CASE STUDY

DEBUGGER TOOL ON TARGET FOR COMPLEX SIMULATION ENVIRONMENT REQUIREMENTS

WHEN CAS PURCHASED THE TOTALVIEW DEBUGGER TO TEST AND DEBUG AIR AND MISSILE DEFENSE MODELS AND SIMULATIONS, THE DEVELOPERS GOT FAR MORE VALUE THAN EXPECTED—INCLUDING REDUCED DEVELOPMENT CYCLES, COST REDUCTIONS, AND SIGNIFICANT PERFORMANCE GAINS.

The Need

Based on its contract with the Department of Defense (DoD), CAS, Inc. was tasked with finding a robust debugging tool that was compatible with the Intel® Compiler for Linux* to use in its Air and Missile Defense modeling and simulation programs. In addition to this requirement, it was critical that the tool also handle multi-threaded environments and be compatible with CAS's legacy simulation platforms.

The Testing

Only one debugging tool fit all the requirements—the TotalView Debugger*. Not only does it handle high-performance, multi-threaded environments, as well as a multitude of platforms and languages, it is also highly optimized for Intel® Compilers—the requirement mandated by the DoD contract. CAS engineers downloaded an evaluation copy and tested its performance in the lab. They quickly saw the true value of the tool—from its intuitive user interface and speed to its multi-language support.

The Benefits

The TotalView Debugger allowed CAS to run simulations side-by-side in real time, which reduced development time by 60–70 percent. With TotalView's extensive capabilities, CAS didn't need to purchase separate tools, reducing the company's costs by about 40 percent. A streamlined user interface enabled CAS software developers to quickly identify bugs, and its multi-language support allowed developers who were not familiar with older languages, such as Fortran, to effectively use the system.

About CAS

CAS, Inc., founded in 1979, is headquartered in Huntsville, Ala., with more than 26 locations across the nation and worldwide. The company provides service throughout the Department of Defense, specializing in the full range of weapon system support and analysis. CAS's services sustain theater missile defense, air defense, and aviation and land-combat missile systems. In December 2007, CAS, Inc. became a wholly owned subsidiary of ITT Corporation.

About TotalView

TotalView Technologies is the provider of the world's leading debugging solutions on Linux*, UNIX, and Mac OS X*. Since the birth of supercomputing, TotalView Technologies has been dedicated to the advancement of the state-of-the-art in debugging technology.

The Quest for a Failure-proof Development Solution

When developing software programs that model powerful Air and Missile Defense systems, it is critical the program is bug free. A lack of accuracy leaves the government customer with unrealistic impressions of performance. In 2003, when awarded a five-year contract by the Department of Defense (DoD) to technically support Air and Missile Defense programs, CAS, Inc. found itself on a critical path. Under the contract, CAS would utilize legacy models and simulations that provide performance data to the Government project office that is responsible for Lower Tier Air and Missile Defense and the war fighters. The company was also tasked with providing high-fidelity simulations that demonstrate how the Air and Missile Defense systems interact with other weapons. The DoD had one requirement in regard to the development tools: they must be compatible with the Intel® Compiler, Fortran and C++ running on a Linux* platform.

But the criteria for selecting a debugger were a little more complex. Models and simulations provided to and developed by CAS, Inc. ran on several different high-performance computing platforms and were written in various languages. Therefore, the debugging tool needed to meet a variety of requirements beyond what the contract mandated. Adding to this complexity, the debugger had to meet the multi-threaded challenges found in many high-performance development environments.

TotalView Debugger*: Exceeds Multifaceted Requirements

The TotalView Debugger (TVD) was the only tool on the market that met every single requirement. In regard to compatibility with the Intel Compiler, TotalView Technologies had previously worked very closely with Intel to ensure optimization. As an added advantage, it was also tuned for all of the legacy systems and programming languages that CAS had to port to C++. "The other alternative was to use multiple debugging tools, which is not optimal when it comes to cost or efficiency," said Jim Knoblach, Modeling and Simulation Department Manager for CAS, Inc. "But TotalView's debugger didn't only meet all of our needs, it was a also very robust tool that was easy to use and gave us great confidence."

