

5/16/2007 1:45:00 PM

"MODULAR TEST CASE DESIGN:THE BUILDING BLOCKS OF REUSABLE TESTS"

Shaun Bradshaw Questcon Technologies, A Division of Howard Systems Intl.

> International Conference On Software Test Analysis And Review May 14-18, 2007 Orlando, FL USA

Shaun Bradshaw

Shaun Bradshaw joined Questcon Technologies, an IT firm specializing in Quality Assurance and Software Testing consulting in 1998. As the director of quality solutions, he works with dozens of clients in various industries, advising, teaching, and mentoring them on the use of effective testing and test management techniques such as modular test case design, test metrics, the S-Curve, and the Zero Bug Bounce. Shaun is the coauthor and editor of the QuestAssured® Service Methodologies, as well as the primary creator of the methodology training classes offered by Questcon. He has been a featured speaker at local and national QA and Testing conferences including Software Testing Analysis & Review (STAREAST), Quality Assurance Institute (QAI), Software Test & Performance Conference and PSQT.

Shaun received his B.S. in Information Systems with a minor in Computer Science from the University of North Carolina at Greensboro.

Shaun Bradshaw, Director of Quality Solutions Questcon Technologies, a division of Howard Systems International 1429 Westover Terrace Suite A Greensboro, NC 27408

Phone: 336-273-2428 x6399 Fax: 336-273-2413 Email: *sbradshaw@questcon.com*

Quality - Innovation - Vision



Modular Test Case Design:

The Building Blocks for Reusable & Maintainable Tests

Presented By: Shaun Bradshaw & David Dang Questcon Technologies

May 16, 2007



Objectives

The primary objective of this presentation is to discuss how to create modular test cases based on the analysis of available requirements, designs, and prototypes. Attendees will learn about:

- The key differences between procedural and modular test cases
- Analyzing requirements, designs, and the AUT to generate modularized tests
- Developing modular test cases and constructing test scenarios using skeleton scripts
- Utilizing and passing data in the modular test cases
- Converting manual modular tests to automated modular tests



Modular Test Case Design IESTCO Slide 3

The Modular Test Case Methodology



Many manual testers are not familiar with modular test case design. In fact, when you mention modular approaches to them, they are more likely to think about a software development process or test automation framework, but it is just as valid for manual testing as either of those.



Definition

Modular test case design is a function-based method of test design, which allows testers to categorize functionality to be tested into reusable "modules".

- Common modules found in most applications include:
 - Login/Logout
 - Register
 - Create Records/Data

- Search
- Help
- Confirmation
- Using this approach increases maintainability of test suites by reducing the steps/procedures written in each test case.
 It reduces or eliminates the redundancy and confusion often seen in procedural test cases.



