Verifysoft TECHNOLOGY

Software Testing Solutions for your Productivity and Quality

- Code Coverage
- Software Complexity Measurement
- Static Code Analysis
- Dynamic Code Analysis
- Safety-critical Embedded

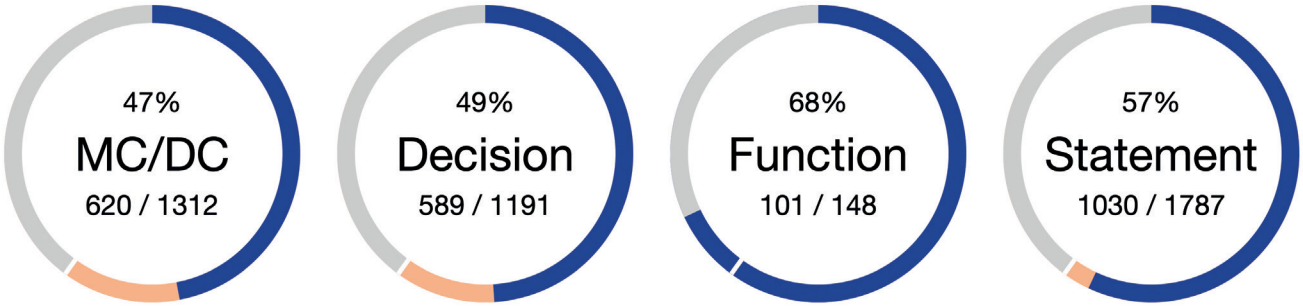
Testwell CTC++ Code Coverage Analyser

Code coverage for the highest requirements of safety standards

Testwell CTC++ analyzes which parts of your source code have been tested. Testwell CTC++ supports all coverage levels and is used by leading companies for safety-critical projects.

Coverage levels

Testwell CTC++ provides all coverage levels required by standards for safety-critical software development: function coverage, statement coverage, decision or equivalently branch coverage and modified condition/decision coverage (MC/DC). Condition and multicondition coverage can also be determined.

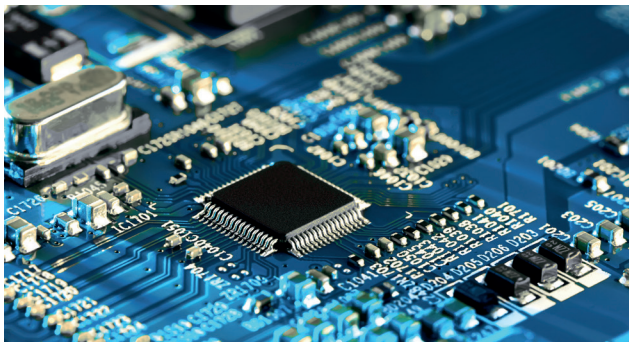


Desktop applications

- ✓ Low impact on the build process
- ✓ Scalable for large projects
- ✓ Compiler-independent
- ✓ For Windows, Linux, macOS

Embedded software

- ✓ Low memory requirements
- ✓ Testing on any target
- ✓ With any cross compiler
- ✓ Customizable runtime layer



Easy to use

- ✓ Generic build integration
- ✓ Very fast execution
- ✓ Seamless integration into many IDEs
- ✓ Ease of integration by modular architecture

Programming languages

- ✓ C, C++
- ✓ Add-On for Java

Working method

Coverage measurement is performed with Testwell CTC++ in three independent phases:

Instrumentation

During compilation, Testwell CTC++ automatically instruments a copy of the source code by injecting measurement code. This creates an instrumented version of the program or test executable – automatically during the build process or on the basis of a simple, one-time build configuration.

Testing

Any type of test can be executed as usual: Unit tests, integration tests or complete system tests. The coverage measurement data are written to a file. When performing tests on a target, this writeout is fully adjustable, e.g. the data can be transferred directly to the host computer.

