



LDRA

Increase Productivity with Automated Unit/Integration/Low Level Testing with LDRAunit®

Delivering Software Quality and Security through Test, Analysis and Requirements Traceability

LDRA Software Technology

Unit Testing/ Module Testing with LDRAunit®

Overview

LDRAunit®, LDRA's class leading stand alone unit/integration test tool, provides a complete verification environment for the automated generation and management of test harnesses and unit/integration tests. This solution maximises developer productivity by giving them the ability to focus on implementing correct software functionality versus burdensome and time consuming, low-level manual testing activities.

LDRAunit automates and increases test throughput and repeatability to significantly increase overall test effectiveness. Software development managers seeking to develop the highest quality code in the most cost effective manner are leveraging automated unit/integration testing to avoid the potential delays caused by inefficient manual low-level testing strategies. These traditional techniques often are inadequate and postpone the discovery and correction of defects until late in system test where they are most expensive to fix.

Making use of the comprehensive control/data flow analysis provided by LDRA Testbed®, LDRAunit determines details of the unit interface, parameters, globals (input and output), return values, variable types and usage and procedure calls. Traditionally this level of information could only have been specified by a developer with an expert knowledge of the unit(s) under test. By automating this process LDRAunit frees up highly qualified staff who may then be re-assigned to other modelling, design and development tasks.

LDRAunit facilitates several test scenarios:

- Single procedures, functions, methods (Unit test)
- Files containing many functions, classes (Module/integration test)
- Complete programs (Sub system & system test)

LDRA has revolutionised the traditional "unit testing" activity, which is typically performed on the host and/or target systems with its new automatic testing capability, eXtreme Testing.

This high degree of test automation saves both time and resources, thereby enabling a quicker time to market. LDRAunit's ability to work in a highly distributed environment provides complete visibility into the overall development processes which can be accomplished even if development teams are distributed globally.

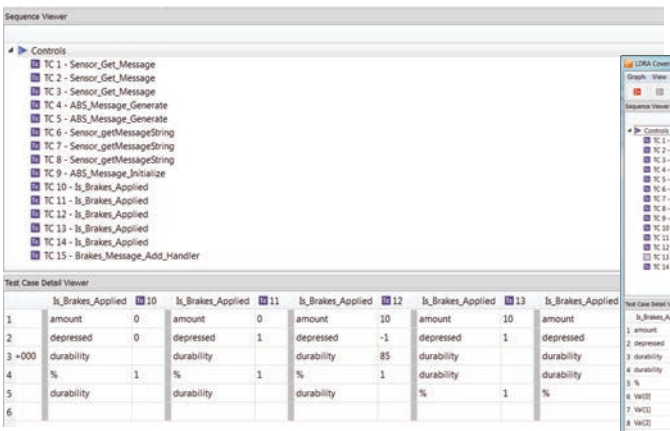
Unit/Integration Testing Embedded Systems with LDRAunit

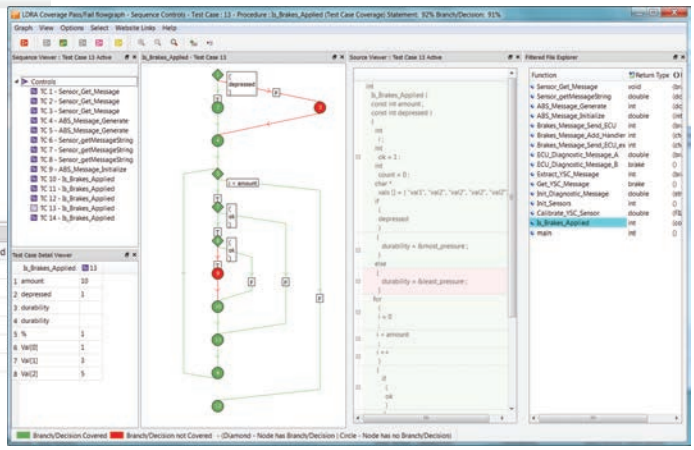
LDRAunit supports the creation and execution of test cases in multiple environments, namely:

- **Host/Host**
- **Host/Target**
- **Host/Simulator**

LDRA's Unit/Integration Testing Features:

