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Effective Software Testing

Tools and strategies for project success

IBM developerWorks Live!

IBM Rational Software Development Platform

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Agenda

- Business Driven Development
- Test Management
- Code and Unit Testing
- Manual Functional Testing
- Break
- Automated Functional Testing
- Performance Testing
- Wrap Up & Resources

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- **Business Driven Development**
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Software delivery challenges for On Demand Business

On Demand Business focus

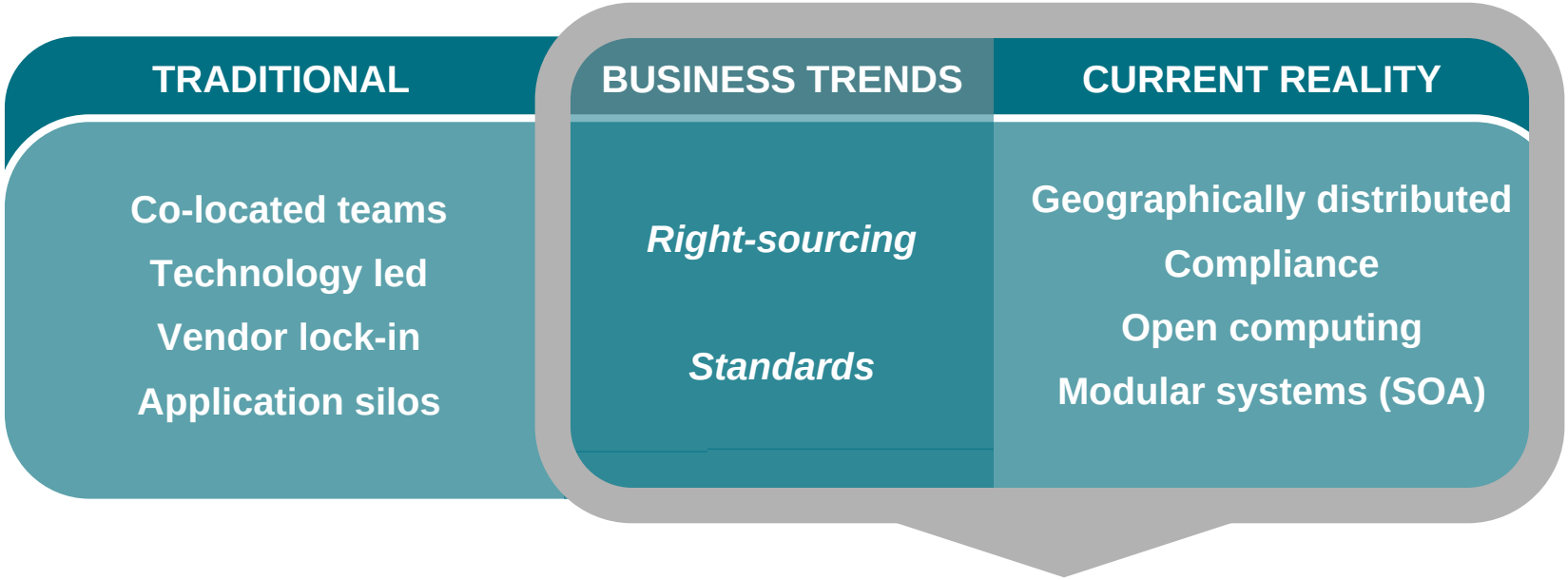
- **Responsiveness** as a key competency
- **Effectiveness** of people as a critical success factor
- **Revenue growth** with cost containment

Software delivery challenges[1]

- Keeping software projects **aligned** with changing business priorities
- Delivering better **business results** within the constraints of current investments and skill sets
- **Effectively managing** business and technical **risk**