Generating reports

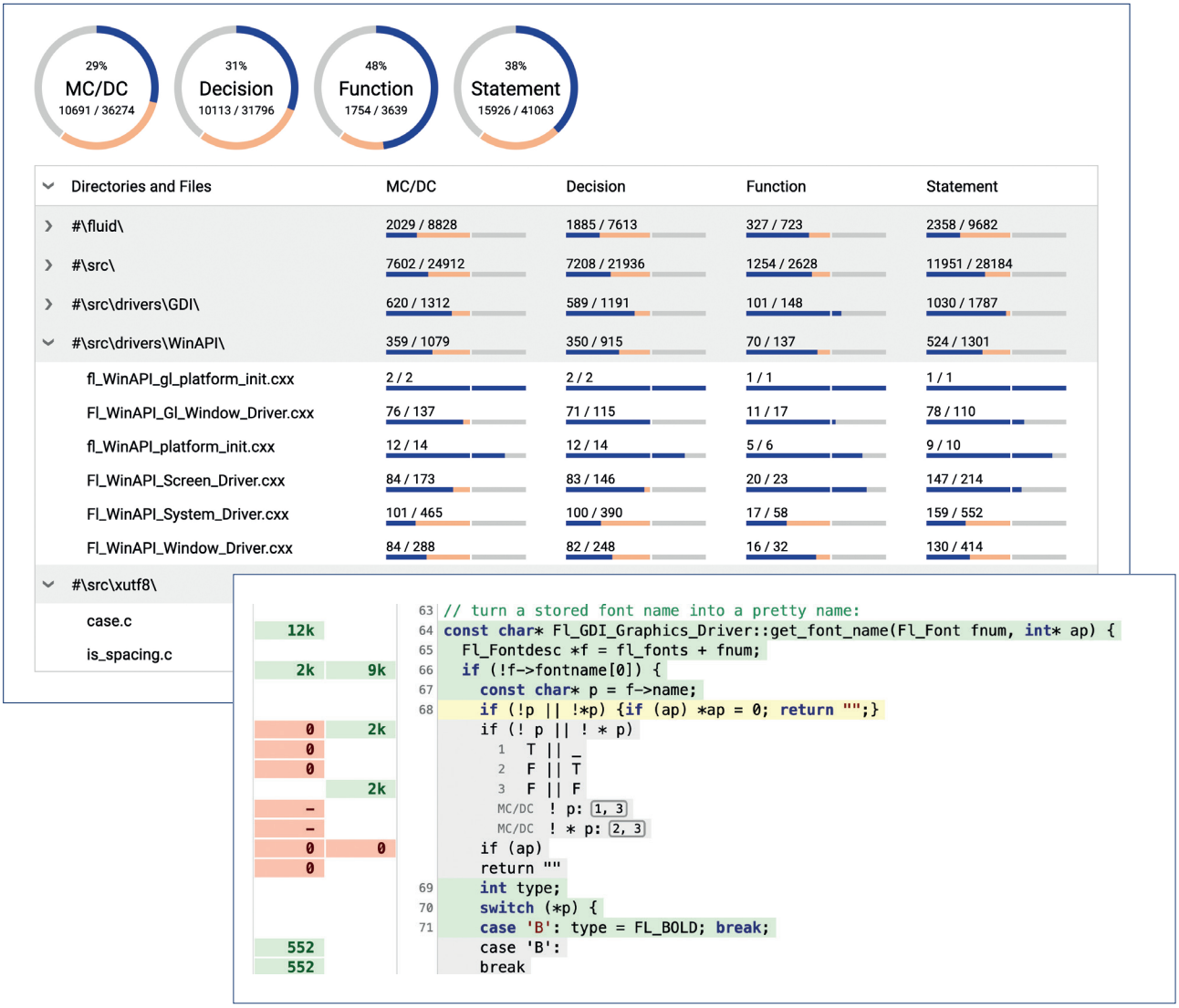
In the third phase, Testwell CTC++ generates coverage reports based on the raw data. Data from different builds and different tests can be combined. A structured HTML report and any text-based exchange formats are available as output formats.

Functional safety

- ✓ Suitable for safety-critical development according to:
  - ✓ ISO 26262
  - ✓ DO 178-C
  - ✓ EN 50716 / EN 50128
  - ✓ IEC 61508
  - ✓ IEC 62304
  - ✓ IEC 60880
  - ✓ ISO 25119 / DIN EN 16590
- ✓ Qualification support
- ✓ TÜV-certified
  - ✓ ISO 26262
  - ✓ IEC 61508
  - ✓ EN 50716
  - ✓ IEC 62304

Coverage reports

Testwell CTC++ provides a comprehensive HTML report that is adaptable to the user's needs and to the type and size of the project.



