CEC Continuing Education Center

DesignNews

Best Practices for Designing Real-Time Embedded Systems

DAY 4 : Testing Your Way to Design Success

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Course Sessions

- System Level Design Philosophy
- Designing a Hardware-less System
- It's All About the Data
- Testing Your Way to Design Success
- The Best Practices Lightning Round

1 Embedded System Testing

Embedded Systems Testing

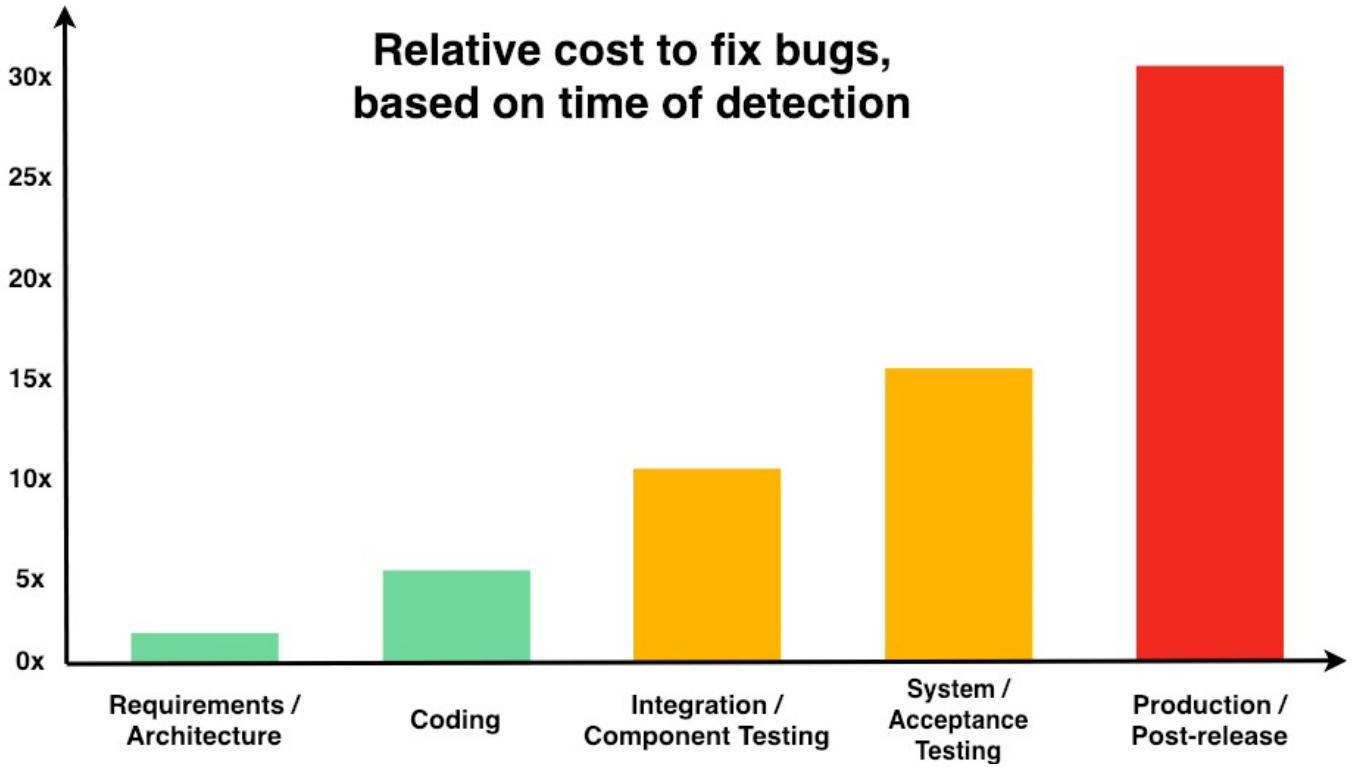
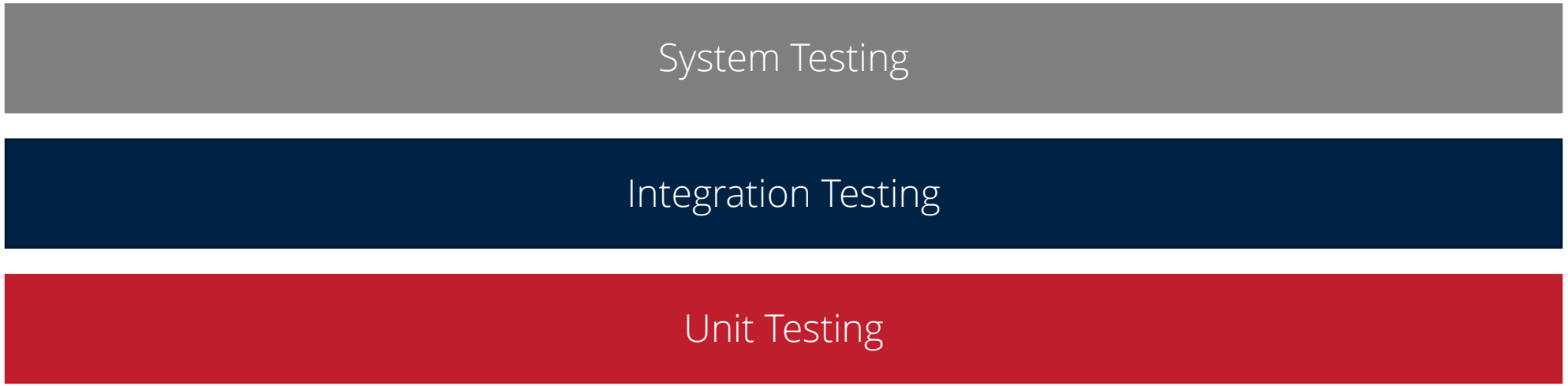


