



IPL Cantata++ 5.4

IPL Cantata++ has been designed around the requirements of the C/C++ languages to produce a tool suite which allows developers to efficiently perform **unit and integration testing**.

IPL Cantata++ offers high productivity for developers through a unique set of dynamic unit / integration testing, code coverage and static analysis on host and target platforms.

WIND RIVER

IPL and Wind River have a long established partnership to provide unit testing solutions for Wind River's platforms. The integration between IPL Cantata++ and Wind River Workbench simplifies unit testing for the VxWorks and Wind River Linux platforms.

IPL Cantata++ is sold by Wind River to customers worldwide, and can be deployed to and used on almost any embedded target platform.

Why Unit/Integration Test

Device Software Requirements

As device software projects grow in size, writing defect-free software becomes almost impossible. Software quality and reliability are often seen as a weak link in the device industry. Software testing is necessary to ensure that shipping devices perform safely and reliably, but it is also a costly and time-consuming process, sometimes using up to 50% of a company's engineering resources. Shorter and shorter timelines are also increasing pressure on companies to assess just how much testing is enough.

Developer Level Testing

Unit testing and integration testing are the lowest levels of testing performed during software development, where individual functions, classes, or subsystems of software are tested in isolation from other parts of a program. This level of testing is also the least expensive time to fix software bugs if they can be identified. IPL Cantata++ allows developers to more efficiently complete unit and integration testing, and code coverage analysis on the tests.

Integration with Workbench

The integration between IPL Cantata++ and the rest of the Workbench development suite places these capabilities within easy reach of every developer. This helps to increase software quality, decrease time-to-market, and reduce support costs through better, faster, more automated testing during the development life cycle.

Benefits

For Software Product Managers

- *Code base maintainability:* The capacity to understand if changes to common code modules will affect current or other projects
- *Long-term product reliability:* minimizing the chance that untested code branches exist in shipping products, eliminating the high cost of having to field fix bugs in shipped products

For Development Managers

- Consistent test case structure and generation
- Increased comfort reusing code
- Ability to monitor quality of outsourced development

For Software Quality Managers

- Consistent, objective, project-wide reporting
- Verification that code meets maintainability standards
- Implementation of coverage rules to meet compliance requirements

For Software Engineers

- Powerful, flexible, easy-to-use tools and wizards
- Integrated into Wind River Workbench
- Makes writing and running test cases fast, easy, and thorough

Product Overview

Valid from April 2010

Major Features

- Unit and Integration Testing on both host and target platforms
- Fully integrated with Wind River Workbench 3.2, its tool chains and supported platforms
- Supports VxWorks and Wind River Linux outside Wind River Workbench
- May be deployed for almost any target platform
- Full support for: ANSI C (89 and 99), ISO C++, EC++ and Java coverage
- Automated Test Script generation navigation and management
- Integrated Code Coverage Analysis (C/C++, Java)
- Automated Stubbing and Wrapping: to simulate and control external interfaces
- Static Code Metrics: complexity and maintainability.
- Available under Wind River standard licensing models.
- Hands-on two day training workshops are also available to kick-start tool deployment.

Quality Pedigree

IPL Cantata++ has been developed under the control of IPL's Quality Management System which is certified to ISO 9001:2000 (TickIT)



Certificate Number FM 01589

IPL Cantata++ 5.4 is the latest version of the IPL Cantata suite first released in 1992.

IPL's testing tools include Cantata++ and AdaTEST (for Ada 83 and 95).

Their use has featured in many high profile projects ranging from telecoms, medical instruments, air-traffic control, avionics, rail transport, automotive, space, defence, nuclear energy, financial and digital broadcast systems.

The common factor in all of these areas is the imperative to produce software which reliably "does what it should do" in a cost-effective manner.

Tool Qualification

An IPL Cantata++ Tool Qualification Package is available free of charge for customers developing to DO-178B / ED-12B or other high integrity standards.



Code Coverage

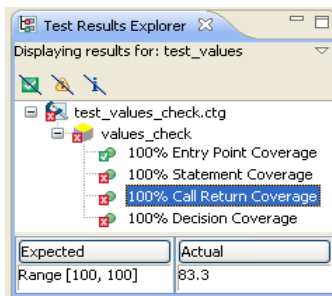
Coverage analysis provides objective measurement of how effective testing has been in executing the source code.

