

Oracle Developer Studio Code Analyzer



KEY FEATURES

- Integrated and comprehensive view of common coding errors via interactive GUI or command-line interface to meet scripting needs
- Quick identification of Silicon Secured Memory runtime-related errors on the latest Oracle SPARC systems with Silicon Secured Memory technology
- Get accurate analysis faster than competitive alternatives
- Low false positive rate
- Static code checking detects common programming errors as part of normal build process
- Dynamic code checking finds memory-related errors in executed code paths
- Code Coverage checking informs developers of gaps in test coverage

KEY BUSINESS BENEFITS

- Improve software quality, security, and reliability
- Increase developer productivity

The Oracle Developer Studio Code Analyzer ensures application reliability and security by detecting application vulnerabilities, including memory leaks and memory access violations, enabling developers to write better code with fewer errors faster.

Introduction

Have you ever been called in the middle of the night because your application crashed? Does your application exhibit mysterious intermittent failures that are hard to pinpoint? Do you think your software is not adequately tested? The Code Analyzer helps identify application reliability and security issues by utilizing dynamic, static and code coverage analysis to detect common coding errors, including memory leaks and memory access violations faster than competitive alternatives. In addition, the Code Analyzer provides support for SPARC Silicon Secured Memory, enabling developers to find and fix memory errors with minimal overhead.

The Code Analyzer performs static analysis when you are compiling your application and it performs dynamic analysis when you are running your application and gives you feedback about where you may have errors. In addition, it provides code coverage data to give you information about functions that are not covered by your test suite and provides guidance on the type of benefit you could get by covering those functions. The Code Analyzer provides a comprehensive view of application vulnerabilities by synthesizing the data collected from these three types of analysis, enabling you to improve application correctness and reliability. It also provides advanced error filtering and sorting capabilities, enabling you to track, detect, and fix issues faster.

Static Analysis

Modern static checking can uncover implementation defects in software earlier, more reliably and at a far lower cost than conventional testing methods. Unlike early Unix tools like lint, programs can now be analyzed at a semantic level to point out real defects, rather than “potentially problematic constructs”. Using sophisticated analysis techniques, bugs and implementation defects can be found during compilation and fixed right away, saving enormous amounts of time and resources.

Static Analysis is enabled in the compiler when building your application. Some of the useful errors found during this phase include:

- Reading and writing beyond array bounds
- Incorrect malloc and freed/ freeing memory issues

- Null pointer dereference (leaky pointer checks)
- Infinite empty loop
- Uninitialized memory reads / operations
- Type cast violations

All of these types of errors, and many more, are detected during regular builds. Other than the addition of a special option, no other change is necessary. Developers typically find that detecting and eliminating these errors during the design and early implementation phase is an order of magnitude cheaper than detecting them later during development or having to generate patches for critical bugs.