Image Source: https://deepsource.io/blog/exponential-cost-of-fixing-bugs/

Embedded System Testing



Fun Resource Lists Every Testing Type

- https://www.softwaretestinghelp.com/types-of-software-testing/

Which best describes your testing process?

- Main focus on unit testing
- Main focus on integration testing
- Main focus on system testing
- Focus equally on all the above
- Other

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Test Driven Development

A programming style in which coding, testing and design are used to build software incrementally.

Test Driven Development

The Benefits

Reductions in defect rates

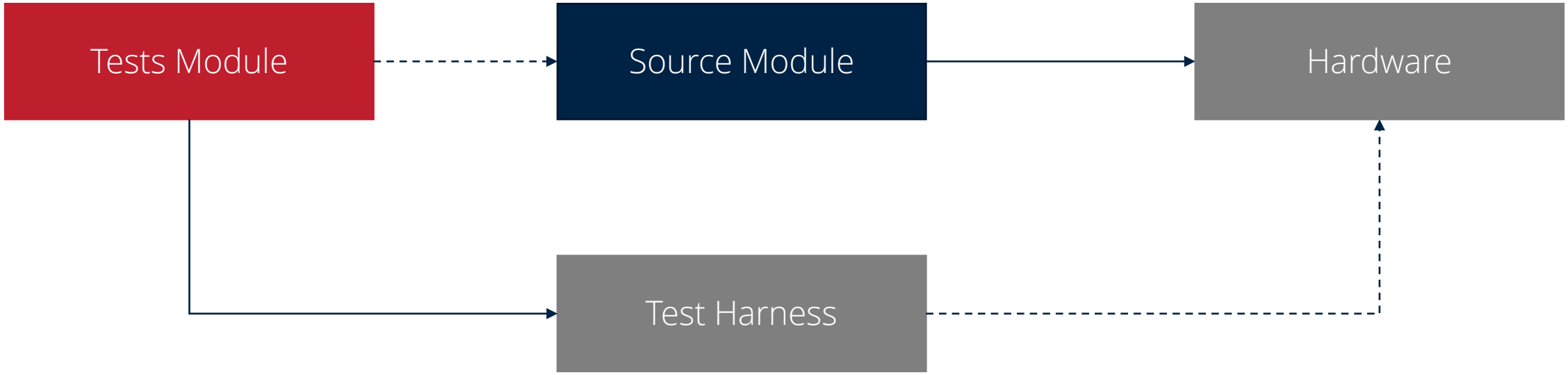
Improved software quality

Less time spent debugging

Better overall design

Regression testing

Test Driven Development



Test Driven Development

TDD Process (Source: Test Driven Development by Kent Beck)

1) Add a small test
2) Run all the tests and see the new one fail
3) Make small changes to make the test pass
