How to Invent an Airplane
How to Invent an Airplane

- Wright brothers had to learn how to test their design elements first
  - Propeller shape
  - Wing design
  - Control surfaces
- Invented the wind tunnel and used it to test propeller and wing designs
- Created and tested kites and gliders to test wing designs and control surfaces
- Had to invent the science of aeronautics
- Had to build testing into their design process
But Software isn’t as Hard as Aeronautics

• Working software can actually be built using code and fix

• But like the Wright brothers, agile developers...
  • Test their components as part of the design process
  • Have had to create test harnesses and testing techniques
  • Make frequent reality checks instead of depending on the wisdom of the plan
What is Agile Development?

- Work is divided into chunks of business value
  - These ‘stories’ seem valuable to a business user
  - Customer can measure progress in their own terms
  - Requires delivery of vertical rather than horizontal collections of code
  - Customer-perspective acceptance tests determine completeness
- Work is scheduled in time-boxed iterations
  - Overhang is rescheduled for a future iteration
  - Ensures regular deliveries of working code
  - Allows team velocity to be measured
  - Contrast with RUP and other spiral methods that use scope-boxed iterations
- Team approach
  - The team contains all the necessary skills
  - The team as a whole is responsible for the success and quality of the software
  - Frequent collaboration, pairing, changing pairs and dispersed knowledge
  - Collective code ownership (optimistic locking)
- Developers write automated unit tests
  - Writing tests is seen as part of the coding job
  - Expected to run tests often
  - Breaking unit tests is always a showstopper
Responding to Change vs. Following a Plan

- Change includes learning
  - We don’t know everything at the start
- Two Approaches to Planning
  - Planning is hard, therefore we must get better at it
  - Planning is hard, therefore we must reduce the need for it

- Agile development is an empirical practice focused on working code (working code over detailed documentation)
- The uncertainties of planning are mitigated with frequent reality checks
- The biggest innovations in testing today are coming from the agile community
Reality Check: Unit Testing

- Units are functions, methods or classes.
- Unit tests are in the same language as the code being tested.
- Unit tests are written by the programmers who wrote the code being tested.
- A test harness or framework collects tests into suites and allows them to be run as a batch.
- The X-Unit frameworks are popular harnesses.
  - JUnit for Java, NUnit for Dot-Net...
- Most agile developers are ‘test-infected’
## Types of Unit Testing

<table>
<thead>
<tr>
<th><strong>Unit isolation testing</strong></th>
<th><strong>Create stubs for external units</strong></th>
<th>• Use Mock Object classes</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Test each unit in isolation</em></td>
<td></td>
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<tr>
<td><strong>Unit integration testing</strong></td>
<td><strong>Call external units</strong></td>
<td>• Introduces dependencies.</td>
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<tr>
<td><em>Test units in context</em></td>
<td></td>
<td>• Test suites take longer</td>
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<tr>
<td></td>
<td></td>
<td>to run</td>
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- Many agile developers strongly prefer unit isolation tests: “true unit tests”
  - Run faster, therefore run more often
  - Less likely to break when refactoring other code
Refactoring
Improving the Design of Existing Code

- Refactoring restructures code (hopefully for the better) without changing its behavior.
- Unit tests define behavior and therefore determine whether behavior was inadvertently changed.
- Traditionally, lack of unit tests have discouraged developers from refactoring, resulting in brittle code.

- Refactoring, by Martin Fowler
  - Testing is an integral component to refactoring.
  - 9 of the 17 “sound bites” mention testing.
Test-Driven Development

- Developers write unit tests before coding.
  - Motivates coding
  - Improves design
    - reducing coupling
    - improving cohesion
  - Provides regression tests

- An approach to design
  - More than just a test strategy
  - Specification by Example
  - Focuses programmer on how callers will use the code
  - Spawning new lightweight frameworks using dependency injection.

```java
public void testMultiplication() {
    Dollar five = Money.dollar(5);
    assertEqual(new Dollar(10), five.times(2));
    assertEqual(new Dollar(15), five.times(3));
}
```
Test-Driven Development: Red-Green-Refactor

1. Write a test, then run it. Make sure it fails. **RED**

2. Make the test pass. **GREEN**
   - Use the simplest design that will work.
   - Bad design (duplication, etc) is OK! (for now)
   - Add code only when tests demand it.

3. **REFACTOR** to improve the design.
   - Now, remove duplication
   - Unit tests are the **reality check** to let you know you didn’t break anything
Reality Check: Continuous Integration

- Rebuild the code whenever a new commit is made
- Then run the unit tests
- Post results to the web
- Send email with any errors

- Tools:
  - Cruise Control
  - Damage Control
Reality Check: Spikes

- The agile approach to architecture
- A spike is throwaway code that explores a particular approach to assembling code
  - Will it work?
  - How will it perform?
  - Is it ugly?
Reality Check: Frequent Delivery of Business Value

- Not just a hunk of code
- Actual functionality that is valuable to end users
- A vertical rather than a horizontal slice
- Delivered to the customer
- Allows customer satisfaction to be measured
- Regular ‘Beta’ testing throughout development
- Usability testing, exploratory testing
- System must remain stable to make this happen (hence the need for automated regression tests)
- Focus on true customer satisfaction rather than just meeting the letter of the requirements
Reality Check: Immediate Acceptance Testing

- A story isn’t done until it has been tested
- Usually tested in the iteration
- “Sometimes you just have to throw a turkey in the engine.”
Automating Acceptance Testing

