Verifysoft TECHNOLOGY

GRAMMATECH CodeSonar®

Automated Detection of Defects and Vulnerabilities with Static Code Analysis

Verifysoft TECHNOLOGY

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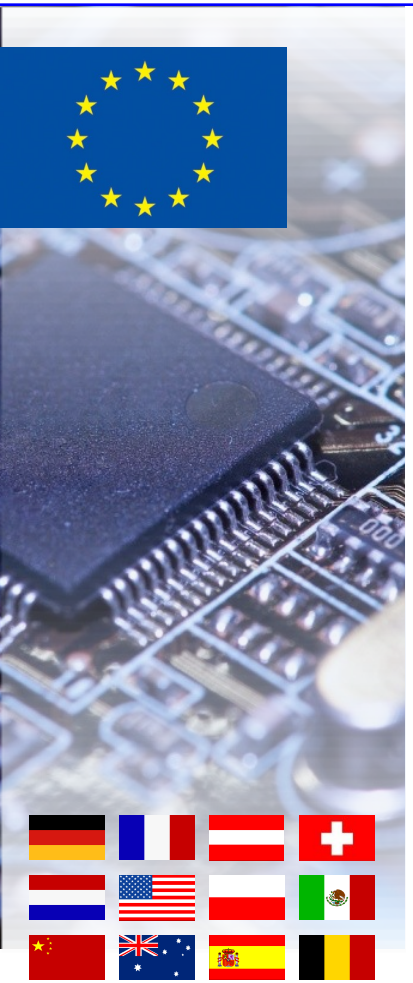
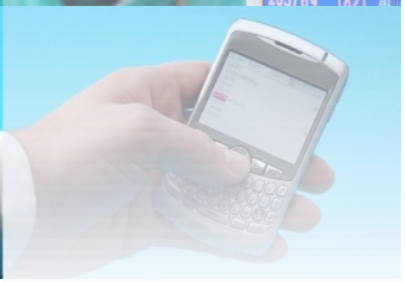


Some Info About Us:

- ✓ Founded in June 2003
- ✓ Located in *Technologie Park Offenburg* (Germany)
- ✓ 300+ customers in Europe (2013)
- ✓ Distribution, consulting and support of testing and analysis tools for software quality in Europe.
- ✓ Distributor for GrammaTech in German speaking countries
- ✓ Development of software tools
- ✓ Seminars and Trainings



Our fields of activity, we distribute software to:

- ✓ Aerospace
- ✓ Automotive
- ✓ Medical
- ✓ Automation
- ✓ Transport
- ✓ Energy

… and further fields of activity where critical software is used and needed to be relied on.

Testwell	Tampere (Finland)
CONFORMIQ	Saratoga (USA)
GRAMMATECH	Ithaca (USA)
software diagnostics	Potsdam (Germany)
Spirula	Paris (France)
elvior	Tallinn (Estonia)
QMETRY	Santa Clara (USA)

Verifysoft Customers

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Core Competency

Static and dynamic analysis of source code and binaries

Founders and Staff

- ✓ Founded in 1988
- ✓ Tim Teitelbaum, CEO (Prof. Emeritus at Cornell Univ.)
- ✓ Tom Reps (Prof. at Univ. Wisconsin-Madison)
- ✓ 50+ employees (16 PhD experts in program analysis)

Products and Services

- ✓ CodeSonar static analysis tool
- ✓ GrammaTech research

Headquarters, R&D

Ithaca (State of New York, USA)

GrammaTech Commercial Customers

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Mil/Aero

Medical

Industrial Control / Electronics

Telecom/Datacom

GrammaTech Research Customers

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- Intelligence Advanced Research Projects Activity (IARPA)
- Department of Homeland Security
- Defense Advanced Research Projects Agency (DARPA)
- U.S. Navy: ONR, NAVSEA, SPAWAR, NAVAIR
- National Aeronautics and Space Administration (NASA)
- National Institute of Standards and Technology (NIST)
- Missile Defense Agency (MDA)
- United States Air Force (USAF)
- National Science Foundation (NSF)
- United States Army