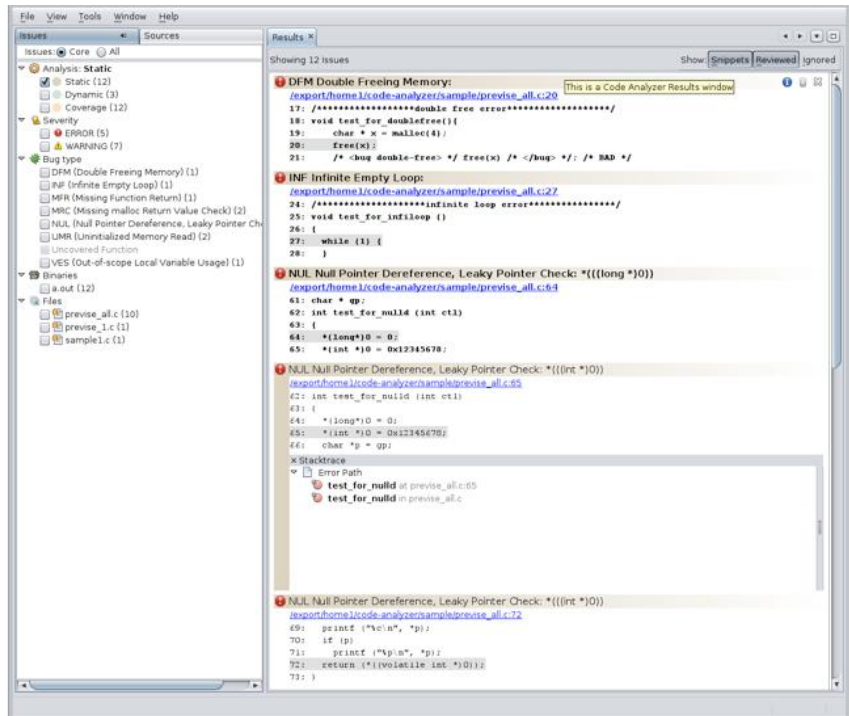


Figure 1. Comprehensive view of static errors

However, not all errors are detectable at compile time. Some real errors may not be reported (these are called false negatives) and some reported errors might not actually be issues (these are called false positives). The goal of the tool is to minimize these types of errors. Another real limitation is that some errors depend on data that is available only at runtime. For such errors, the tool offers dynamic code checking capabilities. The advantage of using the same compiler to produce static errors is twofold: what is compiled is exactly what is checked and the tool does not use any other external parsing technique which may or may not analyze the same code the compilers see during build time.

Dynamic Analysis

While static code checking is extremely useful, it does have some limitations outlined above. Additionally, developers want to know exactly how an issue arose during application runtime. Dynamic checking provides a complementary view in discovering

common kinds of errors:

- Reading from and writing to unallocated memory
- Accessing memory beyond allocated array bounds
- Incorrect use of freed memory
- Freeing the wrong memory blocks
- Uninitialized memory reads / writes
- Memory leaks

Dynamic checking works on binaries built with the Oracle Developer Studio compilers. No special compilation flag is necessary, although the presence of the `-g` option is recommended to help identify offending source lines. Access to source code is not required, which means it can be used on production binaries and works well with third party libraries. The binary is instrumented for these memory related errors. Due to the close linkage with the compilers and intimate knowledge of hardware and Oracle Solaris interfaces, the overhead incurred during dynamic checking is the smallest among similar tools.

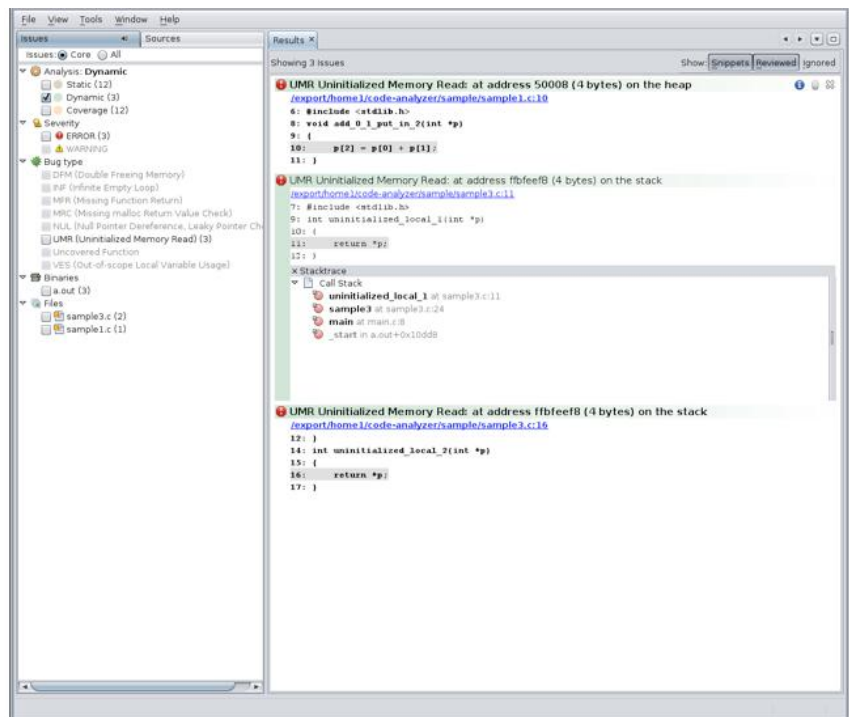


Figure 2. Comprehensive view of dynamic errors

Code Coverage to Identify Gaps in Testing

Code coverage checking uses binary instrumentation to inspect test suite runs of an application and to identify vulnerabilities by highlighting source fragments that are not covered. Highlights include:

- Collecting and aggregating data on uncovered portions of code over multiple runs, thus making it suitable for integration during automated product testing
- Displaying potential coverage percentage
- Multi-threaded and Multi-process safe

- Low overhead of instrumentation during runs

The code coverage checking feature of the Code Analyzer includes unique patented technology that provides a sorted list of most important functions that have not been tested. These are functions with the largest functionalities. It also hides uncovered functions that are subsumed by other functions, reducing clutter.