[1] *IBM Rational research*

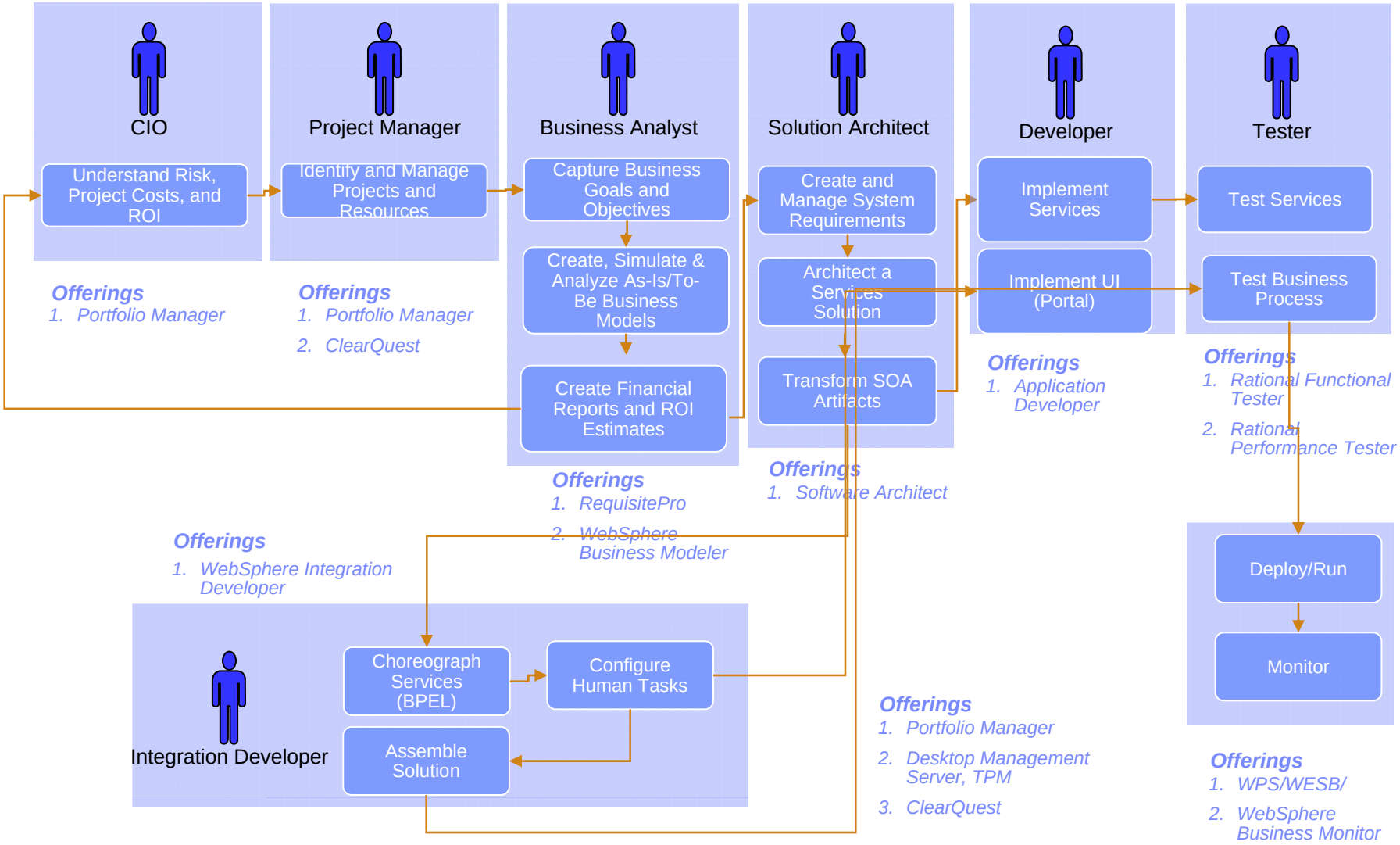
Evolving software and systems delivery



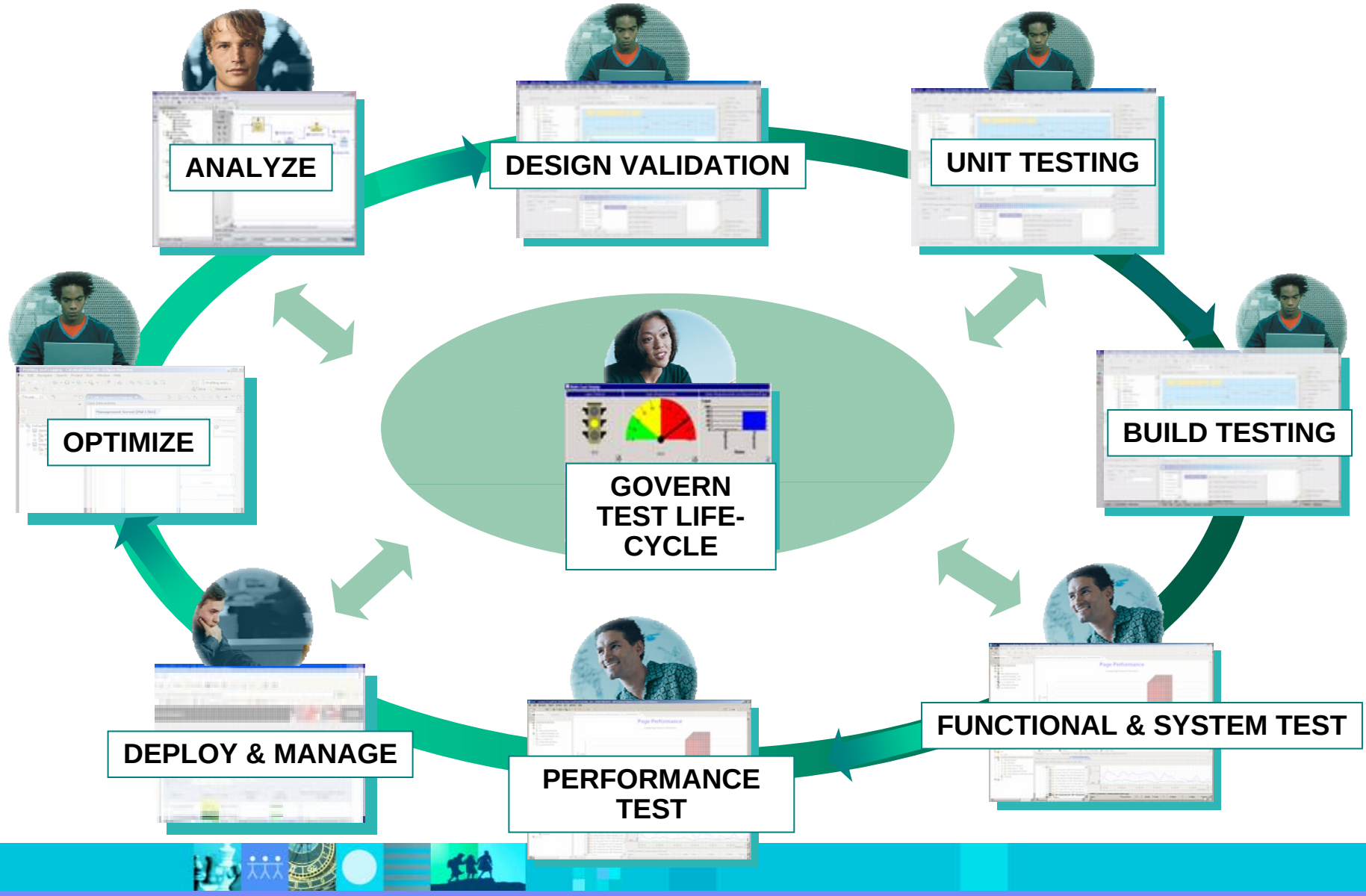
Business Driven Development

Enabling organizations to *govern* the business process of software and systems development