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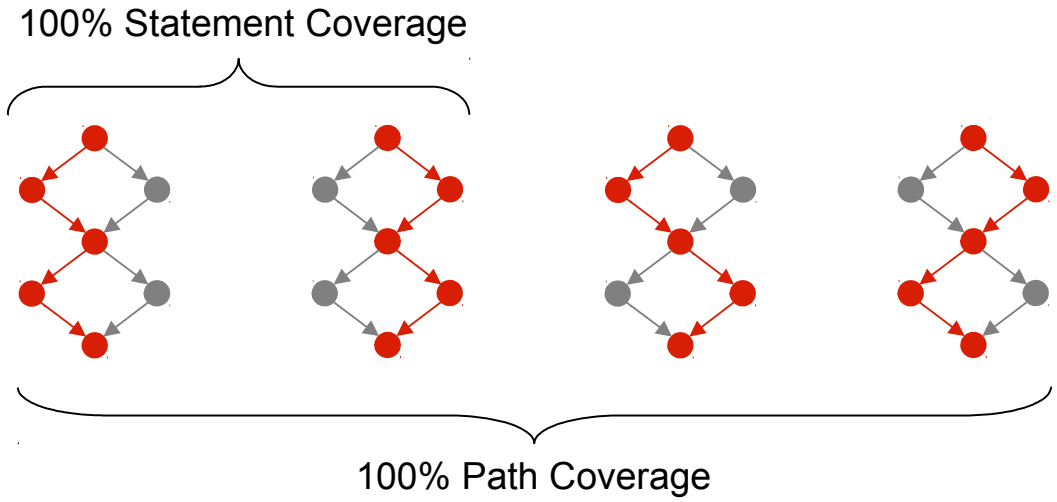
Conventional testing is necessary, BUT

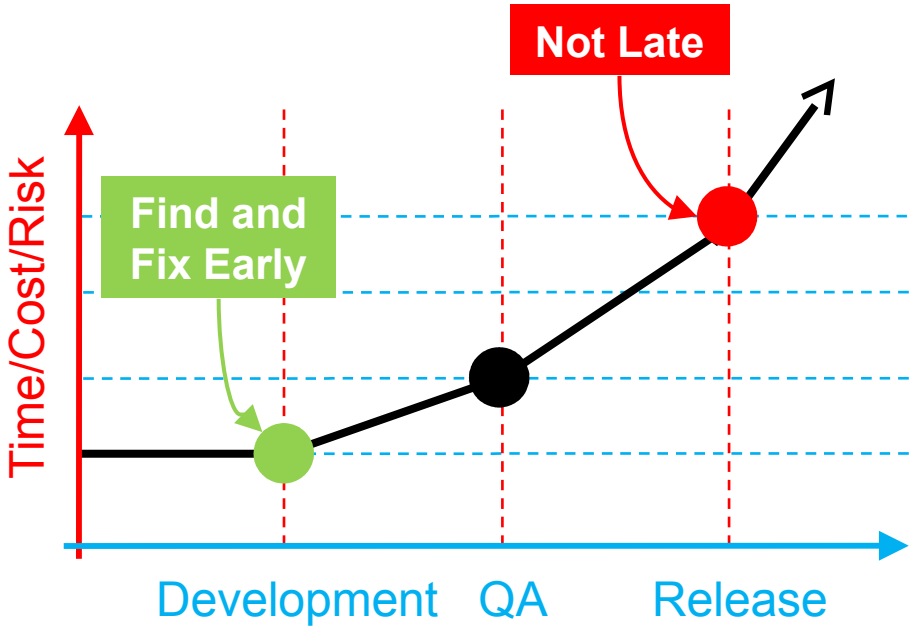
- ✓ Only as good as the test cases
- ✓ Number of paths in code much greater than the number exercised
- ✓ Most paths go untested

