

**Arizona Information Technology Skills Training
Initiative (AITSTI)**

Software Quality Assurance

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The art of software development



Let the experts think great thoughts



- Developer knows best
- Development never stops
- Elegant code is important
- Users should accept what is developed
- User process should be modified to fit new application

Result of lack of disciplined process

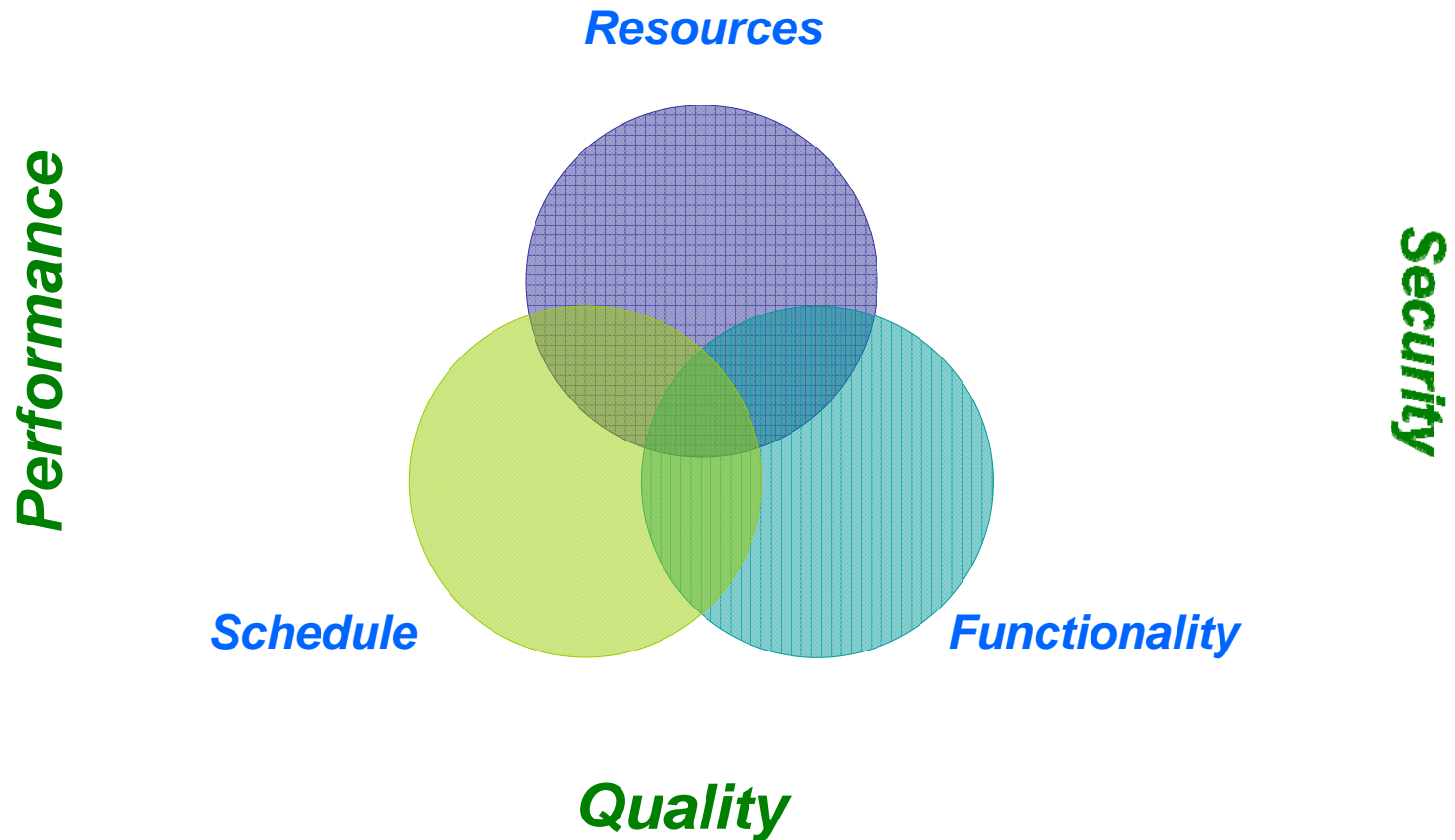


- Application does not meet business needs
- Users need unplanned retraining
- Delays impact business
- High error rate impacts customers
- Projects get cancelled

Software project planning

- Business case and vision
- Requirements
 - What does the customer want?
 - What does marketing want?
- How will the product be developed to meet those needs?
 - What resources are required?
 - How long will it take?
- How will the project be managed?
 - Organization
 - Project management
- How will the user accept the product?