4) Run all the tests and see the new one pass
5) Refactor to remove duplication and improve expressiveness

What is your current skill level for using TDD?

- New to TDD
- Have ran some tests
- Actively use it in my development
- Would like to use it more in my development

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Unit Test Harnesses

A unit test harness is a software package that allows a programmer to express how production code should behave.

- James Grenning
- (Test-Driven Development for Embedded C page 15)

Test Harnesses

Test harnesses Provide:

- A language to define test cases
- A mechanism to run test cases
- An output report with results

Test Harnesses

CppUTest is a C /C++ based unit xUnit test framework for unit testing and for test-driving your code. It is written in C++ but is used in C and C++ projects and frequently used in embedded systems, but it works for any C/C++ project.

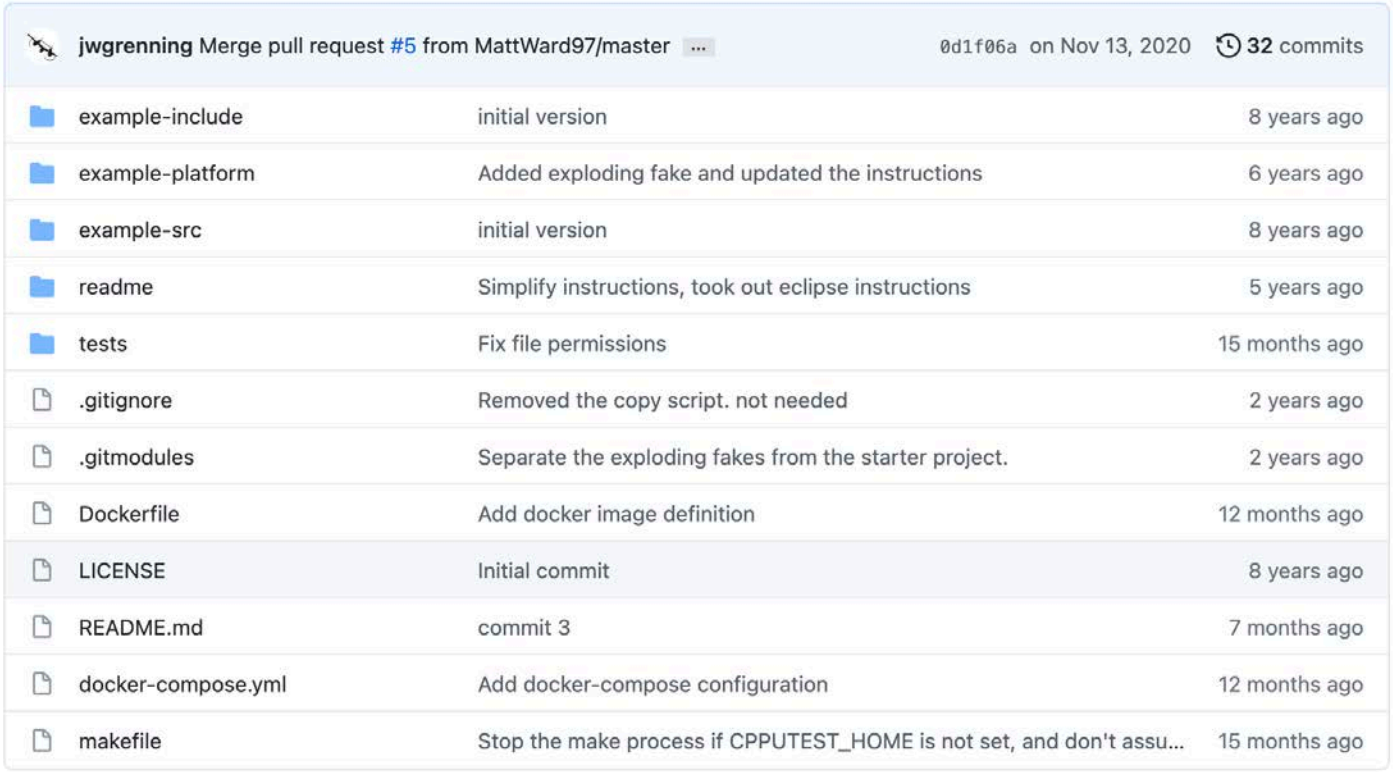
CppUTest's core design principles are:

- Simple in design and simple in use.
- Portable to old and new platforms.
- Build with Test-driven Development for Test-driven Developers.

Source: https://cpputest.github.io/

Test Harnesses

https://github.com/jwgrenning/cpputest-starter-project



jwgrenning Merge pull request #5 from MattWard97/master ... `0d1f06a` on Nov 13, 2020 **32** commits

example-include	initial version	8 years ago
example-platform	Added exploding fake and updated the instructions	6 years ago
example-src	initial version	8 years ago
readme	Simplify instructions, took out eclipse instructions	5 years ago
tests	Fix file permissions	15 months ago
.gitignore	Removed the copy script. not needed	2 years ago
.gitmodules	Separate the exploding fakes from the starter project.	2 years ago
Dockerfile	Add docker image definition	12 months ago
LICENSE	Initial commit	8 years ago
README.md	commit 3	7 months ago
docker-compose.yml	Add docker-compose configuration	12 months ago
makefile	Stop the make process if CPPUTEST_HOME is not set, and don't assu...	15 months ago

Test Harnesses

Install and run make all:

```
compiling AllTests.cpp
compiling ExampleTest.cpp
compiling MyFirstTest.cpp
compiling io_CppUMock.cpp
compiling io_CppUMockTest.cpp
compiling io.c
compiling Example.c
Building archive test-lib/libmy_component.a
a - test-obj/example-platform/io.o
a - test-obj/example-src/Example.o
Linking rename_me_tests
Running rename_me_tests
..
tests/MyFirstTest.cpp:23: error: Failure in TEST(MyCode, test1)
        Now delete this fail and watch the test pass.

..
Errors (1 failures, 4 tests, 4 ran, 10 checks, 0 ignored, 0 filtered out, 1 ms)
```

