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Test Automation Design for Embedded Systems

DAY 1 : Introduction to Test Automation Design

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THE SPEAKER

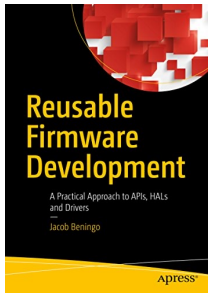
Jacob Beningo

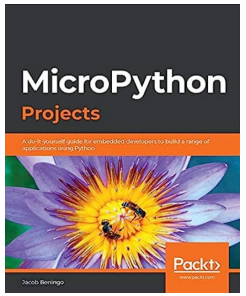
Jacob@beningo.com

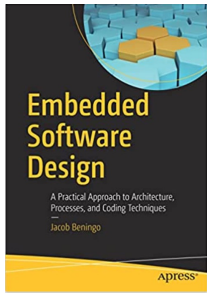
Beningo Embedded Group – CEO / Founder

Focus: Embedded Software Consulting and Training

Help teams deliver higher-quality embedded software faster. We specialize in creating and promoting embedded software excellence in businesses around the world.







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01

Introduction

Embedded Systems Today

Embedded systems today have become extraordinarily complex.

- Connectivity
- High feature demands
- 100's of thousands of lines of code
- Software integrated from multiple sources

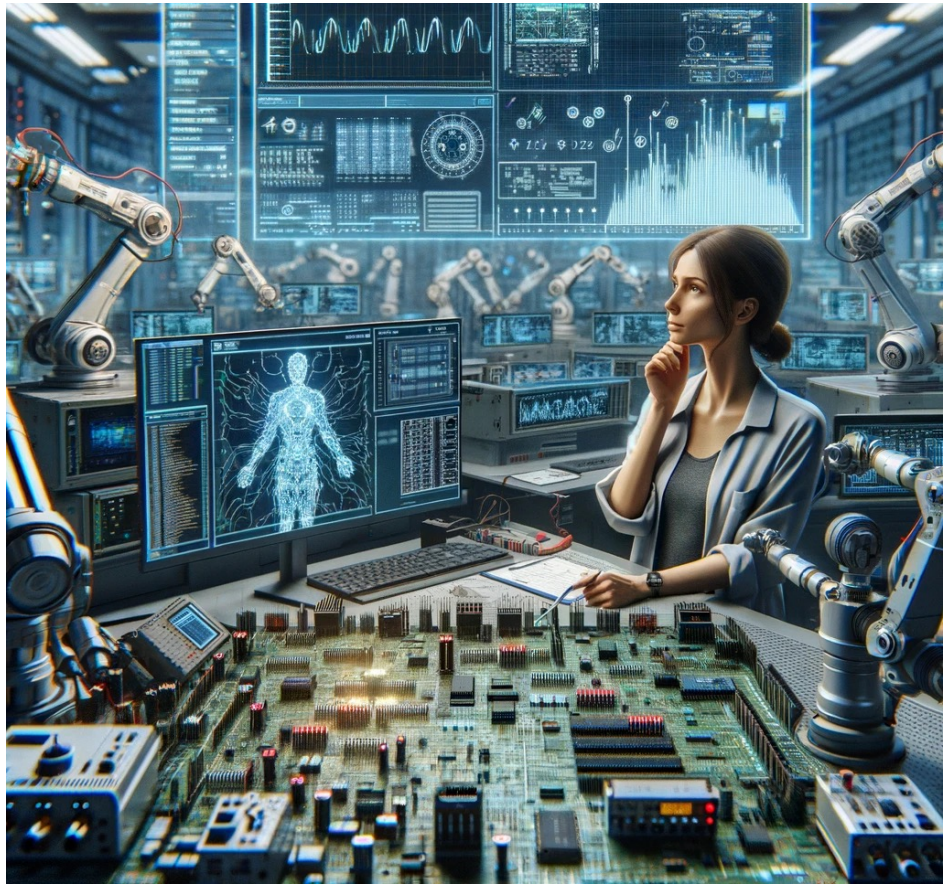
Developing a robust system requires testing, but systems are so "large" that manually testing them requires 1,000's of man-hours.

What is Test Automation?

Test Automation is the process of using specialized software tools and scripts to execute pre-defined test procedures automatically, without human intervention.

It aims to streamline and accelerate the testing process by automating the execution of test cases, thereby increasing the efficiency, repeatability, and reliability of testing efforts.

(Reduces time AND human error!)



What does testing get you?

Testing software is **crucial** for identifying and resolving issues, but it doesn't guarantee that a product is bug-free!

100% Test Coverage does not mean that all boundary conditions, error conditions, or other issues have been covered!