Development constraints



Software development methodologies

- Waterfall
- Iterative – Agile, XP, test driven development
- Spiral - combination of Waterfall and Iterative
- Process
 - System Development Life Cycle
 - IBM Rational Unified Process
 - Open Unified Process (Eclipse)
- Tools
 - IBM Rational tools
 - Whole Plan Model
 - Open source
- Project specific process

Quality

- Major developments after World War II
 - Deming, Juran, Crosby
- Japan took the lead, the U.S. focus started in the Eighties
- Total Quality Management (TQM)
 - Principles: leadership, customer satisfaction, measurement
- Quality management systems
 - ISO 9001 2000
 - Say what you will do, do what you say
 - Six Sigma
 - 3.4 defects per million
 - Capability Maturity Model Integration (CMMI)
 - Software Engineering Institute (SEI), at Carnegie Mellon U
- Malcolm Baldrige Award
 - U.S. Department of Commerce, strategic focus

What is quality ?

- Goodness
- In the eye of the beholder
- I know it when I see it

- Conformance to requirements
- Meets customer business needs

Software quality management

- The goal is defect free software that meets the needs of the customer
- Quality management system
 - set of processes and procedures for implementing quality
 - set of measures for determining whether you've met your standards
- Quality characteristics
 - Measureable characteristics to evaluate quality
- Quality management plan
 - organization-wide description of how you plan to approach quality

Defects

- Defect is a failure to conform to requirements
- Defect prevention is key
- Defect detection and resolution
 - defect removal is more costly in each subsequent phase than the previous phase
 - design, coding, testing, etc.
- Cost of defect removal
 - Getting to zero defects may kill a project

Software testing

- Test planning
 - Test plan
 - Traceability
 - Workflow activities
 - Entry and exit criteria
 - Queries and reports
- Testing
 - Version control
 - Test, report problems, add fixes, retest
 - Performance and security testing
- Test management
 - Earned value management
- Testing is not quality in itself

Development and testing techniques

- Code Coverage Analysis
 - Emma
 - jTest

- Code Inspection processes/techniques
 - Fagan code inspection process
 - Function points

- Static testing
 - Manual or use of tools

- Beta Testing

Software testing tools

- Visual Studio Team Systems test tools
- Open source tools – JUnit, NUnit
- IBM Rational tools
 - process best practices.
 - managing requirements and use cases.
 - defect and change management.
 - manage the test planning, test design, test implementation, test execution, and results analysis.
 - manual test authoring and execution tool.
 - GUI test automation tool
 - automates performance testing.
 - source code control system.

Experience - recent project

- “Cannot do inspections because it will delay the schedule”
- A problem occurred that defied resolution for more than 15 weeks
 - Constant round of retesting
 - Clerical error in source code that would have been found if an inspection had been done
- There is always time to delay the schedule during final testing if critical problems continue to be found.
- The project was delivered a year late.

Summary

- Focus on implementing quality into the development
- Specify a process that works for your project
- Make the process work for you, do not work for the process

Arizona Information Technology Skills Training Initiative (AITSTI)

January 14, 2009

AITSTI Quality assurance training

- **Sponsored by the U.S. Department of Labor**
- **Implemented by the Arizona Department of Commerce**
- **Developed by IBM**
- **Offered by Business and Industry Institute of Mesa Community College**
 - **1st class piloted in Fall 2007**
 - **All 4 classes offered in Spring 2009**

Software development excellence

- **Processes**
 - Industry standard software development life cycle
- **Best practices**
 - World-class IBM software quality process
- **Techniques**
 - Developed, refined, and used by IBM software development organization
- **Tools**
 - Rational tools

On-line classes

- **No physical classroom attendance**
- **Virtual environment**
 - Asynchronous component
 - Class content and lessons on CD-ROM – no Internet connection required
- **Two hour electronic discussion session**
 - Synchronous component
 - Weekly review of homework assignments and for answering questions
 - Students attend from wherever they have an Internet connection

Four courses

- **Software Quality**
 - Introduces the methods used to achieve bug free software during implementation.
- **Engineering Quality in Software Development**
 - Covers advanced concepts in designing software to avoid problems later
- **Testing in Software Quality Assurance**
 - Completes the software life cycle by showing how to verify that the software is stable and meets requirements.
- **Testing Software Using IBM Rational Functional Tester (RFT)**
 - Provides hands-on experience on how to use a popular testing tool.