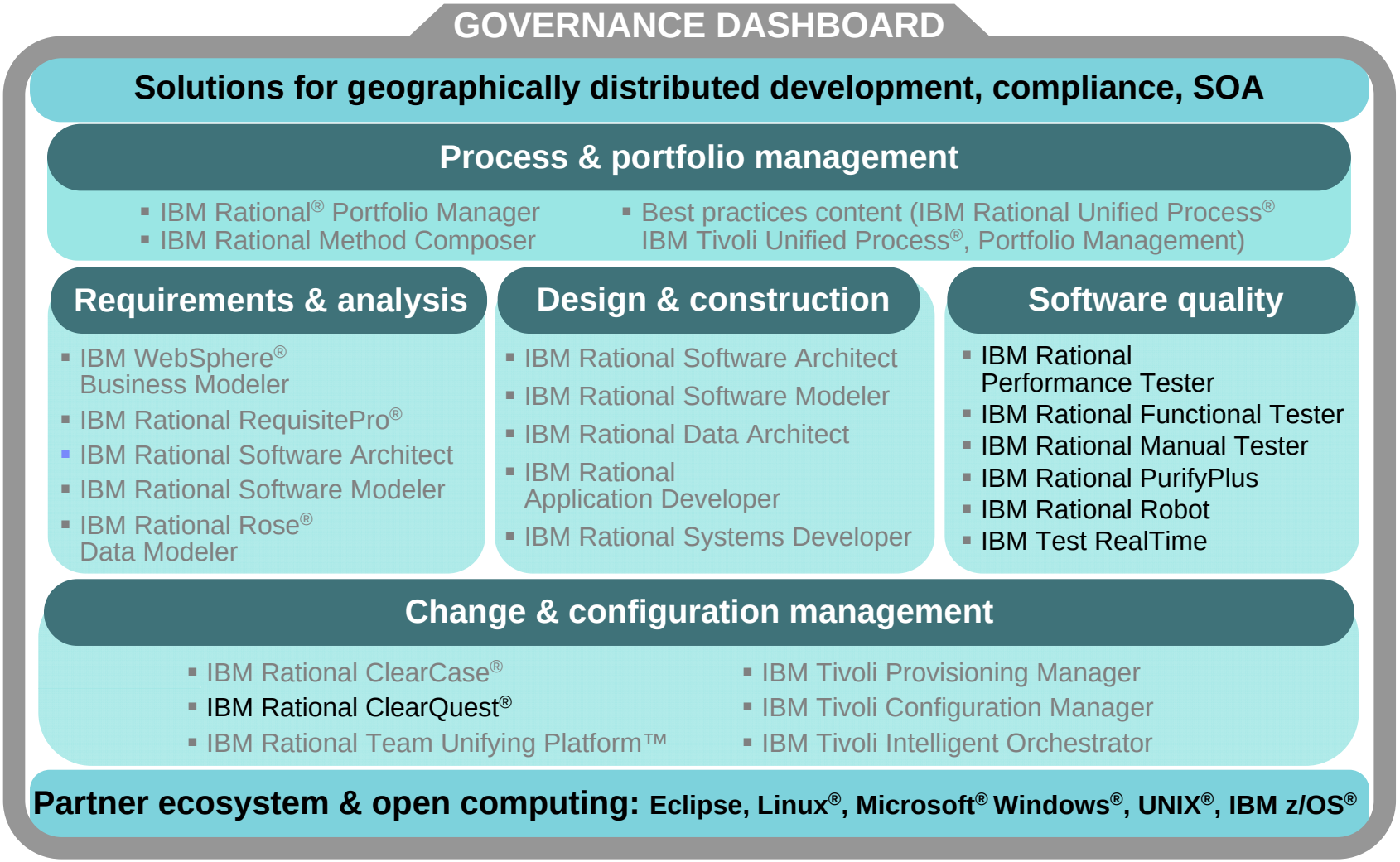
Business Driven Development



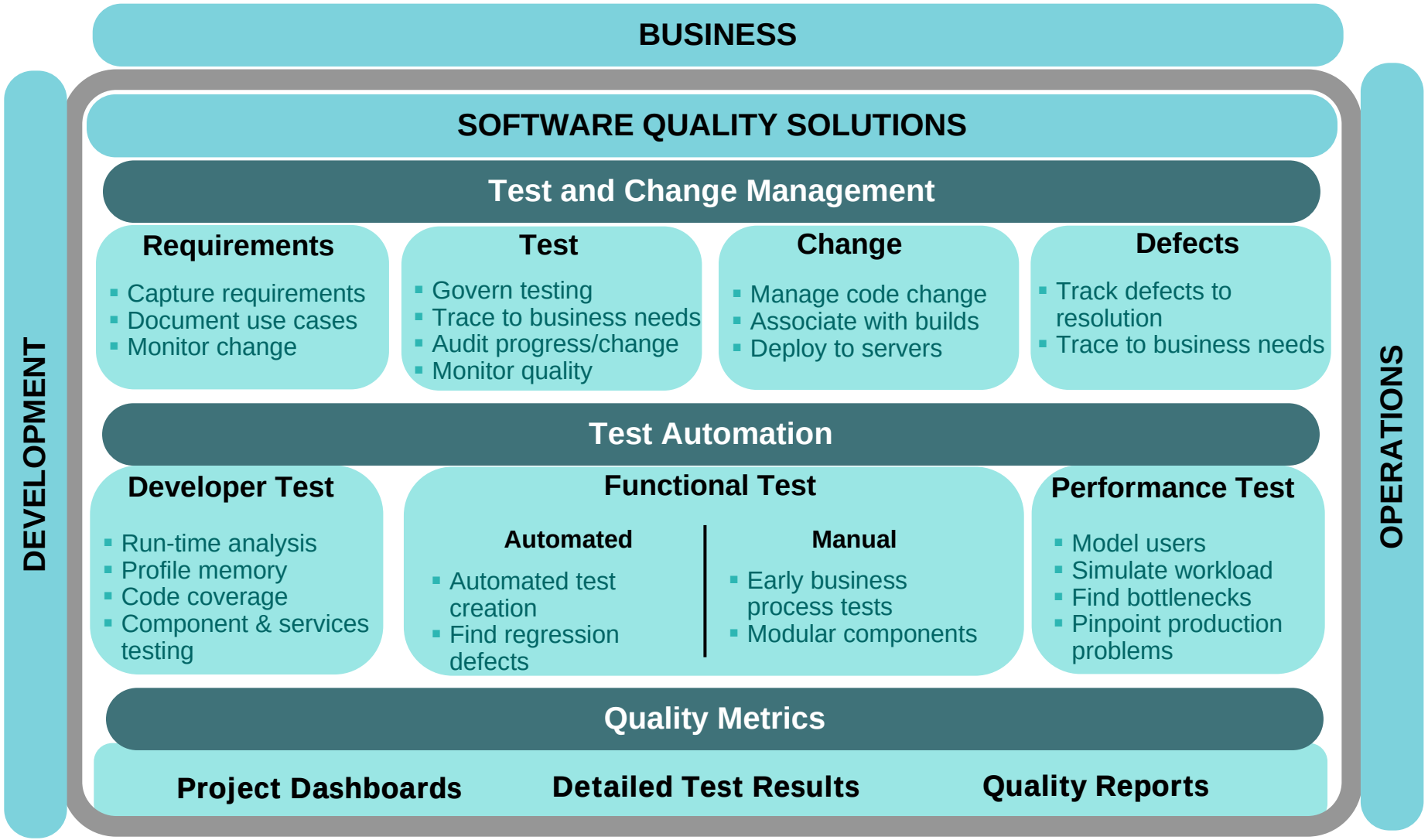
Integrated quality capabilities



Rational Software Delivery Platform



Rational Software Quality Solutions