Graphical or Command-line Interface to Meet Various User Needs

Based on the award-winning NetBeans framework, the Code Analyzer GUI provides an easy to use graphical view of the data collected by these three types of analysis.

The tool opens with two panes: one pane highlights the types of vulnerabilities found and the other pane details the errors in the context of the surrounding code fragments to quickly pinpoint the root cause of the issues. The feature-rich GUI provides:

- Filters to enable focus on select types of vulnerabilities or a selection of source files to focus on
- Buttons to hide, show and mark vulnerabilities according to users preference
- Integrated editor for easy source fixes
- Source browsing: class, method, field usages, call-graph information

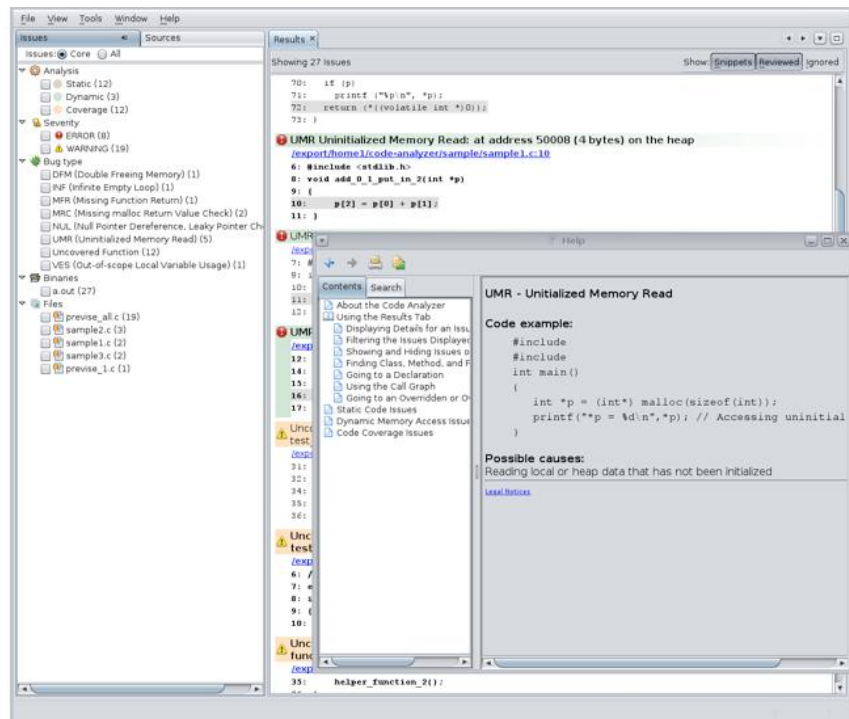


Figure 3. Overview of Code Analyzer GUI

The Code Analyzer also provides a command-line interface to view analysis results. In addition, it provides the ability to filter new errors and recently fixed errors making it easy to understand recent updates to the program.

The Code Analyzer combines the advantages of bug-finding capabilities of static and

dynamic code checking along with coverage capabilities, to help developers produce better code with fewer errors in less time.

SPARC Silicon Secured Memory and Code Analyzer

Oracle's latest SPARC processors offer coengineered hardware and software capabilities that enable applications to run with the highest levels of security, reliability, and speed. This functionality is known as Software in Silicon.

One key Software in Silicon feature is called Silicon Secured Memory. Silicon Secured Memory detects common memory access errors, thereby limiting runtime data corruption due to such errors. It can be used to detect the following types of memory access errors:

- Buffer overflows (Buffer overreads and overwrites)
- Unallocated memory or freed memory access errors
- "Double free" memory access errors
- Stale pointer memory access errors

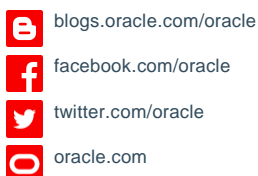
The Code Analyzer detects runtime-related memory errors identified by Silicon Secured Memory and provides developers additional system information, making it easy to locate and fix issues. When using the Code Analyzer on systems with SPARC Silicon Secured Memory technology, developers get a memory access checker that runs at real-time speeds because the tool leverages the acceleration provided by the Software in Silicon capabilities on the hardware.



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