Code Coverage Metrics

- Entry points
- Call Returns
- Statements
- Basic Blocks
- Decisions (branches)
- Conditions
- MC/DC (Masking and Unique Cause)

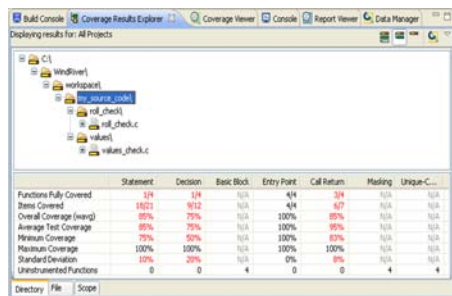
Configurable Coverage requirements are easily defined in simple Rule Sets.

Coverage Target Checks on metrics are integrated into dynamic tests resulting in Pass/Fail for coverage requirements.

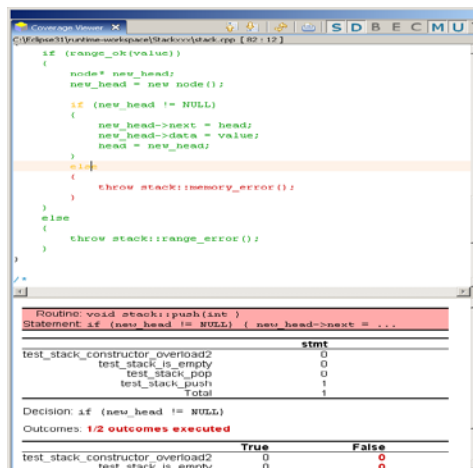


Test Case Optimisation provides option to remove/disable test cases which do not contribute additional coverage.

Project Code Coverage Trees for multiple projects with filters for coverage types / fully covered code items and drill-down to highlighted source code.



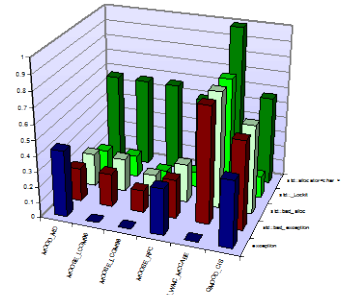
Source Code Coverage Views highlight individual code constructs (not just by line) with additional diagnostics by test case, test run and metric type.



Static Analysis

Static analysis generates over 300 source code metrics. These metrics can be easily used to help enforce code quality standards.

Metrics Reports in .csv format can be imported into spreadsheets for graphical and numerical analysis.



Procedural Metrics code lines, comments, functions, counts of most code constructs.

Metrics sets

- Myers
- MOOSE
- McCabe
- MOOD
- Halstead
- QMOOD
- Hansen
- Robert Martin
- McCabe Object Oriented
- Bansiya's Class Entropy

Highly Configurable

Preferences for the appearance of all views, reports and installation details can be saved in user specific configurations.

Test and Analysis Generation options for test script layout, source language, memory, global data and testability instrumentation can all be user configured.

Reports

Configurable XML reports with summary or full test details.

Printable Views available from within IPL Cantata++ for all test and coverage results displays.

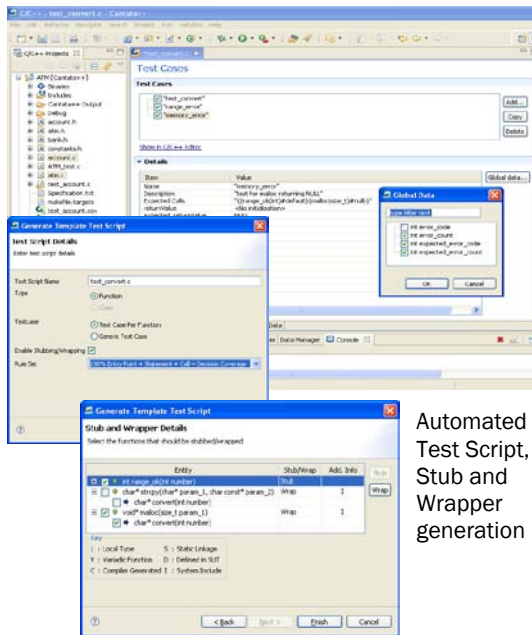
ASCII Text Report available with passes and fails highlighted inside IPL Cantata++ with outline view, or as plain text results file for high integrity certification needs.

Multi-Project reports consolidate results across multiple projects.