Even in the most stringent approaches to testing



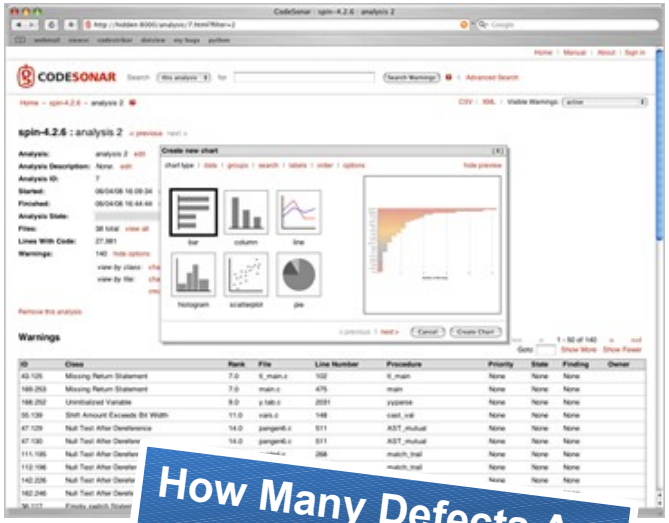
Development Testing

- ✓ Done by developers during software development
- ✓ The **sooner** a bug can be found, the **cheaper** it is to fix!



Code Sonar® Static Code Analysis

- ✓ Finds twice as many **critical defects** compared to other static analysis tools
- ✓ Improves security
- ✓ Designed for high assurance
- ✓ Employs sophisticated algorithms
- ✓ Supports custom checks
- ✓ Provides architecture visualisation



Get Code Sonar® as FREE TRIAL

Considers software as a whole

- ✓ Flow-based analysis of components or program
- ✓ Identifies serious generic defects and security vulnerabilities
- ✓ Crashes, data loss, data corruption

Easy to use and extensible

- ✓ Works with existing build system/requires no changes to the code
- ✓ Browser-based graphics for sharing and productivity
- ✓ Extensible with models and checkers

Provides a search interface for results database

- ✓ Enables users to annotate warnings
- ✓ Results and annotations persist across builds

Defect Checkers

- ✓ Buffer Overrun
- ✓ Null-Pointer Dereference
- ✓ Divide by Zero
- ✓ Uninitialized Variable
- ✓ Data Race
- ✓ Deadlock
- ✓ Free Non-Heap Variable
- ✓ Use After Free
- ✓ Double Free/Close
- ✓ Free Null Pointer
- ✓ Format String Vulnerability
- ✓ Race Conditions
- ✓ Unreachable Code
- ✓ Memory/Resource Leak
- ✓ Return Pointer to Local
- ✓ Mismatched Array New/Delete
- ✓ Race Conditions
- ✓ Unreachable Code
- ✓ Memory/Resource Leak
- ✓ Return Pointer to Local
- ✓ Mismatched Array New/Delete
- ✓ Invalid Parameter
- ✓ Missing Return Statement
- ✓ Dangerous Cast
- ✓ Inconsistent form
- ✓ User-Defined Checks
- ✓ Process Starvation
- ✓ Type Overrun
- ✓ Type Underrun
- ✓ Delete Object Created by malloc