- Characteristics of Successful Test Automation Projects...
  - Collaboration between testers and developers
  - Automate early
  - Team commitment (vs “it would be good if”)  
- Agile teams have all three

- Agile Testing Rules
  - Programmers write automated unit tests.
  - Acceptance tests must also be automated.
  - Programmers and testers work together on acceptance tests.
Challenge: Regression Test Tools

- Most commercial test tools work poorly in an agile environment. Most have these flaws:
  - Vendor-specific languages (vendorscripts)
  - Poor integration with source control
  - Hard to use with continuous integration
  - Impractical to install on every workstation
- These problems make them impractical for use by the team as a whole.
- Agile teams are building their own test tools and releasing many of them as open-source...
Problems with Commercial Test Tools

- Proprietary Scripting Languages
  - Winrunner (TSL), SilkTest (4test), Robot (Test Basic)
  - But newer tools are now using standard languages
    - Astra QuickTest (VB Script), XDE Tester (Java),

- Incompatibility with Source Control
  - Temporary files and directories (WinRunner)
    - http://paulhammant.com/blog/000245.html
  - Key information stored in repositories (Rational)

- Lack of External Calling API’s
  - They refuse to allow themselves to be used as a library.
  - Generally, you can only launch complete scripts with limited access to results information.
  - Therefore difficult to integrate with Continuous Integration
  - Some new low-cost and shareware tools are exceptions
    - E.g. TestComplete

- Restrictive and Expensive Licensing
  - Developers can’t run test suites.

These “features” encourage vendor-lock and frustrate serious programming
  - Open-Source Tools almost always avoid these shortcomings.
Watir

- Watir is a Ruby-library that drives the IE browser.
  - Bret Pettichord & Paul Rogers
- Website
  - http://wtr.rubyforge.org
- Mailing List
  - http://rubyforge.org/projects/wtr/
Selenium

- Selenium is server-side software that delivers a JavaScript browser-bot that runs inside IE, Firefox or Mozilla.
  - Jason Huggins & ThoughtWorks
- Website
  - http://selenium.thoughtworks.com
QA Paradigm #1: Quality Assurance is Testing

- Most QA people are actually employed as testers
- “Did you QA this?”
- “Independent testing is better testing”
- Are used to testing untested code and struggle when working with agile developers
  - E.g., overuse of boundary testing is common
QA Paradigm #2: Quality Assurance is Process

- Role defined by CMM and IEEE
- An approach that many QA groups aspire to
- The Process Police must force discipline on the developers
- However, test teams that also try to enforce process may undermine their effectiveness as testers
  - discourages communication
  - reduces trust
  - may cause delays
- Also, tend to enforce waterfallian practices, which is counterproductive for agile teams
QA Paradigm #3: Quality Assurance is Team Responsibility for Customer Satisfaction

- “Whole Team” means that QA can’t be delegated to a person or subgroup
- Everyone is responsible for raising quality issues
- It’s not enough to say that you did what they asked for
- Quality ultimately is defined by the customer, not by process standards, nor by stale documents
- This is the approach preferred by Agile teams
Agile Is About **Reality Checks**

- This conference is a chance for you to make another reality check.
- Agile is not about doing what the experts say.
- It is about doing what works.
- Ask the speakers how agile methods have or haven’t worked for them.
Open-Source Test Tools from ThoughtWorks

Dashboard
http://dashboard.sourceforge.net/

hloader
http://hloader.sourceforge.net/

jfcUnit
http://jfcunit.sourceforge.net/

MockMaker
http://mockmaker.sourceforge.net/

NMock
http://opensource.thoughtworks.com/projects/nmock.jsp

Marathon
http://marathonman.sourceforge.net/

Marathon.NET
http://marathonnet.sourceforge.net/

PyUnit
http://opensource.thoughtworks.com/projects/pyunit.jsp

SelfEsteem
http://selfesteem.sourceforge.net/

XMLUnit
http://xmlunit.sourceforge.net/
Unit Testing References

• Code First
  • Pragmatic Unit Testing: In Java with JUnit, Hunt & Thomas
  • “Learning to Love Unit Testing,” Thomas & Hunt
  • “JUnit Test Infected: Programmers Love Writing Tests,” Gamma & Beck
    • http://junit.sourceforge.net/doc/testinfected/testing.htm
  • “JUnit: A Cook’s Tour,” Beck & Gamma
    • http://junit.sourceforge.net/doc/cookstour/cookstour.htm
  • “Simple Smalltalk Testing: With Patterns,” Kent Beck
    • http://www.xprogramming.com/testfram.htm

• Test First
  • Test-Driven Development: A Practical Guide, David Astels
  • JUnit Recipes, J.B. Rainsberger
  • Unit Testing in Java: How Tests Drive the Code, Johannes Link
  • Test-Driven Development: By Example, Kent Beck
Further Study

**Context-Driven Testing**
  - Cem Kaner, James Bach & Bret Pettichord
- Mailing List
  - http://groups.yahoo.com/group/software-testing/
- Wiki
  - http://www.context-driven-testing.com/wiki/

**Agile Testing**
- Agile Testing Papers
  - http://www.testing.com/agile
- "Where are the Testers in XP?"
- Mailing List
  - http://groups.yahoo.com/group/agile-testing/

**Open Source Test Tools**
- Home Brew Test Automation