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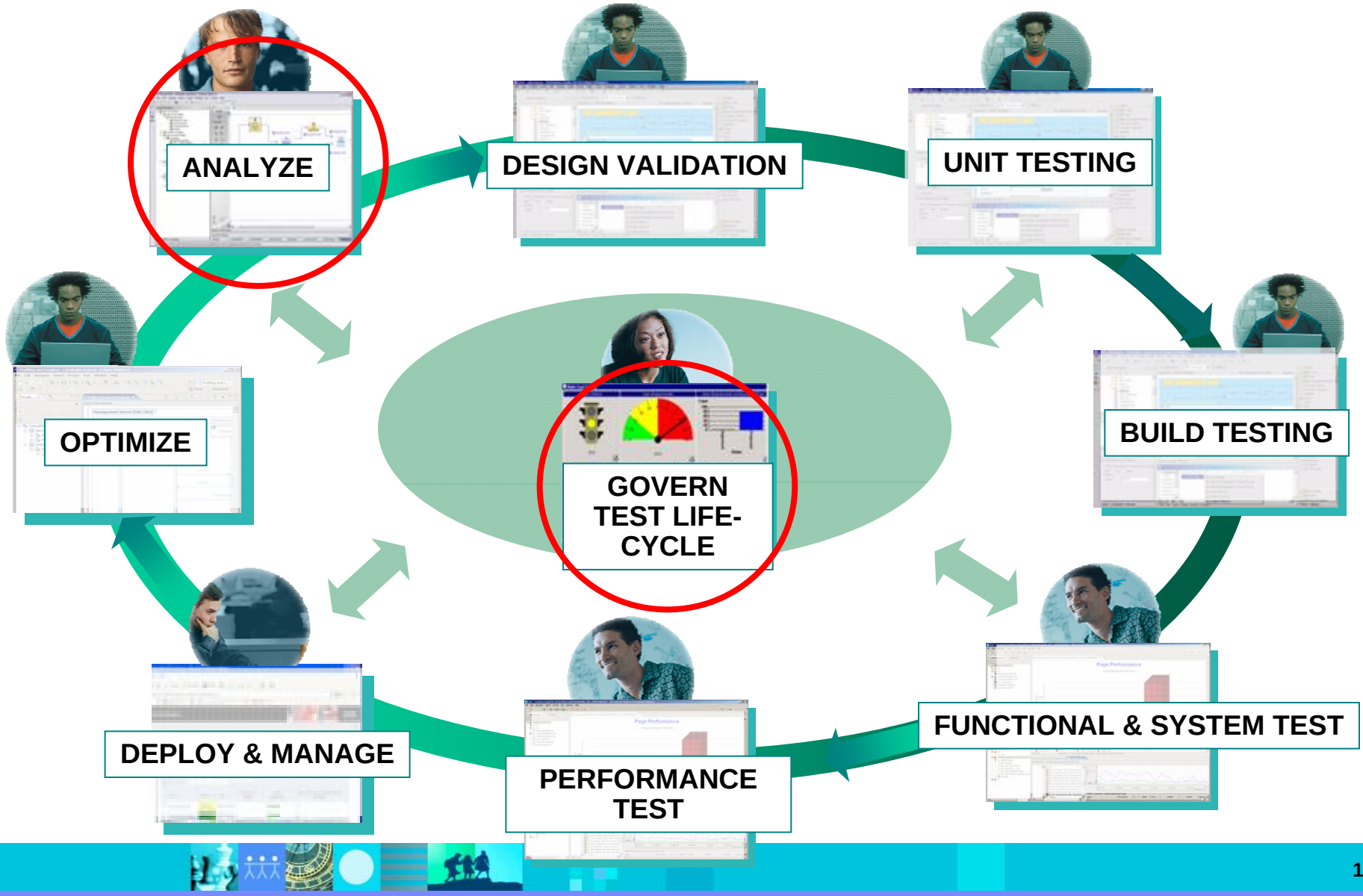


What is Test Management?

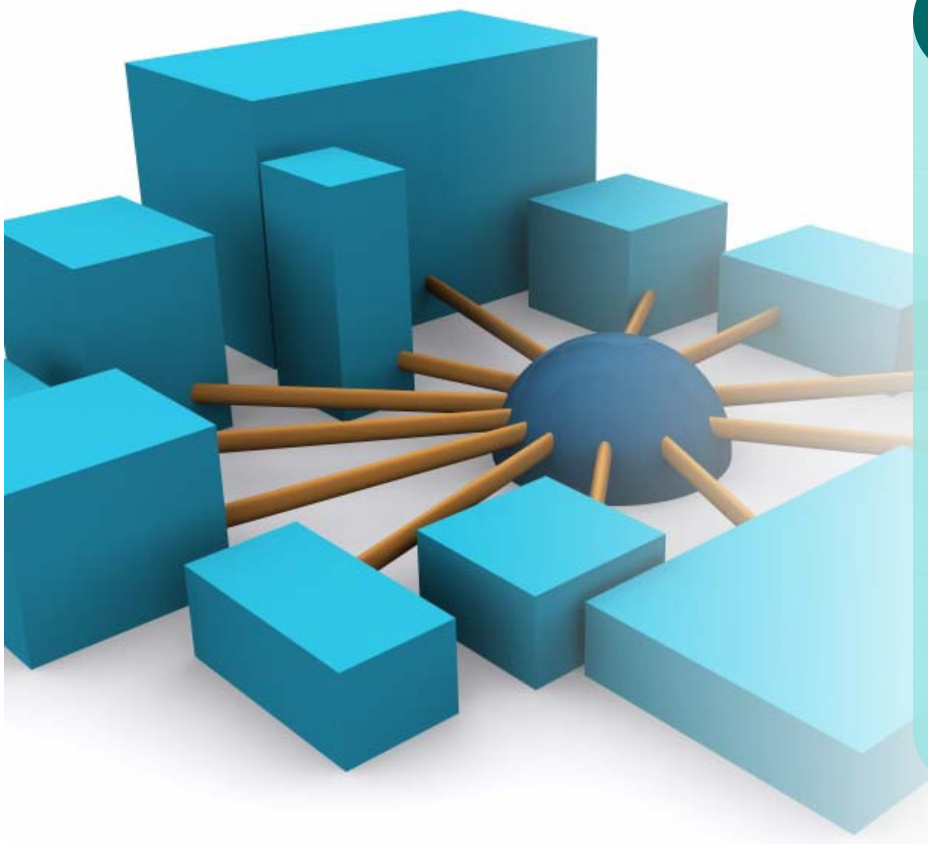
- **Plan Objective**:
  - Organize and maintain an inventory of items to test
- **Create Objective:**
  - Capturing the steps required to complete a given test
- **Execute Objective:**
  - Assembling scripts in sequence to perform a suite of tests
- **Analyze Objective:**
  - Determine current status of testing project