Configurable report layout

- ✓ Desired coverage levels in any combination
- ✓ Selectable report levels with drill-down: directories, source files, functions

Optional source code view

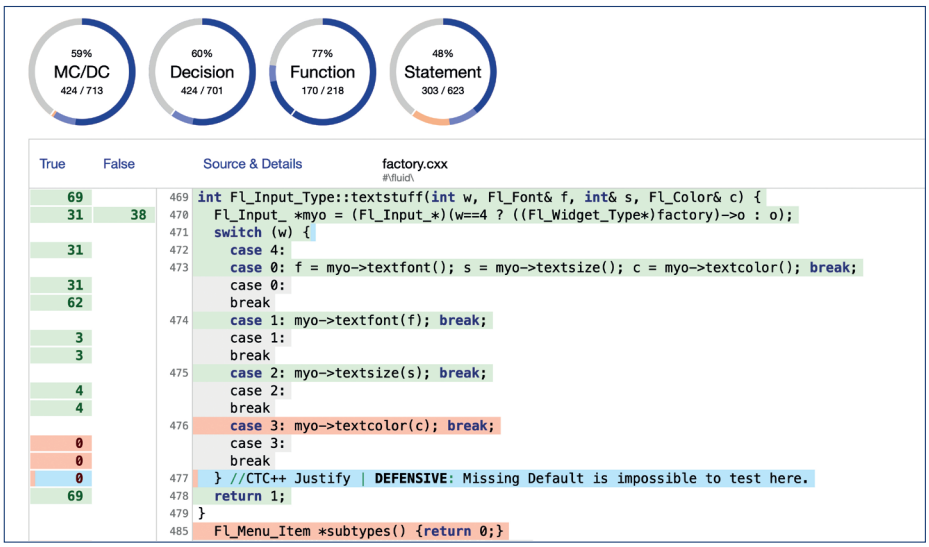
- ✓ Highlighting of executed and not executed lines
- ✓ Display of all coverage counters
- ✓ Compact visualization of complex coverage measures like MC/DC
- ✓ Visibility of missing test cases

Justification of missing coverage

Justifications can be used to record the reasons when full coverage cannot be achieved.

Testwell CTC++ derives which code parts are covered by a justification.

- ✓ Own categorization of justifications
- ✓ Recording in comments or in companion files
- ✓ Clear distinction between tested and justified code
- ✓ Recognition of over-justification

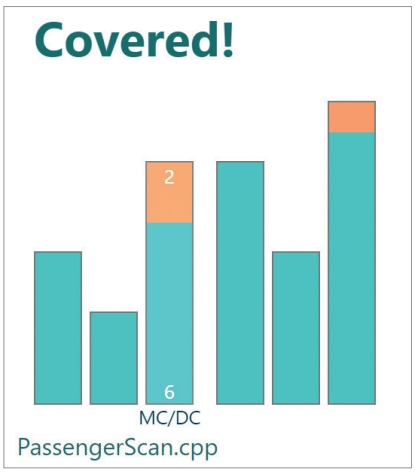


Coverage data in any form

Create template-based reports in any form. With a simple template language for data export, Testwell CTC++ supports structured reports such as HTML reports as well as the export of single text files.

	A	B	C	D
1		MC/DC		
2	Function	Hits	Total	Ratio
3	hasAdmission	6	8	75%
4	calcPrice	9	10	90%
5	main	6	6	100%
6	TicketApp::showInstruction	3	6	50%
7	TicketApp::switch2BatchMode	2	2	100%
8	TicketApp::ask4Input	3	4	75%
9	TicketApp::reportPrice	3	4	75%

Classic exchange formats like CSV, XML, JSON



Overall result as a badge or on dashboards

```
# Coverage Report: Coaster as Markdown

This report was generated at 2024-03-04 09:44:08 using
    `ctcreport -template example_markdown -o coverage.md`

## Coverage in Total
- 54% MC/DC (48 / 88)
- 85% Statement (60 / 70)

## Coverage per Source File
### Directory C:\CoasterCode\
#### PassengerScan.cpp:
- 75% MC/DC (6 / 8)
- 100% Statement (3 / 3)

#### PriceCalculation.cpp:
- 90% MC/DC (9 / 10)
- 100% Statement (5 / 5)
```

Text reports, e.g. in Markdown, for easy archiving and management in a repository

