

## Embedded Test Framework: A Solution Accelerator for Embedded Hardware Testing

**Authors :** Arjun Kumar Rath, Titus Dhanasingh

**Abstract :** Embedded product development requires software to test hardware functionality during development and finding issues during manufacturing in larger quantities. As the components are getting integrated, the devices are tested for their full functionality using advanced software tools. Benchmarking tools are used to measure and compare the performance of product features. At present, these tests are based on a variety of methods involving varying hardware and software platforms. Typically, these tests are custom built for every product and remain unusable for other variants. A majority of the tests goes undocumented, not updated, unusable when the product is released. To bridge this gap, a solution accelerator in the form of a framework can address these issues for running all these tests from one place, using an off-the-shelf tests library in a continuous integration environment. There are many open-source test frameworks or tools (fuego, LAVA, AutoTest, KernelCI, etc.) designed for testing embedded system devices, with each one having several unique good features, but one single tool and framework may not satisfy all of the testing needs for embedded systems, thus an extensible framework with the multitude of tools. Embedded product testing includes board bring-up testing, test during manufacturing, firmware testing, application testing, and assembly testing. Traditional test methods include developing test libraries and support components for every new hardware platform that belongs to the same domain with identical hardware architecture. This approach will have drawbacks like non-reusability where platform-specific libraries cannot be reused, need to maintain source infrastructure for individual hardware platforms, and most importantly, time is taken to re-develop test cases for new hardware platforms. These limitations create challenges like environment set up for testing, scalability, and maintenance. A desirable strategy is certainly one that is focused on maximizing reusability, continuous integration, and leveraging artifacts across the complete development cycle during phases of testing and across family of products. To get over the stated challenges with the conventional method and offers benefits of embedded testing, an embedded test framework (ETF), a solution accelerator, is designed, which can be deployed in embedded system-related products with minimal customizations and maintenance to accelerate the hardware testing. Embedded test framework supports testing different hardwares including microprocessor and microcontroller. It offers benefits such as (1) Time-to-Market: Accelerates board brings up time with prepacked test suites supporting all necessary peripherals which can speed up the design and development stage(board bring up, manufacturing and device driver) (2) Reusability-framework components isolated from the platform-specific HW initialization and configuration makes the adaptability of test cases across various platform quick and simple (3) Effective build and test infrastructure with multiple test interface options and preintegrated with FUEGO framework (4) Continuous integration - pre-integrated with Jenkins which enabled continuous testing and automated software update feature. Applying the embedded test framework accelerator throughout the design and development phase enables to development of the well-tested systems before functional verification and improves time to market to a large extent.

**Keywords :** board diagnostics software, embedded system, hardware testing, test frameworks

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