Challenges of Test Management

- **Comprehensive**
  - Keep track of test assets including requirements, test scripts, logs, results and reports
  - Ensure testing addresses the requirements and business use cases
- **Distributed**
  - Accommodate the requirements of both dedicated, independent QA teams as well as integrated project teams and distributed teams to ensure high operational integrity.
- **Extensible**
  - Lower the cost of test lab management
  - Simplify the management of tools from multiple vendors
- **Configurable**
  - Ensure compliance and enforcement of project and company policies
  - Project-specific needs and workflow automation

ClearQuest: The hub for life-cycle management

Govern the test and development process



IBM Rational ClearQuest

Test **Change** **Defects**

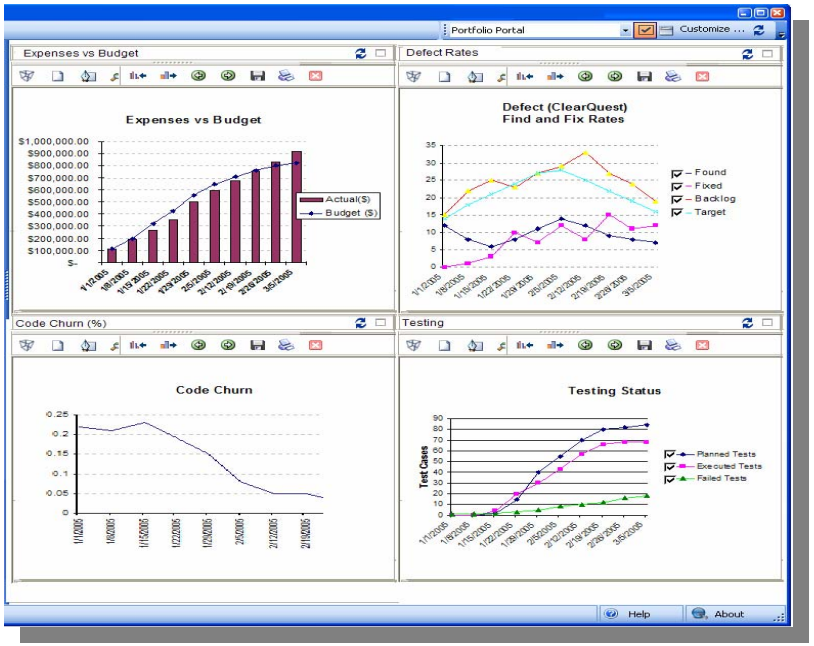
- Single project view
- Global test project coordination
- Configurable, enforceable processes
- Extensible test ecosystem