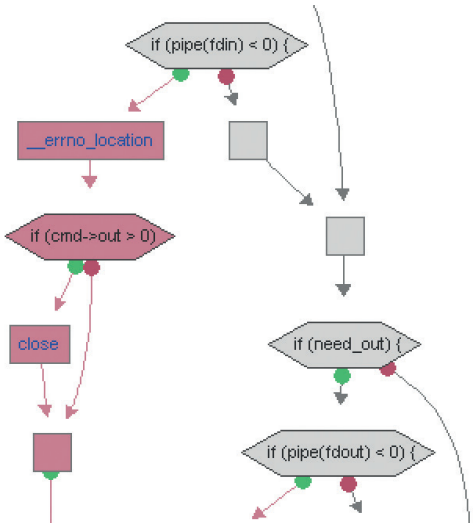
Imagix 4D

For visualization and verification of programs
Easily understand and evaluate unknown source code

Imagix 4D is a tool to understand, document and improve complex, third party or legacy source code written in **C, C++ and Java.** Imagix 4D automates the analysis of control flow and dependencies. It detects problems in data usage and task interactions. With Imagix 4D you increase productivity, improve quality, and reduce risk.

Improve quality by uncovering bugs and vulnerabilities

- ✓ Automated checkers find anomalies in the source code
- ✓ Large quantity of metrics (including McCabe Cyclo matic and Essential Complexity, Halstead Complexity, Maintainability Index, HIS Metrics etc.) to identify critical modules in a matter of seconds
- ✓ Semi-automated reviews assist in performing efficient qualitative analyses compliant to CWE or to your own requirements



Keep control even for large projects

- ✓ Meaningful diagrams provide views from a global perspective up to granular characteristics of a single data type
- ✓ Δ-Analyses enable a detailed change tracking of revisions
- ✓ Checks of the existing architecture are compliant to structural requirements based on comprehensive architecture diagrams

Improve your software development cycle

Speed up looking up information for specific symbols by effcient database queries

- ✓ Easily understand and evaluate unknown source code with Imagix 4D
- ✓ Automatically generated documents based on the present source code representing the recent state of the project

Benefit from the integration of Testwell CTC++

- ✓ Visualization of Code Coverage in control flow diagrams
- ✓ Understand the correlations between Tests and Test Coverage for a faster development of suitable test cases
- ✓ Function- and call-coverage reports complete the portfolio of Testwell CTC++

AI Analysis

AI Analysis in Imagix 4D can be involked in all its displays and reports. The queries can be sent to OpenAI ChatGPT or Google Gemini. Imagix will provide a limited number of queries with its license

Source code evaluation

Imagix 4D includes a wide range of useful tools for evaluating your software:

Source Code Analysis

- ✓ Subsystem architecture diagrams
- ✓ Design structure matrices (DSM)
- ✓ UML class diagrams
- ✓ Class inheritance diagrams
- ✓ File include hierarchy views
- ✓ UML task collaboration diagrams

Delta Analysis

- ✓ Identification of structural differences between alternative versions of your code
- ✓ Visualization of control flow differences in architecture diagrams
- ✓ Highlighting of logical differences in the source code

Static Analysis

Detection of functional issues such as:

- ✓ Concurrency errors
- ✓ Uninitialized variables
- ✓ Mismatched pointer casts
- ✓ Suspicious for-loops
- ✓ Portability issues
- ✓ And many other critical defects

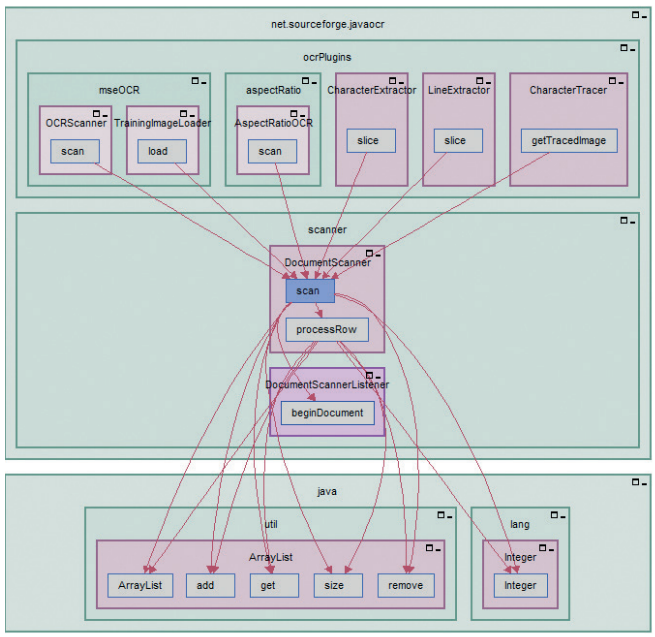
Code Review Functionality

Result evaluation based on:

- ✓ Total number of findings
- ✓ Reviewed findings
- ✓ Findings classified as concerns
- ✓ Findings classified as violations

Metrics Collection:

- ✓ HIS metrics
- ✓ McCabe cyclomatic complexity
- ✓ Maintainability Index (Welker)
- ✓ Chidamber and Kemerer object-oriented metrics (6)
- ✓ Class cohesion (Hitz/Montazeri)
- ✓ Class coupling
- ✓ Subsystem stability
- ✓ Comment ratio
- ✓ Decision depth
- ✓ Halstead complexity
- ✓ Nodes (Woodward et al.)
- ✓ Statements, lines, etc.



Compliance Checking (MISRA):

- ✓ MISRA C 2012
- ✓ MISRA C++ 2008
- ✓ AUTOSAR C++14
- ✓ Verification of compliance with the CWE standard 2.8 – 3.3

Automatic Documentation Generation

- ✓ Descriptions and analyses at the architecture, file, package, namespace, and class levels
- ✓ Graphical representations of interfaces, usage, and external dependencies
- ✓ Over 80 metrics, including object-oriented and cyclomatic complexity

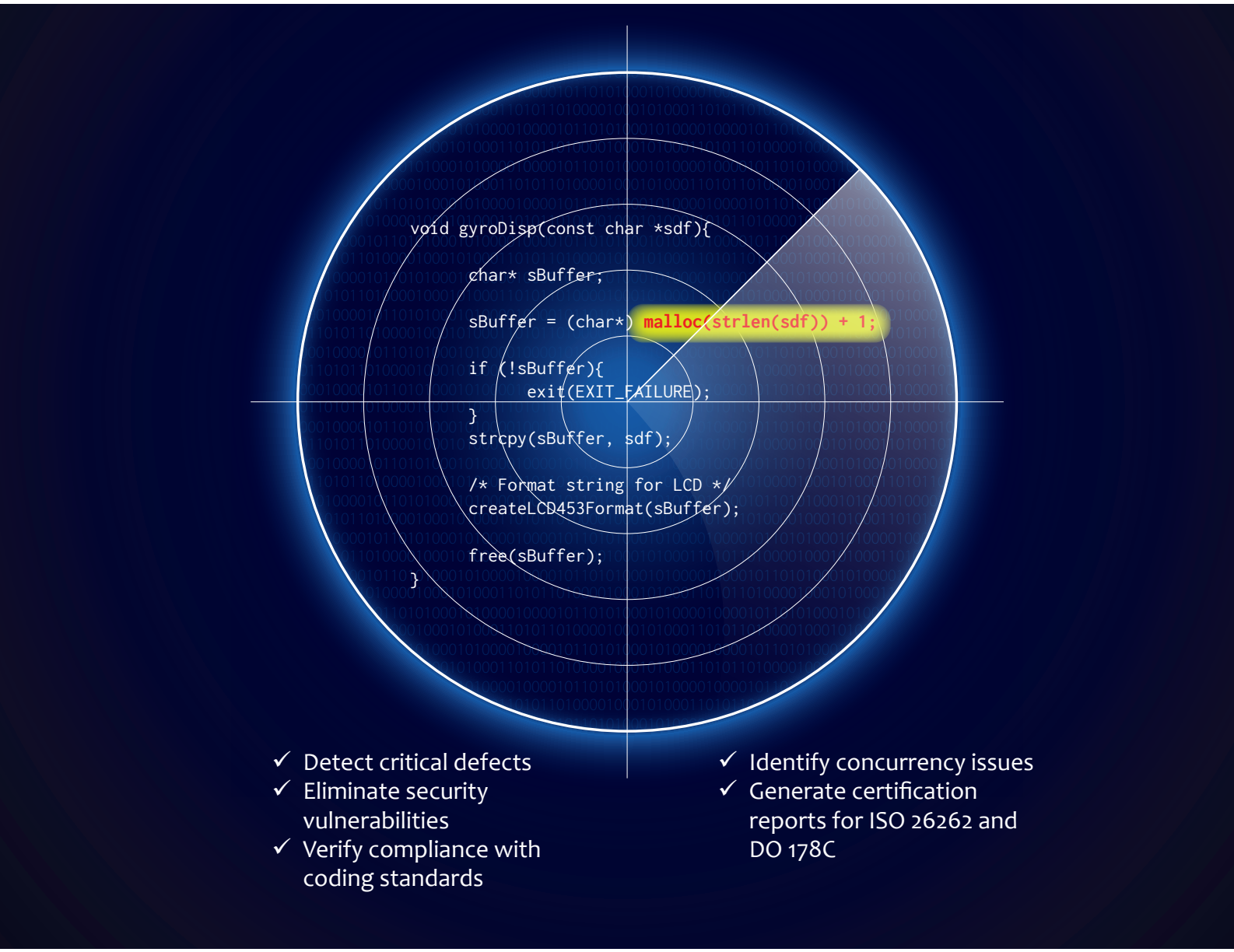
Down to implementation details, including:

- ✓ Function flow diagrams
- ✓ Variable assignments and accesses
- ✓ Cross-references for type usage

CodeSecure CodeSonar® – When software quality is elevated to a principle

Static analysis of source and binary code

Static Code Analysis can be used early in the development process and uncovers critical software defects. Risks, such as dangerous security vulnerabilities, non-deterministic concurrency errors and memory leaks, can thus be minimized. Maintenance costs are reduced thanks to more readable code.



- ✓ Detect critical defects
- ✓ Eliminate security vulnerabilities
- ✓ Verify compliance with coding standards
- ✓ Identify concurrency issues
- ✓ Generate certification reports for ISO 26262 and DO 178C

Static binary analysis

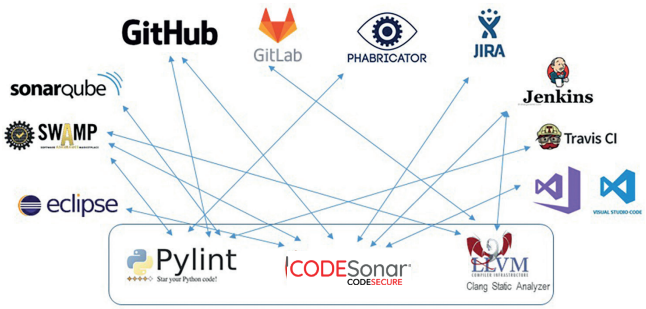
Third-party components (libraries) are often integrated into applications. Since these are frequently available only as binary files, doubts about their quality are difficult to dispel, putting the stability and security of the overall application into question. CodeSonar for Binaries goes beyond source code analysis and detects critical defects in binary files as well.

SARIF

SARIF (Static Analysis Results Interchange Format) is an open standard from OASIS (Organization for the Advancement of Structured Information Standards). CodeSonar can read SARIF data and exports analysis results in SARIF format.

GitLab, GitHub and Docker

CodeSonar can be controlled via GitLab pipelines and supports GitHub. Execution in Docker containers is also possible.



Static source code analysis

As a leading tool for static source code analysis, CodeSonar not only offers superior defect detection compared to many other static analysis tools, but also stands out due to its comparatively low rate of false positives.

BACKGROUND KNOWLEDGE

Supported programming languages

- ✓ C/C++
- ✓ Java
- ✓ C#
- ✓ Python
- ✓ Kotlin
- ✓ Go
- ✓ Rust
- ✓ .NET
- ✓ JavaScript
- ✓ TypeScript
- ✓ Others in preparation

Supported platforms

- ✓ Windows
- ✓ Linux
- ✓ NetBSD
- ✓ FreeBSD

Certification

CodeSonar has been certified by **exida** as a suitable tool for obtaining certifications according to:

- ✓ ISO 26262 to ASIL D, TCL3
- ✓ IEC 61508 to SIL4
- ✓ EN 50128 to SW-SIL 4

Prequalification documents help you to minimize time and costs.

Qualification

Regarding the certification of your applications, depending on the result of the classification, in some cases (e.g. according to DO 178-B/C) a qualification of CodeSonar as part of the toolchain used is necessary. The test cases required for this can be provided.

Testwell CMT++ / Testwell CMTJava

Testwell CMT++
Testwell CMTJava

Software complexity analysis for C, C++, C# and Java

Testwell CMT++ and Testwell CMTJava are tools for analysing complexity of C, C++, C# and Java source code. Both tools analyse source code and inform you immediately about the current internal quality of your software product, even those with large project sizes. Avoid software erosion by achieving a good internal code quality and see how maintainability and testability will be significantly improved.