More Defect Checkers

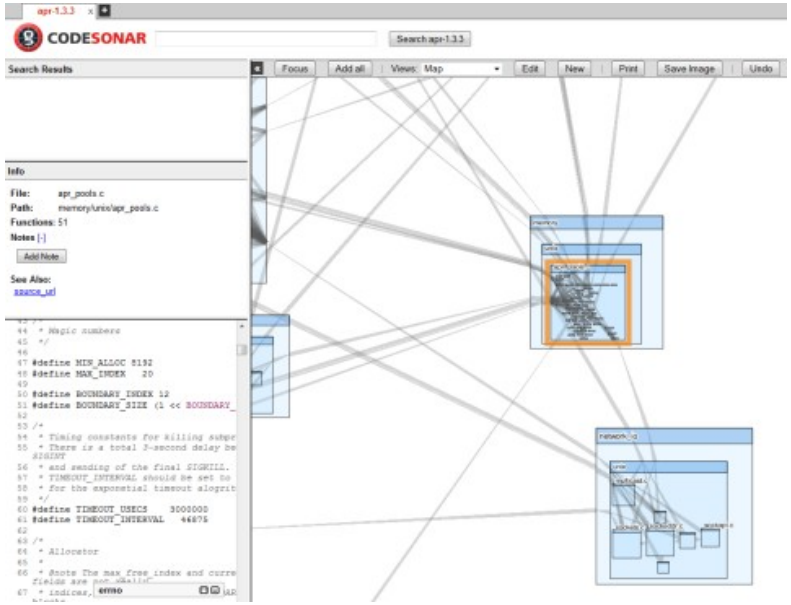
- ✓ Delete Object Created by new[]
- ✓ Free Object Created by new[]
- ✓ Free Object Created by new
- ✓ Redundant Condition
- ✓ Unused Value
- ✓ Useless Assignment
- ✓ Varargs Function Cast
- ✓ Ignored Return Value
- ✓ Null Test After Dereference
- ✓ Double Close
- ✓ TOCTTOU Vulnerability (time-of-check-to-time-of-use)
- ✓ Double Lock
- ✓ Double Unlock
- ✓ Try-lock that will never succeed
- ✓ Misuse of Memory Allocation
- ✓ Misuse of Memory Copying
- ✓ Misuse of Libraries
- ✓ Return Pointer to Free

And still more…

www.verifysoft.com

Architecture Visualisation

- ✓ Designed to optimise visual inspection and analysis
- ✓ Shows relationships between different elements in your code base
- ✓ Able to analyse large code bases:
  > 10 Mio. LOC



Smooth, real-time navigation

- ✓ Zoom, pan, expand, collapse, and more
- ✓ Even as program sizes grow into the millions of LOC

Layered data presentation

- ✓ Detail is progressively revealed as you zoom in
- ✓ Detail is abstracted as you zoom out
- ✓ A "link bundling" option effectively eliminates the visual clutter of individual links in high-level views while preserving connectivity information.

Display only the elements you are interested in

- ✓ Dedicated focus areas for arbitrary portions of the program
- ✓ Hide links and nodes that are not currently relevant

Metric		Granularities		
		Project	File	Procedure
Basic Counting Metrics				
Blank Lines		x	x	x
Code Lines		x	x	x
Comment Lines		x	x	x
Include file instances		x	.	.
Lines with Code		x	x	x
Lines with Comments		x	x	x
Mixed Lines		x	x	x
Top-level file instances		x	.	.
Total Lines		x	x	x
User-defined functions		x	.	.
Cyclomatic Complexity and Variations				
Cyclomatic Complexity	vG	.	.	x
Essential Complexity	evG	.	.	x
Module Design Complexity	ivG	.	.	x
Integration Complexity	S1	x	.	.
Modified Cyclomatic Complexity	mvG	.	.	x

Halstead Metrics				
Total Operators	N_1	.	.	x
Total Operands	N_2	.	.	x
Distinct Operators	n_1	.	.	x
Distinct Operands	n_2	.	.	x
Halstead Program Length	N	.	.	x
Halstead Program Volume	V	.	.	x
Halstead Program Level	L	.	.	x
Halstead Program Difficulty	D	.	.	x
Halstead Programming Effort	E	.	.	x
Halstead Programming Time	T	.	.	x
Halstead Intelligent Content	I	.	.	x

MISRA-C 2004 and MISRA-C++ 2008

Built-in Support for Rules:

- ✓ 1.2
- ✓ 6.3
- ✓ 8.7 and 8.10
- ✓ 9.3
- ✓ 11.1
- ✓ 13.1
- ✓ 14.4
- ✓ 16.2 and 16.10
- ✓ 17.5
- ✓ 19.1, 19.5, 19.6 and 19.7
- ✓ 20.3 and 20.4
- ✓ 21.1