- **Automated test driver / harness generation with no manual scripting requirement**
- **High levels of test throughput via the intuitive graphical and command line interface options**
- **Sophisticated automated analysis facilities which reduce test effort, freeing up developers and empowering testers**
- **Storage and maintenance of test data and results for fully automated regression analysis**
- **Automated detection and documentation of source code changes**
- **Tool driven test vector generation**
- **Execution of tests in host, target and simulator environments**
- **Automated generation of test case documentation including pass/fail and regression analysis reports**



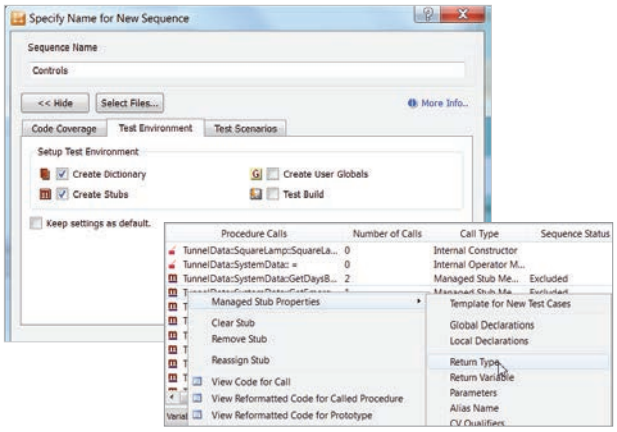


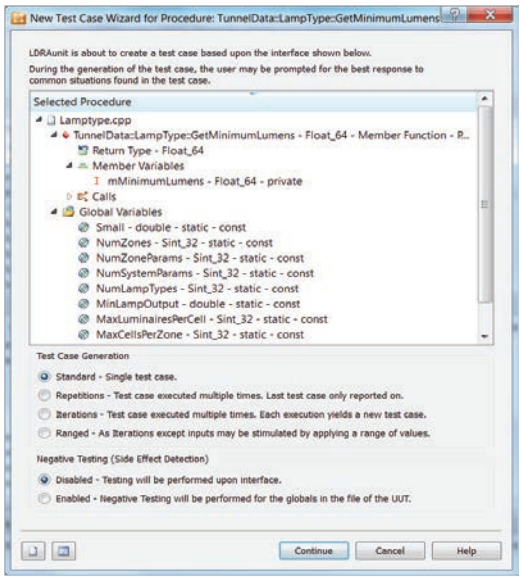
LDRAunit enables the fully automated creation of test driver programs. The generated driver handles all language features automatically. Key features are detailed below:

Automatically Generated Driver Program/Test Harness

LDRAunit utilises sophisticated control flow and data flow analysis techniques to document the interface to the unit(s) under test in full. This level of information then enables LDRAunit to automatically generate test drivers removing the need for manual scripting.

There are no limitations to the automatically generated driver. It is pure C/C++, Ada 83/95 or Java depending on the application code and can be executed in the host, target or simulator environment as required.





Stub Creation

Stubs can be written by hand or generated automatically for functions, methods, constructors, system calls, packages, generics, etc. The automatically generated "managed stubs" are sufficiently complete to allow the test harness to build and execute.

The default behaviour of managed stubs can be modified via an intuitive graphical user interface to tune such items as return and global parameter values. For instance, it is possible to vary return values depending on the number of occasions on which the stubbed function has been called, whilst passed parameter values can become pass/fail criteria for the unit tests themselves.

Exception Handling

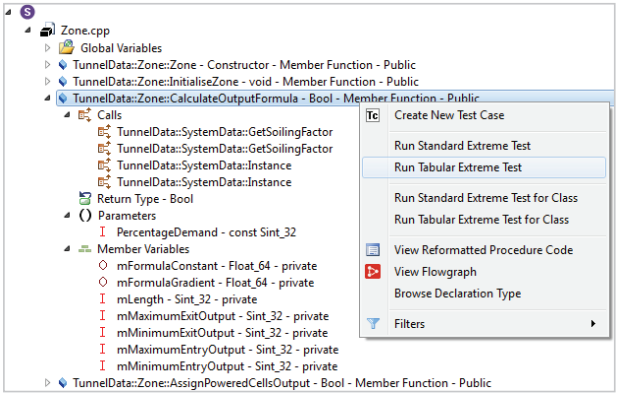
Exceptions can be automatically caught and test cases can be passed or failed dependent on whether such an exception has been raised. The exception handling method is configurable.