Test Harnesses

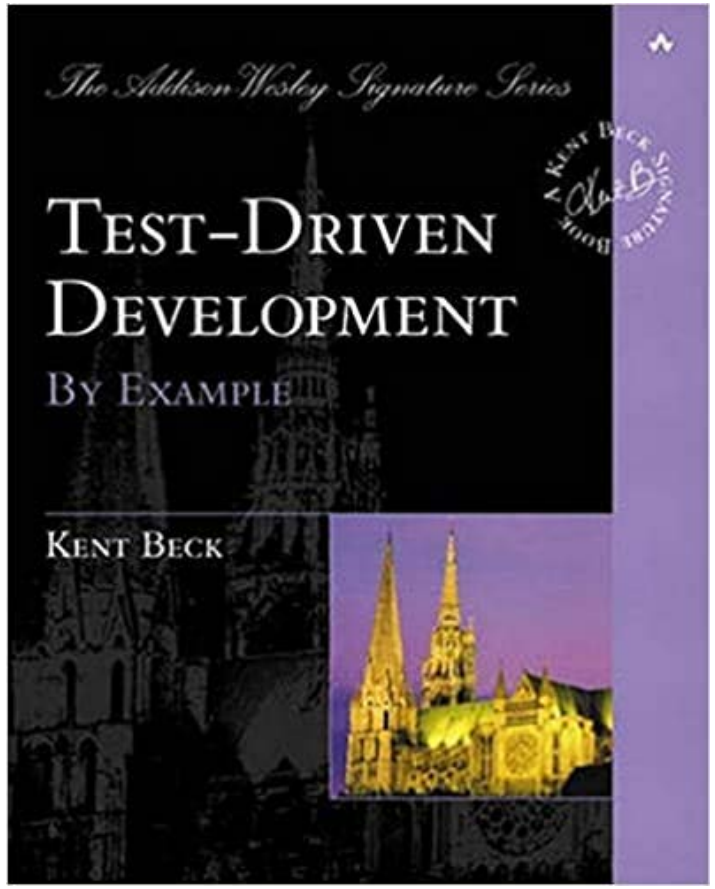
Fix the error in MyFirstTest.cpp:

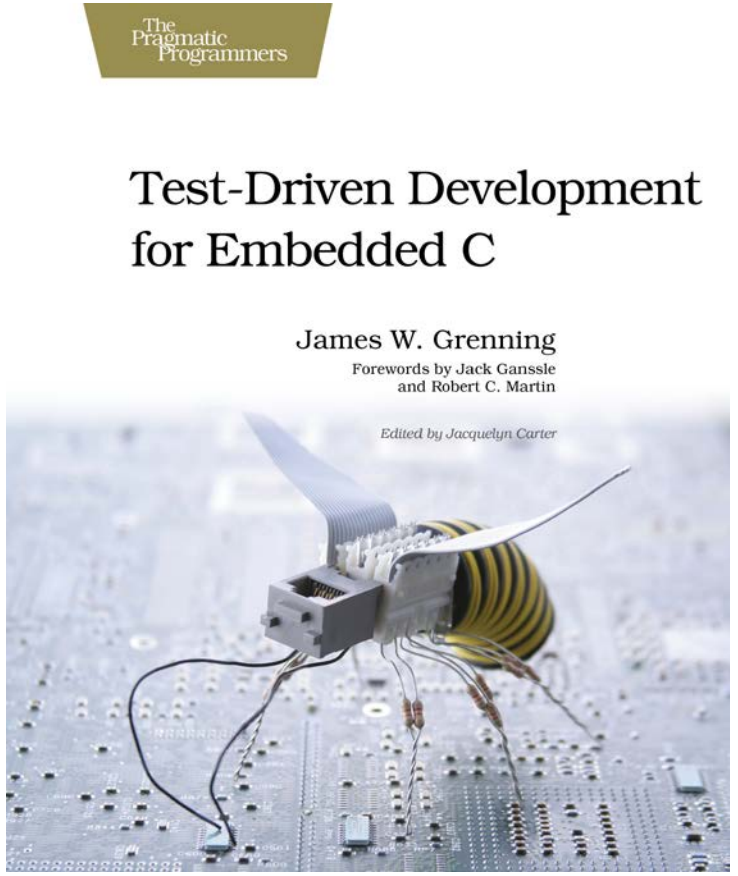
```
compiling MyFirstTest.cpp
Linking rename_me_tests
Running rename_me_tests
....
OK (4 tests, 4 ran, 9 checks, 0 ignored, 0 filtered out, 1 ms)
```

Will you try Cpputest after this session?

- Yes
- No, I have a different test harness
- No, I’m just understanding the fundamentals
- Other

Going Further with Test Driven Development





Thank you for attending

Please consider the resources below:

- www.beningo.com
  - Blog, White Papers, Courses
  - Embedded Bytes Newsletter
    - http://bit.ly/1BAHYXm

From www.beningo.com under

- Blog > CEC – Best Practices for Real-Time Embedded Systems

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