Examples

Google

- Search
- Web Results
- Map Results



1.27 11/1

Examples

Yahoo! Mail

- Sign In/Login
- Sign Up/Register
- Help

Inter-(Inter-varios com/(Uss/yahos/edd) Inter-(Inter-varios com/(Uss/yahos/edd) </th <th>Edit View Favorites Iools Help</th> <th></th> <th></th> <th></th>	Edit View Favorites Iools Help			
The state of the state	Back 🔹 🕥 🗉 🛋 🛃 🏠 🔎 Search 🤶 Favorit	es 🚱 🍃 🌺 🔜 🔜 🦓		
Yahool Mail Search Search Image: Search Account Info Home - Help Search Account Info Home - Help Yahool Sign-in and Registration Help Yahool Sign-in and Registration > Yahool Sign-in and Registration Help Yahool Sign-in and Registration > Yahool Sign-in and Registration Help What if the text or picture at the top of the sign-in box? • What if the text or picture at the top of the sign-in box? • What if the text or picture at the top of the sign-in box? • What if the text or picture at the top of the sign-in box? • What if the text or picture at the top of the sign-in momber to recover my password? • How can Itelli if will be able to use my credit card number to recover my password? • How do I change my password?	ss 截 http://help.yahoo.com/l/us/yahoo/edit/			
Constraints of the Second	<u>Yahoo! MyYahoo! Mail</u>		Search Search	
Yahool Sign-in and Registration Help Yahool Sign-in and Registration > Yahool Sign-in and Registration Help Yahool Sign-in and Registration > Yahool Sign-in and Registration Help What is the text or picture at the top of the sign-in box? What if I forgot my password or Yahool ID? What if I forgot my password? How do I change my password? How do I close my account? Ner Help Links Sign-in and Registration Help Marketing Preferences Help About alternate email addresses Changing Users or Locations Marketing Preferences Help Nater Papeline Sign-in and Registration Help About alternate email addresses Changing Users or Locations Marketing Preferences Help Privacy Policy Market Papeline Nater Yahool Your Home Page		_	Account Info Home - Help	
Yahoo! Sign-in and Registration Help Yahoo! Sign-in and Registration > Yahoo! Sign-in and Registration Help Exponentiation What is the text or picture at the top of the sign-in box? What if I forgot my password or Yahoo! ID? What if I forgot my password? How do I change my password? How do I close my account? Verifying Your Alternate Email Addresse Nate Help Links Sign-in and Registration Help Sign-in and Registration Help Marketing Preferences Help Security Center Privacy Policy Marke Yahoo! Your Home Page		P		
Yahool Sign-in and Registration > Yahool Sign-in and Registration Help Top Questions • What is the text or picture at the top of the sign-in box? • What if I forquit my password or Yahool Di? • How can Itell if will be able to use my credit card number to recover my password? • How do I change my password? • How do I close my account? More Help Links • Sign-in and Registration Help • Si	Yahoo! Sign-in and Registration F	lelp		
Top Questions • What is the text or picture at the top of the sign-in box? • What if I forgot my password or Yahoo! D? • How can itell if i will be able to use my credit card number to recover my password? • How do I change my password? • Signini and Registration Help	Yahoo! Sign-in and Registration > Yahoo! S	ign-in and Registration Help		
Top Questions Ask Yahoo! Sign-in and Registration Help • What is the text or picture at the top of the sign-in box? • What if I forgot my password or Yahoo! ID? • How can Itell if I will be able to use my readition and card number to recover my password? • Ask Yahoo! Sign-in and Registration Help • How do I change my password? • How do I change my password? • Ask • How do I close my account? Registration and account setup information Yahoo! ID and Password • How do I close my account? Verifying Your Alternate Email addresses Yahoo! ID and Password • Sign-in and Registration Help • Marketing Preferences Help • About alternate email addresses Privacy, security and your sign-in seal • Security Center • Account options for users and locations Ouestion not answered here? Try Yahoo! Help Central • Privacy Policy • Make Yahoo!Your Home Page • Make Yahoo!Your Home Page • Privacy • Privacy				
 What is the text or picture at the top of the sign-in box? What is file text or picture at the top of the sign-in box? What if forgot my password or Yahoo! ID? How can Hell if i will be able to use my credit card number to recover my password? How do I change my password? How do I close my account? Registration and account setup information and account setup information and password More Help Links Sign-in and Registration Help Marketing Preferences Help Security Center Privacy Policy Make Yahoo! Your Home Page 	Top Questions	Ask Yahoo! Sign-in and R	egistration Help	
What if forgot my password or Yahoo! ID? Ask How can Iteli if I will be able to use my credit card number to recover my password? Ask How do I change my password? Registration and account setup information Yahoo! ID and Password Working with your Yahoo! ID and password How do I close my account? Yerifying Your Alternate Email Adout alternate email addresses Yahoo! ID and Password Privacy, security and your sign-in seal More Help Links Sign-in and Registration Help About alternate email addresses About alternate email addresses Ouestion not answered here? Try Yahoo! Help Central locations Marketing Preferences Help Security Center Changing Users or Locations Account options for users and locations Ouestion not answered here? Try Yahoo! Help Central	 What is the text or picture at the top of the sign-in hov? 	Enter your inquiry as a question or phras	5e.	