And others…

Security Checks

Common Weakness Enumeration (CWE) compatible

Supports

- ✓ “Build Security In” (BSI)
- ✓ Power of Ten Rules
- ✓ JPL Rules (NASA Jet Propulsion Laboratory)

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Case Study: Recalled Medical Device

Software Forensics Lab at FDA Case Study

- ✓ 200 KLOC C program for old device
- ✓ Device had failed in the field and had triggered an FDA investigation, during which the maker had to provide all source code to FDA investigators
- ✓ The FDA used static analysis to find issues in the code

Results

- ✓ 127 serious problems
- ✓ Manufacturer was previously aware of 82 of these
- ✓ 45 were not previously known

"Flaws in medical coding can kill", Jonathan D. Rockoff, Baltimore Sun, June 30 2008, http://www.baltimoresun.com/news/health/bal-te.fda30jun30,0,912831.story.
"Using Static Analysis to Evaluate Software in Medical Devices", Raoul Jetley and Paul Anderson, Embedded Systems Design, April 2008, Volume 21, Number 4, pp 40-44, TechInsights, http://www.embedded.com/design/207000574.

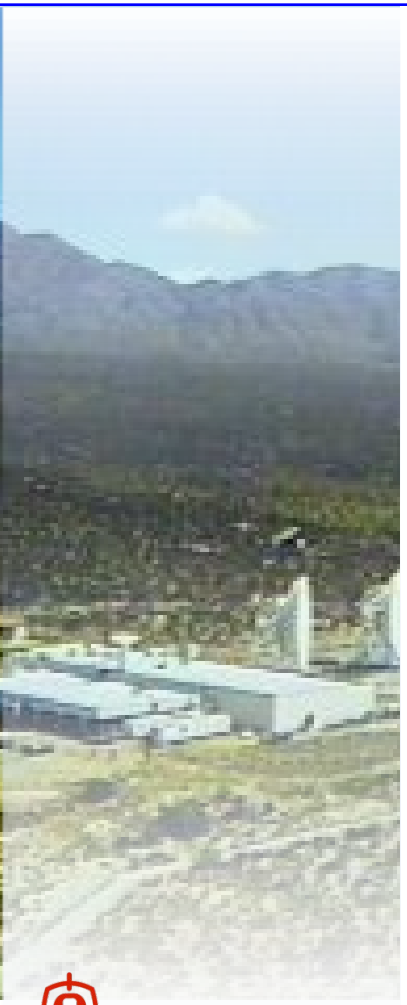
Case Study: Mars Rover

- ✓ NASA JPL Mars Curiosity Rover
- ✓ Most ambitious Mars rover to date
- ✓ 2.7 meters long and 900 kg

Rover electronics module

- ✓ RAD750 CPU, 256 kB of EEPROM, 256 MB of DRAM
- ✓ 2 GB of flash memory
- ✓ VxWorks multi-tasking RTOS
- ✓ 2 million lines of code

Results: NASA/JPL decided to use Gramma-Tech CodeSonar® to analyse the software and enforce the Power of 10 Coding Standard.



Case Study: Satellite Ground Station

- ✓ NASA's Tracking and Data Relay Satellite System (TDRSS)
- ✓ Nine geosynchronous satellites and three ground stations
- ✓ Launch support and on-orbit communications and tracking services for most NASA missions
- ✓ Striving for 99.9% availability (excl. scheduled down times)
- ✓ Detailed study of ROI for the usage of CodeSonar on ground station software
- ✓ Conducted by NASA White Sands under the sponsorship of NASA Ames Research Center and the NASA IV&V Facility
- ✓ Found that tool price plus cost of labor to use was about equal to debugging labor cost
- ✓ However, tool use prevents outages, whereas reactive debugging does not

Results: CodeSonar was adopted to reduce software errors.