The exception handlers themselves can also be subject to unit tests. Such tests can be applied irrespective of whether the exceptions are raised, allowing coverage to be achieved even when the raising of an exception would be impractical.

eXtreme Testing

eXtreme Testing builds on LDRAunit's ability to automatically populate unit test cases, extending this to the generation of the test cases themselves. It automates the unit/module/integration testing processes and, by encompassing test harness and test vector production, it eliminates almost all of the overhead associated with bottom-up testing. It is the fastest and simplest way to get started with unit testing.

Features include the ability to automatically fine tune the processes used to create the test vectors to optimise the level of coverage achieved. Vectors generated by means of eXtreme Test can then be complemented by means of manually generated test cases.



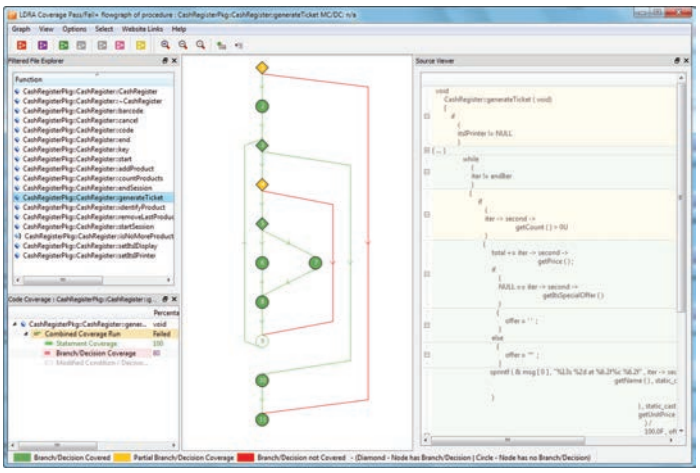
Test Case Files/Test Case Management/Storage

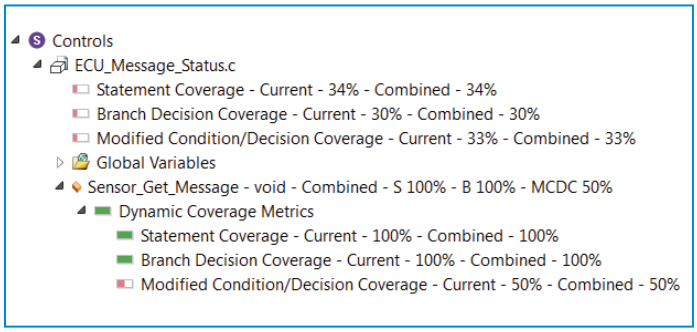
LDRAunit stores groups of test cases as sequences. Users can then export a sequence to a Test Case File (TCF) which contains all of the information required to re-run the test cases. TCF's can be grouped with regression reports and can be stored for regression verification and either saved with the source file, via a software configuration management (SCM) system, or used as an annotation. Requirements based testing documentation, including why particular values were chosen and tags to map to a requirement management system, can be added for storage.

When used as a SCM annotation these files allow managers to determine directly from the SCM system that developers are testing their code on check in. TCF's can also be re-run from the command line and in batch mode so that as the source code changes module interfaces and output can be verified. For companies concerned about managing outsourced development, TCF files can be easily distributed and provide a standard template around the world.

Structural Coverage Metrics

LDRAunit has access to the full range of coverage metrics available in the LDRA tool suite. These include Procedure Call, Statement, Branch/Decision, MC/DC and LCSAJ (Test Path). Users can choose an appropriate metric or set of metrics based on their safety and program constraints. For example, MC/DC coverage is essential to verify results are not masked by condition input conditions and LCSAJ coverage provides a comprehensive metric to evaluate loops. All of these metrics are available graphically, via flow graph displays, call graph displays and the file view of the LDRAunit GUI. Users can directly access compliance reports to give overall pass / fail metrics for standards such as DO-178B/C. Line by line views indicating which statements, branches and conditions have been executed are also shown in these reports.