Yahoo! ID? How can Itell if I will be able to use my credit card number to recover my password? Example: How do I request help? - Tips How do I change my password? Registration and account setup information Yahoo! ID and Password How do I close my account? Working with your Yahool ID and password Protecting Your Account Privacy, security and your sign-in seal More Help Links Sign-in and Registration Help Marketing Preferences Help Security Center Changing Users or Locations Account options for users and locations Ouestion not answered here? Try Yahool Help Central	What if I forgot my password or		Ask	
• How can refur thill be able to use my credit card number to recover my password? Registration Registration and account setup information Yahoo! ID and Password Working with your Yahool ID and password • How do I close my account? Verifying Your Alternate Email Address About alternate email addresses Protecting Your Account Privacy, security and your sign-in seal More Help Links Sign-in and Registration Help Marketing Preferences Help Security Center Changing Users or Locations Account options for users and locations Ouestion not answered here? Try Yahool Help Central	Yahoo! ID?	Example: How do I request help? - Tips		
password? Registration Yahoo! ID and Password How do I change my password? Registration and account setup information Working with your Yahoo! ID and password How do I close my account? Verifying Your Alternate Email Address Protecting Your Account Privacy, security and your sign-in seal More Help Links Sign-in and Registration Help Protecting Your Account Address Sign-in and Registration Help Changing Users or Locations Account options for users and Iocations Ouestion not answered here? Try Yahool Help Central Iocations	 How can I tell IT I will be able to use my credit card number to recover my 			
How do I change my password? How do I close my account? How do I close my account? Verifying Your Alternate Email Address More Help Links Sign-in and Registration Help Marketing Preferences Help Security Center Privacy Policy Make Yahool Your Home Page Privacy Policy Make Yahool Your Home Page	password?	Registration	Yahoo! ID and Password	
Verifying Your Alternate Email Address Protecting Your Account Privacy, security and your sign-in seal More Help Links About alternate email addresses • Sign-in and Registration Help • Marketing Preferences Help • Security Center • Privacy Policy • Make Yahool Your Home Page Protecting Your Account Privacy, security and your sign-in seal	 How do I change my password? How do I close my account? 	information	password	
Address Privacy, security and your sign-in seal More Help Links About alternate email addresses • Sign-in and Registration Help • Marketing Preferences Help • Security Center • Privacy Policy • Make Yahool Your Home Page Changing Users or Locations Account options for users and Iocations Question not answered here? Try Yahool Help Central Iocations		Varifying Your Alternate Email	Protecting Your Account	
More Help Links About alternate email addresses • Sign-in and Registration Help • Marketing Preferences Help Changing Users or Locations • Security Center Account options for users and locations • Privacy Policy Iocations • Make Yahool Your Home Page		Address	Privacy, security and your sign-in seal	
Sign-In and Realistration Help Marketing Preferences Help Security Center Privacy Policy Make Yahool Your Home Page	More Help Links	About alternate email addresses		
Account options for users and Try Yahoo! Help Central Iocations Make Yahoo! Your Home Page	Sign-in and Registration Help Marketing Preferences Help	Changing Users or Locations	Question not answered here?	
Privacy Policy Iocations Make Yahool Your Home Page	Security Center	Account options for users and	Try Yahoo! Help Central	
Make Yahool Your Home Page	Privacy Policy	locations		
	 <u>Make Yahoo! Your Home Page</u> 			
	More Help Links • Sign-in and Registration Help • Marketing Preferences Help • Security Center • Privacy Policy • Make Yahool Your Home Page	About alternate email addresses <u>Changing Users or Locations</u> Account options for users and locations	Question not answered here? Try Yahoo! Help Central	
	Copyright © 2007 Yahoo! Inc. Al	I rights reserved. <u>Privacy Policy</u> - <u>Terms of Service</u> -	Copyright/IP Policy - Ad Feedback	
Copyright © 2007 Yahoo! Inc. All rights reserved. Privacy Policy - Terms of Service - Copyright/IP Policy - Ad Feedback				
Copyright © 2007 Yahoo! Inc. All rights reserved. <u>Privacy Policy</u> - <u>Terms of Service</u> - <u>Copyright/IP Policy</u> - <u>Ad Feedback</u>				
Copyright © 2007 Yahoo! Inc. All rights reserved. <u>Privacy Policy</u> - <u>Terms of Service</u> - <u>Copyright/IP Policy</u> - <u>Ad Feedback</u>				ternet