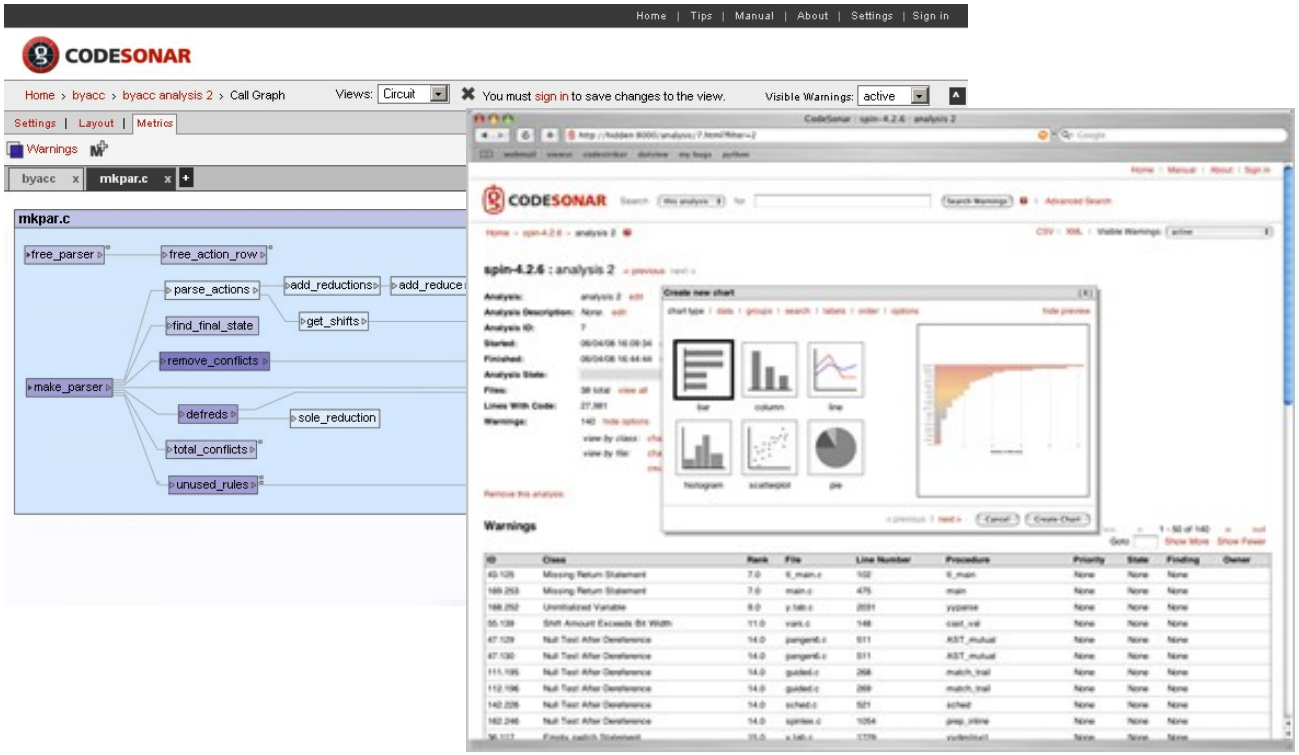
More Case Studies at www.verifysoft.com

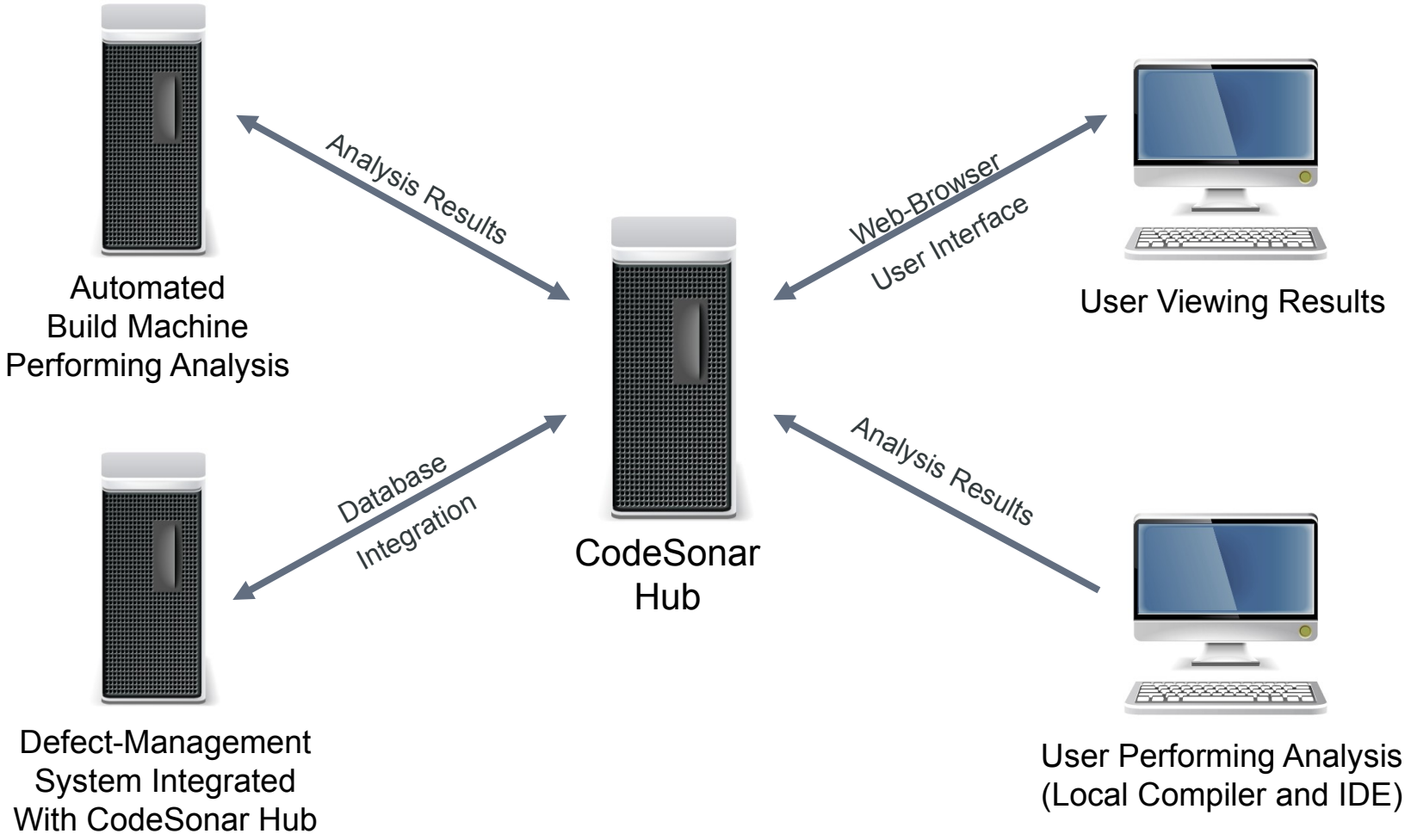
GrammaTech CodeSonar®: Fallstudien

- NASA: Mars Rover Searches for Signs of Life with the Help of CodeSonar
- GrammaTech Helps BCA Ensure Reliability of Life-Saving Mobile App
- FDA Uses GrammaTech to Analyze Recalled Medical Devices
- NASA Uses GrammaTech to Increase Satellite Uptime
- Boston Scientific Streamlines Analysis of Medical Device Software
- CodeSonar Helps Vivante Deliver Reliable GPU Cores On Time
- Critical Link: GrammaTech Ensures High Reliability of DSP Software
- CodeSonar Helps Harvard Apparatus Tackle the Medical Device Market
- CodeSonar Streamlines Certification of High-Security Devices

CodeSonar® Demo

Evaluation available - Try on your own code




Analysis Results
Automated
Build Machine
Performing Analysis
Web-Browser
User Interface
User Viewing Results
Database
Integration
CodeSonar
Hub
Analysis Results
Defect-Management
System Integrated
With CodeSonar Hub
User Performing Analysis
(Local Compiler and IDE)

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