Testing, especially with automation, helps us to know under specific conditions that the system works as expected.

Audience POLL Question

What percentage of your tests today are automated?

- 0 – 4.9%
- 5 – 24.9%
- 25 – 49.9%
- 50 – 74.9%
- 75 – 99.9%
- 100%

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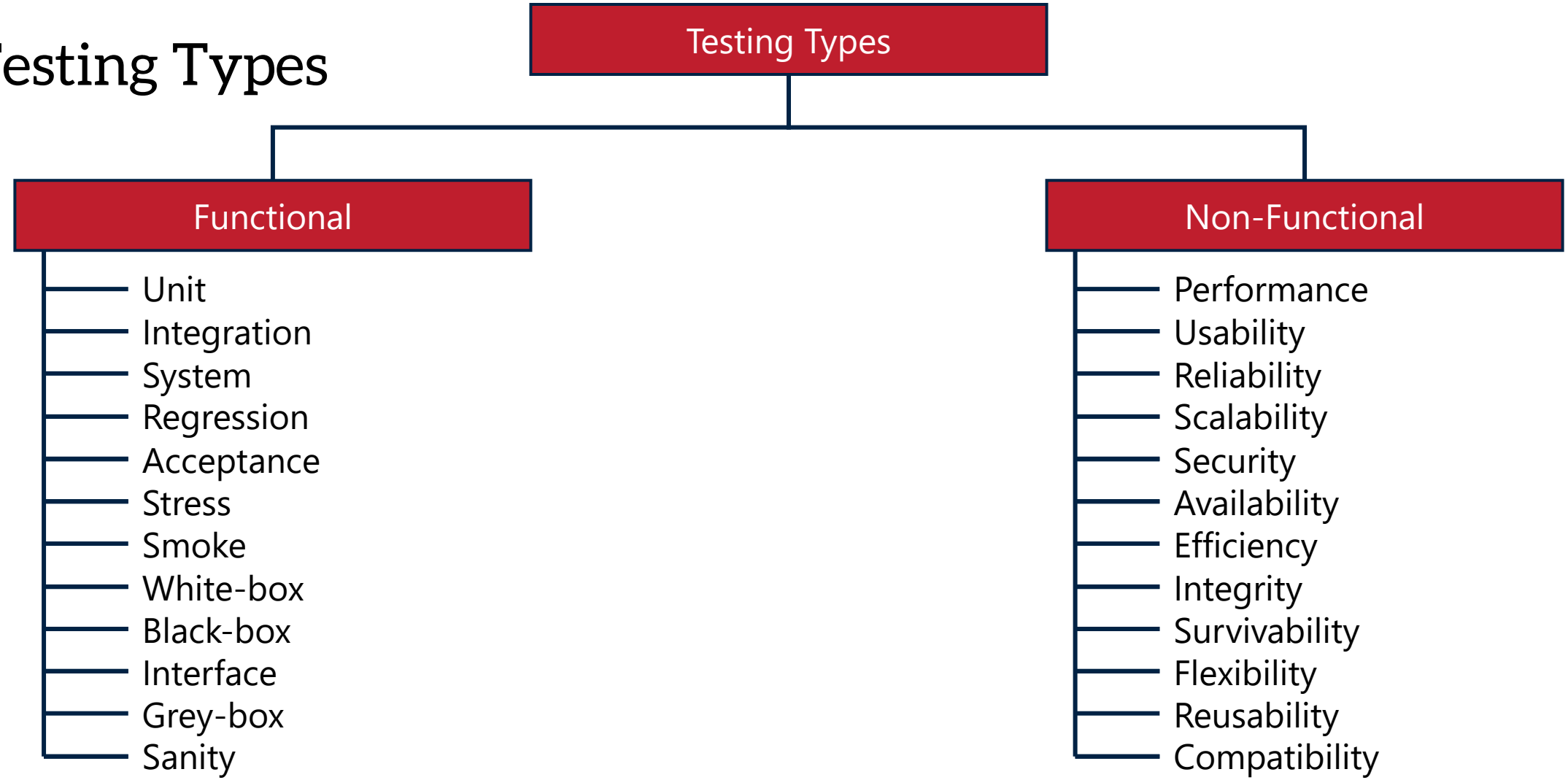
02