Seminars

Software and its quality determines the economic success of a company. Companies with well-established processes and structures to ensure software quality will be able to maintain and successfully expand their market position.

Do you want to keep up to date with the latest quality measures and software testing activities?
Is your company planning to set up or expand activities in software quality?
Do you want to train your employees to be able to use our software testing and analysis tools productively within the shortest time possible?
We can support you in achieving these goals.

Take advantage of our seminars and gain the knowledge you need to develop and test software efficiently and reliably.

Further information at
www.verifysoft.com/en_events

Verifysoft

First-class tools worldwide since 2003 !

As an independent and solidly operating company, Verifysoft supports customers worldwide with highly specialized software for the quality assurance of their software products. We develop our core products under the TESTWELL brand with a highly skilled and effective team and also offer first-class complementary tools, seminars and services.

We understand our customers and are a reliable partner for them – also in the long term. At Verifysoft, the human being is our priority. We enjoy working in a good and fair working atmosphere for the benefit of our customers, colleagues and our social environment.

We have a long-term strategy. Customer satisfaction is more important to us than „quick money“. For us, success is when customers and employees are satisfied.

We look forward to working with you.

More than 800 customers all over the world

ABB AIRBUS AISIN ALSTOM AMG arbe ARGUS arianeGROUP arm ASMPT Audi
BAUMULLER Baxter BAIC Group B&R bertrandt BMW GROUP BOMBARDIER BORGWARNER BOSCH
BROADCOM BT Bundesamt für Sicherheit in der Informationstechnik ca technologies Canon CARIAD CATL cisco COMARCH Continental
CURTIS DAIMLER TRUCK DAIWHA DGA DENSO Digiteq Automotive DLR DONGFENG dSPACE ETAS
EATON Elektrobit EMBRAER Endress+Hauser esa ESO Exonetik framatome GETINGE
GE Giesecke+Devrient Creating Confidence 长城汽车 Great Wall Motors Hama HARMAN HELLA HIMA HITACHI HONDA The Power of Dreams Honeywell
HYDAC HYUNDAI HYUNDAI TRANSYS IAV Infineon intel jenaoptronik kappa KNORR-BREMSE KONGSBERG
KPIT LG Mentor A Siemens Business LIEBHERR McLaren medela Mercedes Miltenyi Biotec Micron
ModuTram MONTERIS MEDICAL NASA Itelma Electronics NDT Global NISSAN MOTOR CORPORATION NOKIA
NVIDIA NXP OHB Opsys Technologies PHILIPS PHOENIX CONTACT PINTSCH Safety for Rail PORSCHE Raytheon
RENESAS Qualcomm Roche SAFRAN SAMSUNG SCANIA SCHAEFFLER Schindler Schneider Electric
secunet seeingmachines SICK Sensor Intelligence. SIEMENS SKF socionext SONY SPIE
SRMTech ideas@work ST life.augmented ST Engineering TATA TELESPAZIO a LEONARDO and THALES company TenaFe THALES thyssenkrupp
tomtom TTTECH UAES 联合汽车电子有限公司 Vibracoustic VIESMANN vitesco TECHNOLOGIES VW VOLVO VORWERK
WATLOW Powered by Possibility WEICHAI West By your side wipro YASKAWA ZEISS ZF

Verifysoft TECHNOLOGY

Verifysoft Technology GmbH is specialized in the development, distribution and support of software testing and analysis tools. In addition to our own Testwell tools, we also distribute complementary tools from our partners. Verifysoft was founded in 2003 in Offenburg, Germany and has since been operating successfully as an independent company in the field of software quality.

With an international team, we support more than 800 customers in over 45 countries. Our development and support staff have many years of experience in the test tool sector. Find software defects and problems as early as possible before release and guarantee the highest software quality with tools from Verifysoft Technology.

All tools presented here can be evaluated free of charge and requested at any time without obligation. Are you interested in our tools or training seminars?

Get in touch with us today!

Verifysoft Technology GmbH, Am Alten Schlachthof 14, 77652 Offenburg (Germany)
Phone: +49 781 127 8118 - 0, info@verifysoft.com

Follow us

Issue: February 2026; Photos: www.fotolia.de, www.aeroweb-fr.net, www.heinzalbers.org, www.mev.de, NASA, Verifysoft Technology GmbH