TVD offers a number of advanced features that help speed code development and eliminate bugs quickly. Debugging multi-threaded code—a type of code that

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"One of our simulations was about 1.5 million lines of code. We had to complete the simulation within schedule which required us to use code from other sources, most of which was written in Fortran and other legacy languages and needed to be converted to C++. The ability to port the code, and to watch and test on two different platforms side-by-side in real-time using TotalView's debugger cut development time by 60 to 70 percent, we wouldn't have been able to achieve this if we had to use more than one debugging tool. It also saved us about 40 percent in costs because we didn't have to purchase other tools."

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Modeling and Simulation Department Manager

CAS, Inc.

is characteristic in modeling and simulations like those required for the Air and Missile Defense programs—presents some unique challenges. Plus, the differences between development environments and working environments result in subtle timing variations that are inherent in multi-threaded processing. The TVD allows developers to precisely control each individual program thread and thereby more accurately troubleshoot elusive bugs in the lab. It also provides visibility into thread creation and grouping via a full graphical user interface that brings clarity to the process, giving developers the ability to quickly analyze bugs and manipulate threads as needed. All of this can be done without having to recompile a program.

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Simulations of large size are not the only area in which TVD is eminently useful. CAS, Inc. developed a smaller simulation that is used for Air and Missile Defense design analysis. It is essential that there are no bugs and no downtime. The Air and Missile Defense planning simulation runs in a multi-threaded environment and is difficult to control with a standard source debugger. TVD offers a comprehensive feature set of complete thread control, conditional break points, memory usage, heap status and the memory leak detection. This has improved the software reliability by more than 50 percent.

Performance Gains through Multi-processing

In addition, through TotalView's collaboration with Intel, the TVD was optimized for Intel multi-core processors. In CAS's case, it uses the Dual-Core Intel® Xeon® processor 5150 in the lab to run the modeling and simulations. The Dual-Core Intel Xeon 5150 has two computational cores on one processing die—enabling it to handle parallel workflows and help transform complex data into actionable information in less time. "Using the Intel Xeon processor we get about 4 times the performance at one-tenth of the cost of other platforms we've used in the past," said Knoblach. "We also benefit from the reduction in heat output, less power consumption, as well as the ability to put more systems in less space."

About the TotalView Debugger* (TVD)

TotalView Debugger* (TVD) is TotalView Technologies' flagship product reflecting more than 20 years of continuous improvement to attain its clear best-of-breed position. TVD has unequaled value for software applications written for simulation and modeling, special effects, aerospace, telecommunications, animation, finance, scientific analysis, biotechnology and many other fields.

Built to handle the complexities of the world's most demanding applications, TVD is capable of scaling to thousands of processes or threads with applications distributed over multiple machines and processors. Its intuitive GUI provides enhanced graphical representations that enable developers to quickly isolate problems.

TVD supports multiple platforms, including Linux*, UNIX, and Mac OS X*, eliminating the frustration of working with and learning how to use multiple debuggers. It is also the market and performance leader in debugging C/C++, Fortran, and MPI/OpenMP applications. The non-intrusive memory debugging helps developers find leaks, track heap allocations and dealloactions and get usage information anytime. There is no need for a cumbersome binary of source code instrumentation process.

To learn more, visit: **www.totalviewtech.com/productsTV.htm**

About the Intel® Compiler

Accelerate software performance using Intel® compilers. Compatible with other tools you use, Intel compilers easily integrate into popular development environments and feature both source and binary compatibility with other widely-used compilers. The Intel® Compiler Suite Professional Edition offers outstanding support for creating multi-threaded applications. The suite includes Intel® C++ and Fortran Compilers, with advanced optimization, multi-threading, and processor support that includes automatic processor dispatch, vectorization, auto-parallelization, OpenMP*, data prefetching, and loop unrolling, along with highly optimized C++ templates for parallelism, math processing, and multimedia libraries.

To learn more, visit: **www.intel.com/cd/software/products/asmo-na/eng/compilers/284132.htm**

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