Testing Types

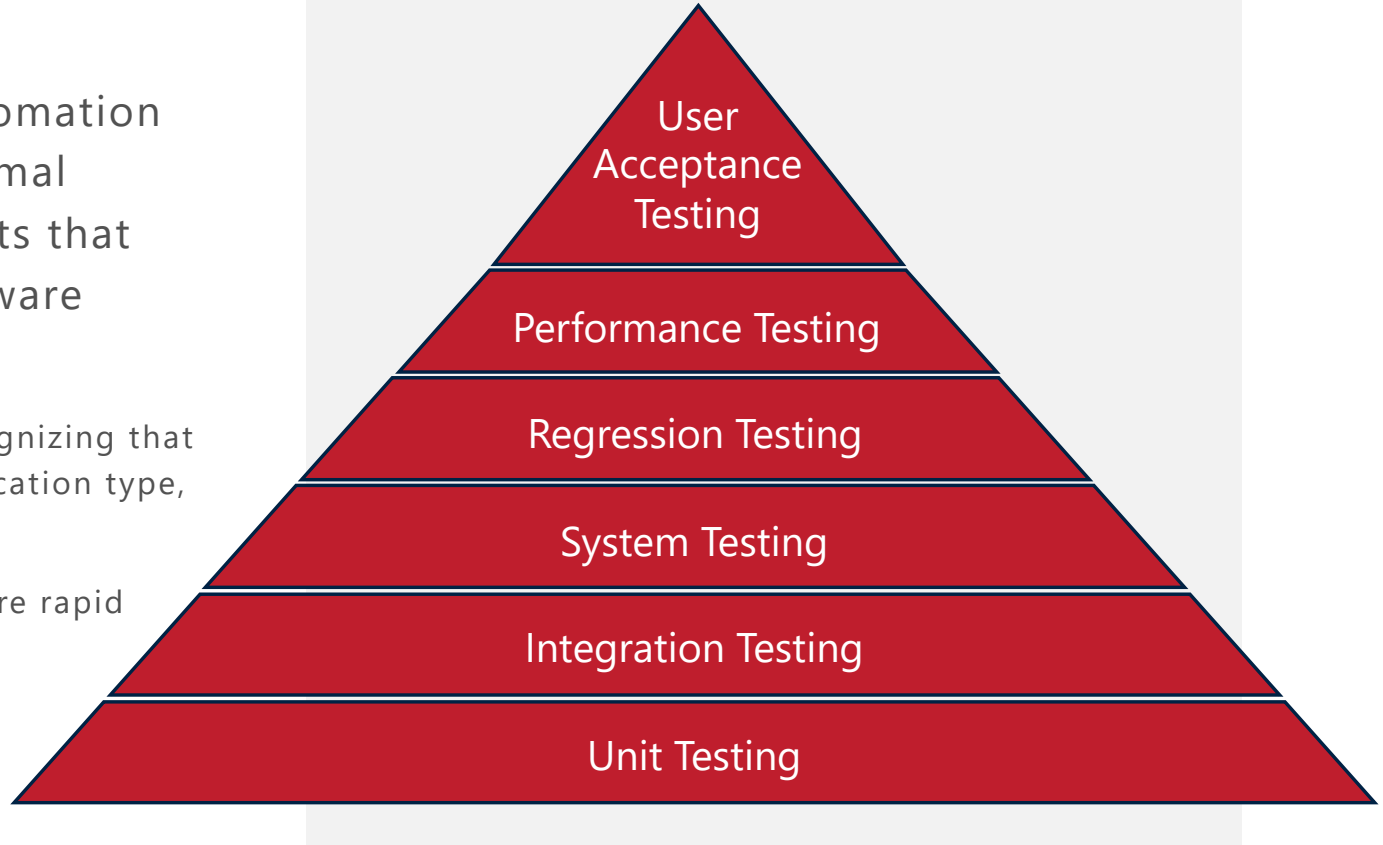
Testing Types



The Testing Triangle

The testing triangle, also known as the test automation pyramid, is a concept used to describe the optimal distribution of different types of automated tests that should be used to develop a well-rounded software testing strategy.

- Adapt the pyramid to fit the project's specific needs, recognizing that the ideal distribution of tests can vary based on the application type, architecture, and risk areas.
- Automate as much as possible within the pyramid to ensure rapid feedback and efficient use of testing resources.
- Unit Testing forms the foundation of testing!



Defining Test Types

- Unit Testing: Testing individual components or functions of a software application to verify that each unit performs as designed.
- Integration Testing: Testing the combination of two or more components or systems to ensure they work together correctly.
- System Testing: Testing a complete and integrated software system to evaluate its compliance with specified requirements.
- Regression Testing: Testing existing software applications after changes (like enhancements or bug fixes) to ensure that the new code hasn't adversely affected existing functionality.
- Performance Testing: Testing to determine the speed, responsiveness, and stability of a system under a particular workload.
- User Acceptance Testing (UAT): Testing conducted to determine if a system satisfies the business needs and requirements, typically performed by end-users or clients before the system goes live.