Unit and Integration Testing

Test Build and Run

- **Automated Test Script Generation** by parsing source code to derive parameter and data information with stubs and wrappers auto-generated into the test script.
- **Automatic Test Build Enablement** for Wind River Workbench / Eclipse projects.
- **Test Script Manager** providing graphical development and management of tests.
- **Intuitive Test Directives** help developing structured, independent, repeatable tests with clear and unambiguous results.
- **Test Case Re-use** for inherited classes and template instantiation.
- **Flexible Test Execution**
 - configurable test generation options
 - from inside IPL Cantata++ Eclipse/Wind River Workbench plug-ins
 - via developer's build system
 - CLI batch mode invocation
 - unchanged tests on-host or on-target



Automated Test Script, Stub and Wrapper generation

Flexible Tool Kit

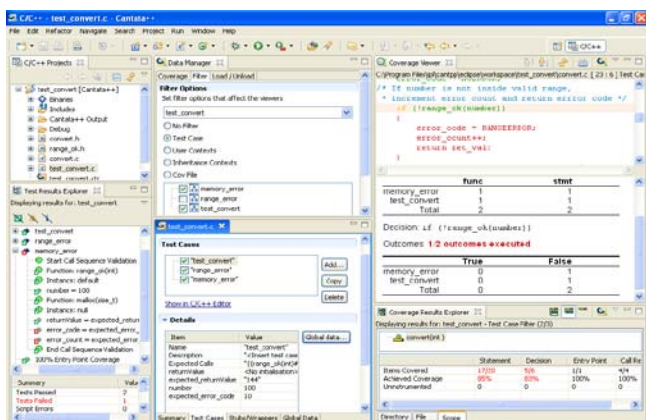
IPL Cantata++ provides a flexible tool kit for C/C++ developers to perform unit and integration testing more efficiently:

- Static analysis metrics aid planning most efficient tests
- Powerful in-built EDG C/C++ parser generates detailed understanding of code, for automatic generation of test cases as thorough or light touch as required
- Test harness automates testing as appropriate for:
 - black-box / white-box
 - positive / negative testing
 - requirements / robustness
 - single / large input data sets
 - procedural / object oriented
 - call simulation / interception
 - isolation / integration test
 - host / target execution
- Unique testability instrumentation and wrapping provide precision test control and verification
- Integrated code coverage and test optimisation pin-points gaps and efficiently directs test effort
- Results and diagnostics used for rapid error identification and to support certification
- Automated repeatable execution retains value of tests whenever code is built

Black-Box / White-Box Testing

IPL Cantata++ can be used for both black-box and more efficient/thorough white-box testing.

- **Table-driven Test Cases** with multiple input value ranges, and CSV import/export for black-box verification testing.
- **Robustness Testing** with pre-defined values for data types, and table driven test cases.
- **Automated Global Data Checks** to verify expected and unexpected changes to global data.
- **Automated White-Box Access** providing the ability to efficiently call functions/methods, and set/check data from the test script
 - static data and functions
 - C++ private data, unnamed namespaces and methods



Cantata++ Comprehensive Test Development & Analysis Environment

Control of Interfaces

- **Automated Stubs** providing programmable dummy versions of external software, with optional checks on parameters/returns.
- **Automated Wrapping**
 - Programmable before/after and replace interceptions to the real external software.
 - Default pass-through for quick set-up with optional checks on parameters/returns.
 - More powerful and flexible control over interfaces than stubs.
- **Call Sequence Verification** providing full control over call order and use of Stub or Wrapper instances in each test case.
- **Automatic Checks** of parameters passed over call interfaces.

- **C++ Exception Verification** of multiple expected and unexpected exceptions.

Test Diagnostics

- **Project Level Tree Views** of test pass/fail results with drill-down for easy navigation to individual test cases and checks.
- **Detailed Test Diagnostics** for all checks of expected against actual results by test case for:
 - Global data
 - Parameters and returns
 - Exceptions
 - Call order

Eclipse™

IPL Cantata++ 5.4 has the highest level of Eclipse integration, and is available as:

- Wind River Workbench 3.2 add-on product
- 'Built-on-Eclipse' complete testing IDE
- 'Eclipse-Ready' set of plug-ins for an existing Eclipse 3.5 Galileo installation

IPL Cantata++ seamlessly integrates with other Eclipse 3.5 (Galileo) tool plug-ins

IPL Cantata++ can also be used alongside other IDEs

Platform Availability

Wind River Platforms

Optimized to work with:

- Wind River Workbench 3.2 All Wind River Workbench 3.2 supported host operating systems.
- VxWorks 5.5 and 6.3-6.8
- VxWorks DO-178B and 61508 (6.6 Cert)
- VxWorks 653 2.3
- Wind River Linux 2.0, 2.2, and 3.0
- Earlier versions of Workbench are supported by earlier versions of IPL Cantata++.