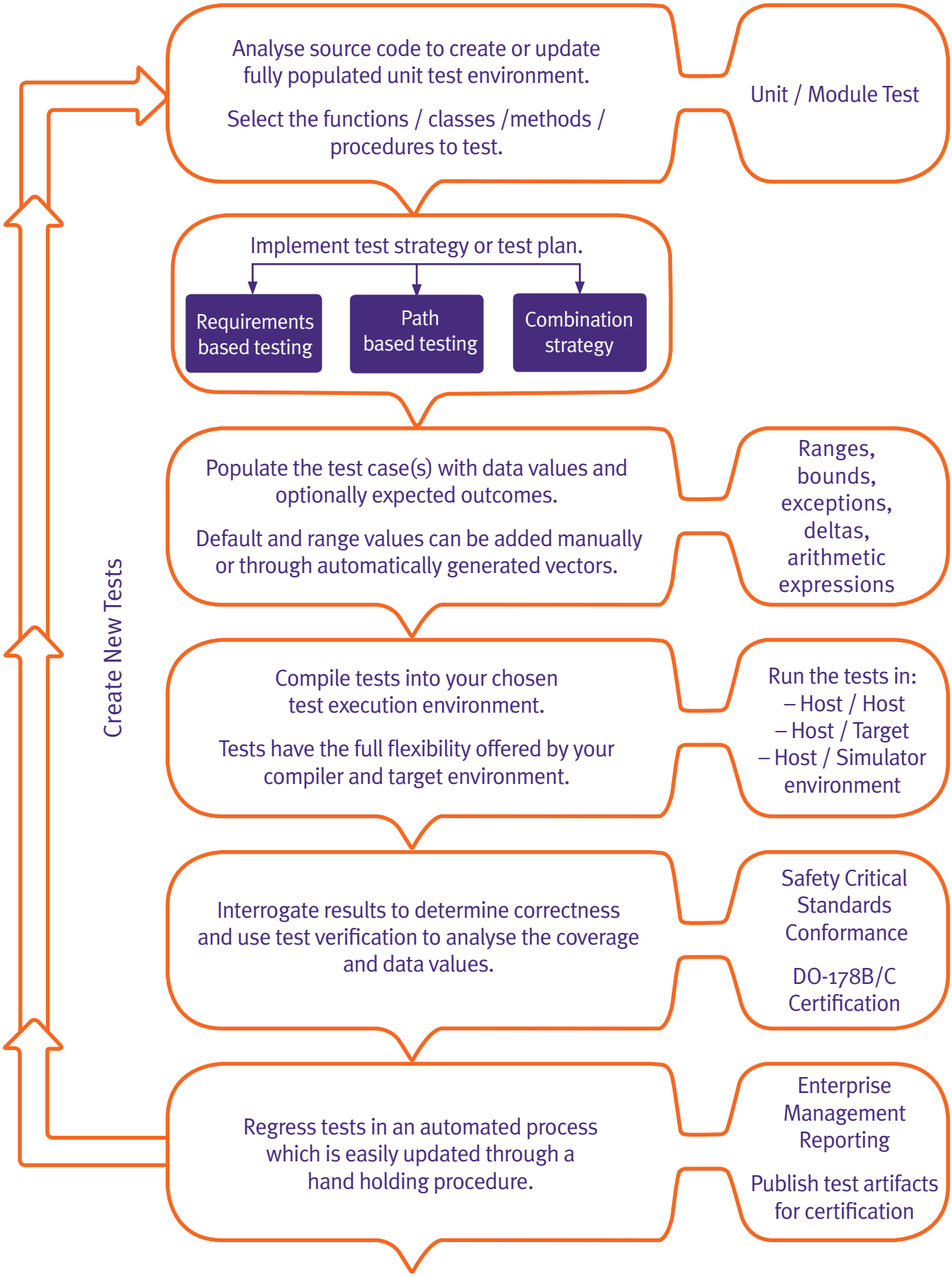


Additional Automatically Handled Language Features:

- Abstract Class Testing
- Automatic Creation of Compound Objects in Test
- Access to Private and Protected Data
- Re-use of Tests through Class Hierarchy
- Polymorphism
- Inheritance
- Templates
- Structure/Arrays/Unions
- Automated Resolution of Templated Types
- Classes
- Automatic Creation & Object "Re-Use" (Through Attachment)
- Access Methods & Attributes through the entire Hierarchy
- Exceptions
- Pointers
- Generics (Ada)
- In / Out Parameters (Ada)
- Records (Ada)

LDRA Software Technology

LDRA's Automated Unit Testing Process with LDRAunit



LDRA's best in class features are illustrated on real world projects with the client testimonials below.

Client Testimonials

Lexus RC-F Coupe

'LDRA has the ability to work with hardware that has limited resources which is important in the automotive sector in order to meet the demands for cost reduction and downsizing. We use the LDRA tool suite as a benchmark for other third-party and similar software platform products.'

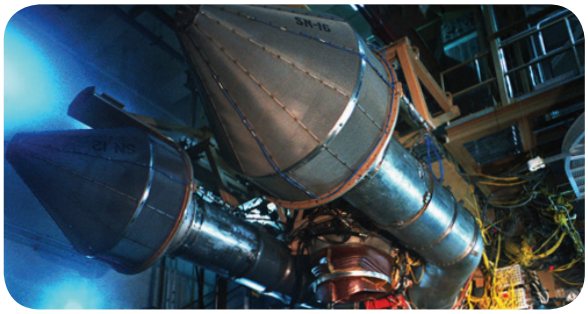
Akihito Iwai, Project Manager DENSO Japan

Orion Crew Exploration Vehicle

'Once the LDRA tool suite has analysed the code, it knows the inputs and outputs, expected returns and types, and every function. So, instead of spending months hand-coding and qualifying a test harness, the tool can use this information to automatically generate a test harness that will call every function, feed data in and out, and test every path of the program.'

Trevor Tidwell, Software Development Engineer, USA

Pratt & Whitney F135 Engine for JSF



'We found that the graphical user interface was easy to work with and made developing a rapid, intuitive test process a lot easier than creating it manually. This saving was further increased through the repeatability of tests utilising the automated regression testing facilities. This automated solution made our job a lot easier. The LDRA tool suite resulted in a saving of £2 million.'

Tom Roberts, Engineering Manager, Embedded Software and Systems, Ultra Electronics Datel

F-35 Lightning II

'LDRA has proven they will support us in any way to get the job done especially in meeting demanding milestones. They provided outstanding support for several F-35 teammates: Lockheed Martin (Fort Worth), BAE (Warton), Northrop Grumman (El Segundo), Seaweed, and Honeywell which directly contributed to a successful first flight of the AA-1 aircraft. We continue to work closely with LDRA to develop the needed automated process support to ensure that our software meets program cost, schedule, and quality targets.'

John H. Robb, Air Vehicle Software Senior Manager, LMCO

Languages & Platforms

The LDRA tool suite is available for the following source code languages and host / target platforms:

Languages

Ada 83
Ada 95
C/C++
Java

Atmel Assemblers
Freescale Assemblers
Intel Assemblers
Texas Instruments Assemblers
ARM Assemblers

Languages shown in orange signify *TBrun* availability

Host Platforms

Windows 7/8/XP
Solaris
Linux
RHEL 5 32 bit
RHEL 6 64 bit
Ubuntu 10.10 32 bit
Ubuntu 12.04 64 bit

Target Platforms

IDE:
Analog Devices
AONIX
ARM
Cosmic
Eclipse
Freescale
GNU
Green Hills MULTI
IAR
iSYSTEM
Keil
LynuxWorks
Microchip MPLAB X
QNX
TI
Renesas
TASKING
Wind River

Processor:
ARM
Freescale
Infineon
Intel
Microchip
MIPS
PowerPC
Renesas
TI
Xilinx

Note: This is not an exhaustive list as other languages and host / target platforms are available. Please contact LDRA for more information.

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