Audience POLL Question

Which types of tests do you neglect the most?

- Unit
- Integration
- System
- Regression
- Performance
- User Acceptance

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03

Automated Testing Systems

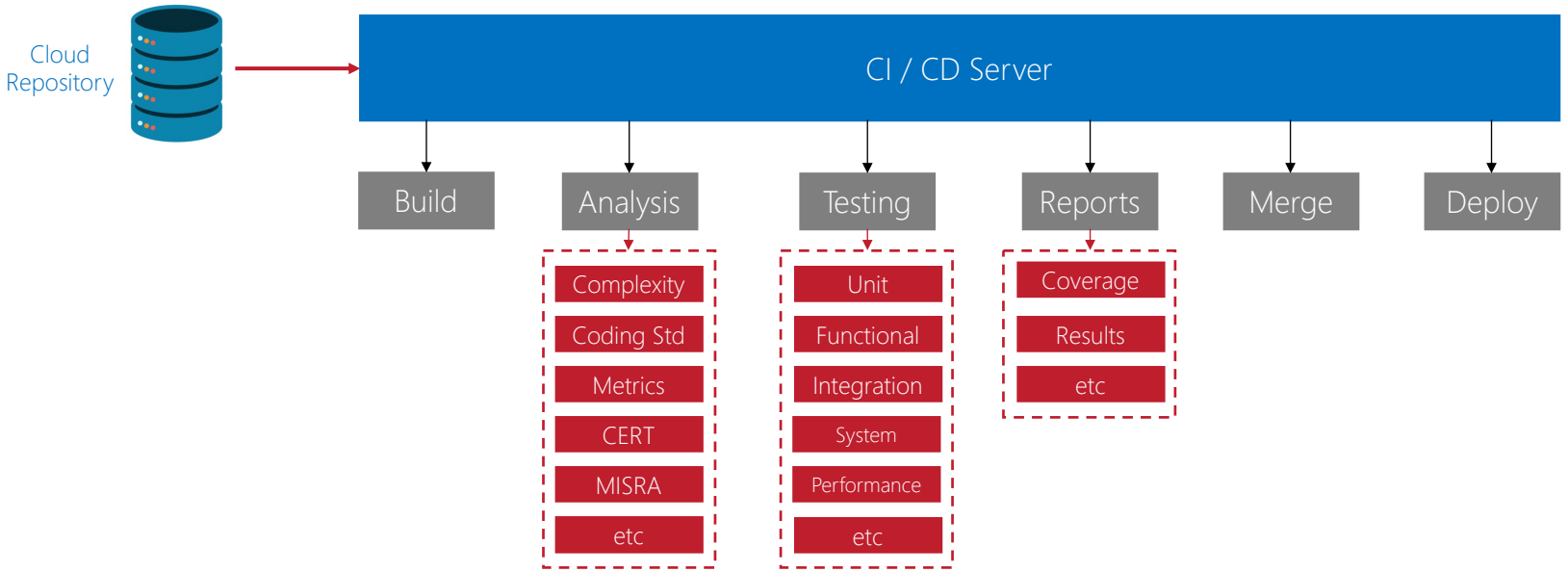
Automated Testing Systems

Several types of automated testing systems:

- Testing Frameworks
- Continuous Integration / Continuous Deployment (CI/CD)
- Design Methodologies (Test-Driven Development)
- Static and Dynamic Analysis Tools
- COTs systems
- “Homegrown” systems

Continuous Integration / Continuous Deployment (CI/CD)

CI/CD is a methodology that allows developers to frequently integrate code changes into a shared repository and automate the testing and deployment of applications.



Testing and Simulation

Home Grown

- Test stands
- CI/CD integration
- Product displays

Commercial

- Standard solutions
- Custom integrations
- Third-party maintenance

Audience POLL Question

What are you most interested in for automated testing?

a) Unit Testing
b) CI/CD
c) System level hardware in loop testing
d) other

Next Steps

04

Test Automation Build System

Build System Example

- Docker container build system
- Makefile-based
- Cmake with Ninja Example
- Compilation scripts
- Integrated tools like cpputest

https://mailchi.mp/beningo/beningo-devops

Additional Resources

Please consider the resources below:

- Jacob's Blogs
- Jacob's CEC courses
- Embedded Software Academy

- Embedded Bytes Newsletter
  - http://bit.ly/1BAHYXm

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Next Steps

- Introduction to Test Automation Design
- Using Docker for a Test Automation Environment
- Unit-Testing Using Test-Driven Development Part 1
- Unit-Testing Using Test-Driven Development Part 2
- Automating System-Level Testing

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