UESTCON

Pros & Cons

Pros

- Increases reusability
- Provides consistent look and feel to test procedures
- Decreases maintenance
- Compliments business-driven focus of IT
- Utilizes data abstraction

Cons

- Longer lead time to design & develop
- More intricate knowledge of the AUT is required
- Different way of thinking about testing (NOT a linear approach)
- Greater learning curve to become proficient at it
- Data abstraction



Case Studies

- Major lending institution was spending too much in manual test case maintenance
- Suggested they utilize modular test approach for manual and automated testing
 - 830 manual procedural test cases and converted to 53 test modules
 - Automated 670 of the test cases
- Major federal financial institute wanted to automate functional and regression testing
- Implemented an automation framework using a modular approach
 - Consolidated 5500 use cases into 1500 test cases
 - Created 31 automation modules that generated 1200 automated test cases (300 tests remained manual)

Test Analysis for Modular Designs



Test Analysis

Requirements & Design Analysis

- Understand branching of the application: modules, windows, or pages
- Identify the workflow of the application
 - In procedural tests you can learn this as you execute the test
 - In modular tests you need to understand the branching/paths upfront to understand which modules need to be created
- Consider if some objects are repeated on a page or across pages
- Establish rules on when a module should be created:
 - New screen
 - New page
 - Repeated objects
 - Combine multiple simple screens and pages (links only or limited functionality or branching)



Data Abstraction

<u>Utilizing Variables</u>

Consumable data – must be changed for each test execution

- Dates, primary key data, account number, SSN
- Cannot be hard-coded; should use an algorithm to change for each test
- Fixed data data that can be reused across multiple test cases & executions
 - Address, name, search term, amount

Passing Variables

- Understand, upfront, how data will move through a test (from module to module)
- What are inputs to modules; what are outputs from modules
- Need data conventions to identify:
 - Where the data originated (which module)
 - Which module produced the output data



Modular Test Templates

Modular tests are made up of two distinct types of test cases

Modules

Module	Name	<modulename< th=""><th>></th><th></th></modulename<>	>	
Availab	le Input Variables	<var1> <var2> <var3> (option <var4> (option</var4></var3></var2></var1>	al) al)	
Step ID	Procedure		Input Variables	Expected Results/Outputs
1	<procedural 1="" step=""></procedural>		<var x=""></var>	<expected result=""></expected>
2	<procedural 2="" step=""></procedural>		<var x=""></var>	
3	<procedural 3="" step=""></procedural>		<var x=""></var>	<expected result=""></expected>
4	<procedural 4<="" step="" td=""><td>4</td><td><var x=""></var></td><td><expected result="">, <modname_varout></modname_varout></expected></td></procedural>	4	<var x=""></var>	<expected result="">, <modname_varout></modname_varout></expected>

Skeleton Scripts

Test Ca	se ID	<unique id=""></unique>			
Test Ob	ojective	ctive <purpose of="" test="" the=""></purpose>			
Step ID	Procedure		Input Data	Expected Results	
1	Call <modulename></modulename>		<var>: <value></value></var>	<expected result=""></expected>	
2	Call <modulename></modulename>		<var1>: <value> <var2>: <value></value></var2></value></var1>	<expected result=""></expected>	
3	<procedural if="" necessary="" step,=""></procedural>			<expected point="" result="" validation=""></expected>	
4	Call <modulename></modulename>		<modname_varout>: <value></value></modname_varout>	<expected result=""></expected>	
5	Call <modulename></modulename>		<var>: <value></value></var>	<expected result=""></expected>	
6	<proced< td=""><td>ural Step, if necessary></td><td></td><td><expected point="" result="" validation=""></expected></td></proced<>	ural Step, if necessary>		<expected point="" result="" validation=""></expected>	

Developing & Executing Modular Tests



Procedural Tests

- Explicit steps/procedures are written
- Step/procedure redundancy occurs within and across test cases
- Data abstraction is optional and rarely used

Modular Tests

- Implicit steps/procedures are used via "skeleton scripts"
- Step/procedure redundancy is reduced or eliminated
- Data abstraction is required within the modules



Modular Tests vs. Procedural Tests <

Let's look at an example of a test written in procedural and modular form

- Note that the same test coverage is achieved in both examples
- Requirement: <u>Changing the Time Zone will automatically adjust the date</u> and time displayed in the Date & Time Properties.

Date	ruary			one 2007	Inte		Time
S	М	Т	W	Т	F	S	
				1	2	3	1 i 🥢 i i
4	5	6	7	8	9	10	
11	12	13	14	15	16	17	
18	19	20	21	22	23	24	· · · · · · · · · · · · · · · · · · ·
25	26	27	28				8:41:33 AM
urrent time zone: China Standard Time							



Procedural Test

Procedural Test Case

Test Ob	jective	Verify Time Zones are co Properties.	prrectly set and dis	played, using the Time Zone selection tab on Date & Time
Step ID	Procedure		Input Data	Expected Results
1	Click Sta	irt menu		
2	Hover ov	er Settings		
3	Click Cor	ntrol Panel		
4	Double-c	lick Date and Time		Date & Time Properties window displays
5	Click Tim	ne Zone tab		
6	Change time zone		GMT	
7	Click Apply			Time Zone is set to "GMT Standard Time"
8	Select D:	ate & Time tab		Current Time Zone displayed is "GMT Standard Time"
9	Adjust hours		12	
10	Adjust minutes		00	
11	Adjust seconds		00	
12	Adjust tir	me period	AM	Time displayed is "12:00:00AM"
13	Click Apply			Time is set to "12:00:00AM"
14	Click Time Zone tab			
15	Change time zone		+08:00 - Beijing	
16	Click App	olγ		Time Zone is set to "China Standard Time"
17	Select D	ate & Time tab		Time displayed is: 08:00:00AM (<i>plus execution time</i>) Current Time Zone displayed is "China Standard Time"



