of over provisioning. The user can then secure erase the drive and read the entire drive looking for the “not” secure erase pattern. Note: the drive has to go back to NAND for the reads.	With SVF Pro and Deep Analyzer and the increased analyzer window, the user now has the ability to search the entire drive using data patterns. Search can also be done using the “not” capability.

Summary

SSD customers rely on data integrity and data security. SSD vendors must ensure their SSD accurately stores and erases data as directed. SVF Pro/Enduro’s integrated protocol analyzer with Deep Analyzer improves your ability to discover and root cause failures associated with data validation, data atomicity and secure erase.

Utilizing Teledyne LeCroy’s Deep Analyzer solution with our SVF Pro/Enduro validation platform greatly expands the analyzer window and gives users a new, detailed insight into issues and/or failures they could not see before. Deep Analyzer can now help users discover “hard to find” performance and functionality challenges.

Key Benefits:

- Visibility into issues and failures that weren’t possible before
- Detailed insight into issues and/or failures through real-time protocol analysis
- Seamlessly integrated with our test and validation platform SVF Pro / Enduro

For more information and/or demonstration of Deep Analyzer and other Teledyne LeCroy products, visit <https://www.teledynelecroy.com/oakgate> or contact us by email at oakgate_marketing@teledyne.com