Importance of software testing

- **"Testing has evolved into a critical software engineering discipline with it's own distinct practices, tools, and challenges. Companies have entire organizations dedicated to software testing and quality assurance."**
- **"Graduates skilled in this discipline significantly increase their own marketability."**

**Scott Loveland, Chief Architect, IBM Customer Test,
IBM Systems and Technology Group**

Organizational advantages

- **Cost of not testing (Kan, 1989)**
 - Defects uncovered after release may cost as much as 90 times as much as those uncovered during design/coding
 - Defects uncovered during testing can reduce the cost by a factor of 7
- **Classes can be taken during non-working hours**
- **Each class is worth 3 credits and enhances employee worth**
 - Qualifies for tuition reimbursement
- **Cost of classes is dramatically lower than most other training opportunities**
 - \$71 per credit hour vs hundreds of dollars or more

Target audience

- **These courses are excellent for**
 - **Beginning SQA professionals**
 - **Developers**
 - **Project managers**
 - **People looking to broaden their software testing knowledge**
- **Also can be used to transfer credits to ASU Polytechnic Campus**

Software test career opportunities

- **The average salary of software testers with three to six years of experience is near \$85,000 per year¹**
- **Highest paid at \$130,000 per year¹**
- **Students who participate in this world class education program are well positioned to develop lucrative career opportunities.**
- **Those with a Community College education can hope to start around \$35,000 - \$40,000 a year and earn significant increases with additional education and work experience¹**

¹ According to 2004 Department Of Labor statistics

Software testing occupations

- **General Testing**
- **Functional Tester**
- **Performance Tester**
- **Integration Tester**
- **Regression Tester**
- **System Tester**
- **Test Team Lead**
- **Test Manager**
- **Test Architect**

Software development occupations

- **General Software Development**
- **Builder/Packager**
- **System Programmer**
- **System Developer**
- **Application Developer**
- **Software Designer**
- **Software Debugger**
- **Software Architect**
- **User Interface Developer**
- **Database Developer**
- **Software Integrator**
- **Development Tools Developer**
- **Senior/Chief Programmer**

Sample of CD-ROM course content

Course Window

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Arizona Information Technology Skills Training Initiative

Module 7: Principles of GUI Test Automation

Main Menu > Lesson 1: Introduction to Automated GUI Testing

Home Index Help

The Cost of GUI Test Automation

Overview Learn In Depth Checkpoint

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GUI test automation is not free in terms of people's time or effort. It cannot be done on a lunch break or in a team member's spare time. In order to reap the benefits of automation you need to dedicate the time necessary to build an automation framework and then use the framework to facilitate writing tests.

As you begin your automation development project, you will likely need to make a significant investment in education for your team. Your team needs to understand how the automation tool works, how the automation framework is structured, how to write and execute tests, and what to do when the automation breaks.

The cost of beginning a GUI test automation project is steep. It is typical to see no return on investment (ROI) on the first product release. The best idea is to deploy the automation incrementally in order to build in some short term gains while continuing to build a stable and robust framework for the long term.

Cost of GUI Automation

Cost

ROI

Training and planning

Code maintenance

Product Releases (Time)

Back Next

Open Notebook

Done

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Certifications

■ Industry certification

- A new IBM Certification – “**IBM Certified Specialist - Software Quality**” is now available and details can be found at
- <http://www.azworkforceconnection.com/azit> under the IBM Certification section.

■ Certificate of Completion

- A Certificate of Completion in **Software Quality Assurance** is being developed at Mesa Community College

Course delivery

- **Eliminate – available free of cost**
- **Class Content on CD-ROMs**
- **WebCT/Blackboard Learning Management System**
- **MyMCC Portal**
- **Textbook**

Registration Information

Software Quality CIS246.

Engineering Quality in Software Development CIS248.

Software Testing for Quality Assurance CIS249.

Testing SW Using RFT – Special Projects CIS298AC

Section #	Start/End Date	Time	Day	Credits	Tuition
CIS246 #53120	1/19/2009 - 3/13/2009	--	T	3	\$213
CIS248 #53124	3/23/2009 - 5/15/2009	7-9 p.m.	T	3	\$213
CIS249 #53127	3/23/2009 - 5/15/2009	7-9 p.m.	W	3	\$213
CIS298AC #53128	3/23/2009 - 5/15/2009	TBD	TBD	3	\$213

Web site

<http://aitsti.bii.maricopa.edu/homepage/>