Creating & Using Workflows



127711

Modular Test

Modular Test – Skeleton Script

Test Objective Verify Time Zones are correctly set and displayed, using the Time Zone selection tab Properties.			olayed, using the Time Zone selection tab on Date & Time	
Step ID	Procedure		Input Data	Expected Results
1	Call "Acc	ess Date & Time"		Date & Time Properties window displays
2	Call "Adjust Time Zone"		TimeZone: GMT	Time Zone is set to "GMT Standard Time"
3	Call "Adjı	ust Time"	Hours: 12 Minutes: 00 Seconds: 00 TimePeriod: AM	Current Time Zone displayed is "GMT Standard Time" Time is set to "12:00:00AM"
4	Call "Adjust Time Zone"		TimeZone: (+08:00) Beijing	Time Zone is set to "China Standard Time"
5	Select D:	ate & Time tab		Time displayed is: 08:00:00AM (<i>plus execution time</i>) Current Time Zone displayed is "China Standard Time"

Last MI





Modular Test – Modules

Module Name		Access Date &	Time	
Available Input Variables		None		
Step	Proced	ша	Input	Expected Results/Outputs
ID	Trocedure		Variables	Expected Results/Outputs
1	Click Start menu			
2	Hover over Settings			
3	Click Control Panel			
4	Double-click Date a	and Time		Date & Time Properties window displaγs

1.2011

Module Name Adjust Time		Adjust Time Zo	ne	
Availab	de Input Variables	 TimeZone DST (option 	nal)	
Step ID	Procedure		Input Variables	Expected Results/Outputs
1	Click Time Zone tab			
2	Change time zone		TimeZone	
3	Click Apply			Time Zone is set to selected time zone.





Modular Test – Modules

Module	Name	Adjust Time		
Availab	le Input Variables	 Hours Minutes Seconds TimePeriod 	ļ	
Step ID	Procedure		Input Variables	Expected Results/Outputs
1	Select Date & Time	:tab		Current Time Zone and time are displayed
2	Adjust hours		Hours	
3	Adjust minutes		Minutes	
4	Adjust seconds		Seconds	
5	Adjust time period		TimePeriod	New time is displayed
6	Click Apply			New time is set

Lastalli

Module	Name	Adjust Date		
		 Month 		
Availab	le Input Variables	 Year 		
		• Day		
Step ID	Procedure		Input Variables	Expected Results/Outputs
1	Select Date & Time	:tab		Current Month, Day and Year are displayed
2	Adjust Month		Month	
З	Adjust Day		Day	
4	Adjust Year		Year	
5	Click Apply			New date is set

Automated Modular Test Cases



Slide 22

Transitioning to Test Automation

Utilizing a manual modular test approach has many benefits, which reduce the effort required to transition to an automated modular test approach:

- Most of the modularization analysis used to create the manual tests will apply to the automated tests
- Data analysis and abstraction for inputs (and many outputs) easily transfers from the manual tests to automated tests
- The concept of test modularization is spread across the entire test team (not just for the test automation team anymore)
- It is easier to maintain a logical separation between technical automation engineers (who create and maintain the automated scripts) and manual testers (who understand the business and use the test scripts)



Data Utilization & Reuse

Minimizing manual intervention of test automation requires special consideration of how data is handled

- Data Setup
 - Create new input data via automation
 - Query database for input data
 - Refresh test database
- Date Constraints
 - Future Dates
 - Past Dates
 - Aged Data
- Data Uniqueness
 - Social Security Number
 - Account Number
 - Employee Number
 - Other



Additional Test Automation Considerations

Standards

- Coding Standards
- Naming Conventions
- Automation storage location and backup
- Passing data from one module to another

Training

- Automation engineer training
- Manual tester training on the use of the automated modules





Modular test case design is not just for test automation, but can be used to build manual test suites as well.

With a little forethought and extra design work, manual testers can create modular tests and skeleton scripts, which will:

- Increase test reusability
- Reduce test case maintenance time
- Ease the transition to automated testing
- Compliment the business-driven focus of IT



Q&A



1.00011