Other Target Platforms

IPL Cantata++ can be deployed on almost any target platforms on request.

Platform Requirements

Host Platforms

- Host operating system and compiler installed
- Target development environment (RTOS and cross-compiler) installed if required.
- 200MB hard disk space
- 512MB RAM
- Eclipse 3.5 (if Cantata++ installed as a plug-in)

Target Platforms

- No hard disk space
- 16kb RAM (guideline minimum)
- A function to write character output from target (e.g. putc) or file IO
- Standard library functions available:

atoi	strcat
isalnum	strchr
isdigit	strcmp
isprint	strcoll
isspace	strcpy
memcmp	strlen
memcpy	strncmp
memset	strncpy
sprintf	strstr

Host Platforms

- Cantata++ licenses permit use on all the host operating systems with the available host compilers listed below at all business locations of the enterprise.

Host Operating Systems	Host Compilers
Windows (XP, Vista, 7)	Microsoft Visual C++ (6.0 to 2008) GNU GCC/g++ (up to 4.3.x)
SUN Sparc Solaris (7,8,9,10)	GNU GCC/g++ (up to 4.3.x)
Any Linux 2.4 kernel distribution (32bit)	GNU GCC/g++ (up to 4.3.x)
Any Linux 2.6 kernel distribution (32bit, 64,bit)	GNU GCC/g++ (up to 4.3.x)

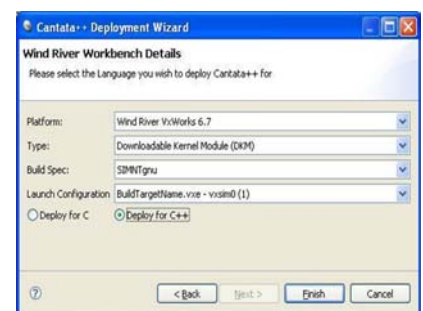
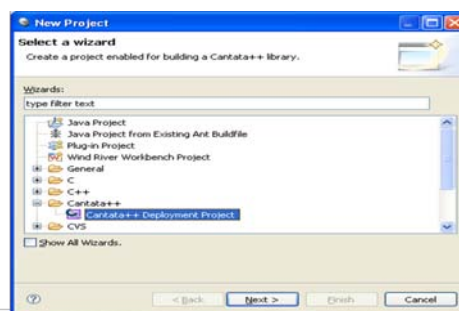
Target Platforms

- Cantata++ licences allow deployment of and use on any number of target platforms.
- Because of the tight integration of IPL Cantata++ with Wind River Workbench, deployment onto VxWorks 6.x and Wind River Linux is extremely simple.
- Cantata++ can however be deployed on almost any ANSI/ISO C/C++ target platforms (a combination of processor, target operating system (if any), cross-compiler version, options and IDE). Below is a list of operating systems, compilers and processors on which Cantata++ has previously been successfully deployed.

Target RTOS	Compiler	Processor
VxWorks	GCC / g++	Intel x86 and 80x1
VxWorks 653 / CERT	Wind River (Diab)	M680x0
Wind River Linux	TI/Code Composer Studio	Coldfire
INTEGRITY	Embedded Visual C++	PowerPC
VelOSity	GreenHills MULTI	TI TMS320 DSPs
pSoS	Renesas	AD 210x0 DSPs
LynxOS	Intel	Infineon C16x
Real-time Linux	Cosmic	Renesas M16 and H8
MontaVista Linux	XGC	ARM
Nucleus	Metaware ARC	ERC32 / LEON
WinCE	Mentor Graphics	Xscale
Windows Embedded	Microtec	FreeScale
RTEMS	Tasking (Altium)	68HC12
QNX Neutrino	Metrowerks CodeWarrior	MIPS
Virtuoso	ARM Developer Studio	SuperH
ThreadX	QNX Momentics	
Bare Board	IAR Workbench	

Target Platform Deployment

The Cantata++ Deployment Editor enables rapid deployment and testing by end users of IPL Cantata++ for Wind River Workbench 3.2 Build Specs and permits deployment to other embedded target environments.



Target configuration services

Using the Cantata++ Deployment Editor, many Cantata++ target deployments do not require any special assistance from the supplier. Where there is need or desire for product configuration services either remotely or on site from your supplier, these are available for a configuration fee depending on the complexity and effort required. Please request a Cantata++ non-Wind River Platform Deployment Questionnaire for more information.