Single project view

Single solution to manage tests, defects and project change

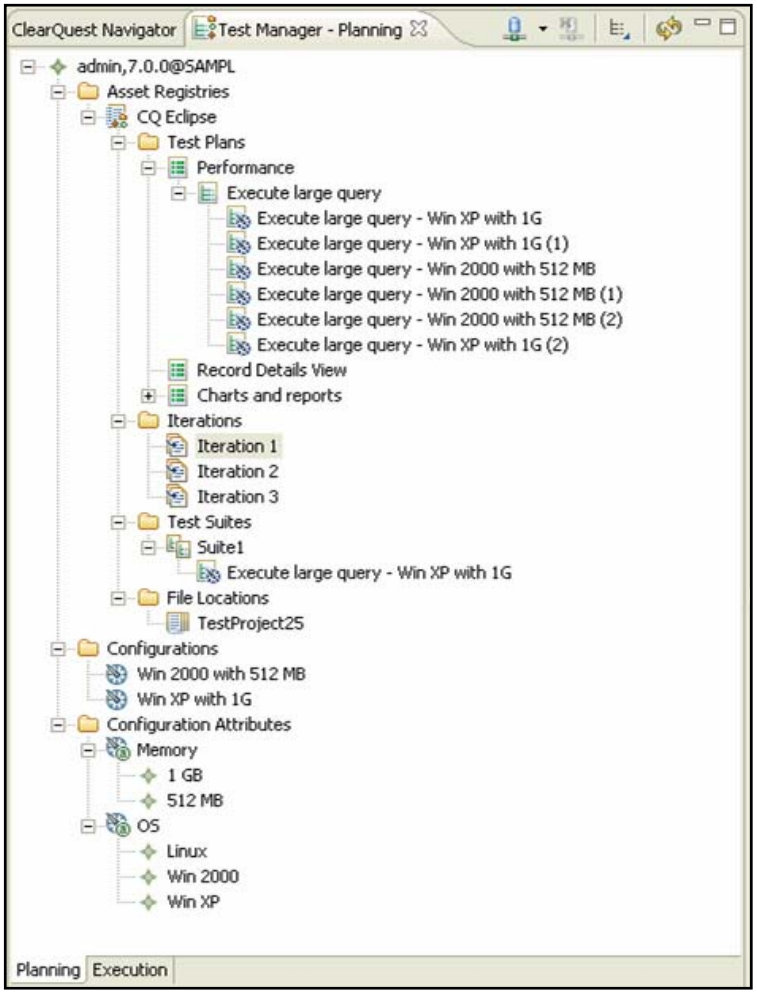
Benefits:

- Consolidated, real-time view of the entire project status
- Traceable, auditable relationships between development, test and project artifacts
  - Manages test planning, test results, quality metrics, and defects
  - Central repository with integrated version control
  - Comprehensive quality metrics in project dashboards and reports
  - Centralized user management



Plan: Enterprise test management & planning

- Manages test planning, test results, quality metrics, and defects
- Link requirements to tests
- Automates sharing and reuse of distributed assets
- Extensible customization of forms and workflows
- Auditable test change history
- e-Signature support
- Supports enterprise-level databases (Oracle, DB2, SQL Server, etc)



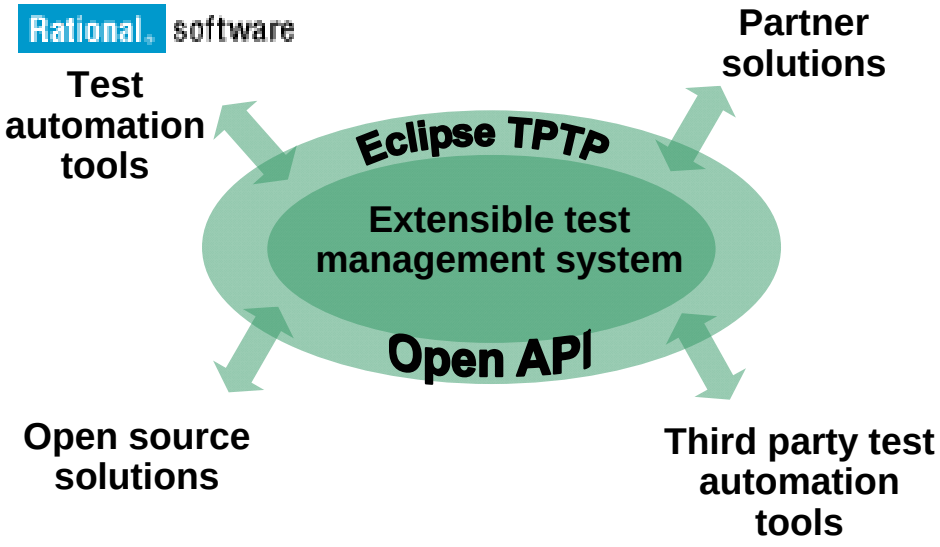
Create and Execute: Extensible test ecosystem

Integrated with Rational, open source and 3rd party test automation tools for Test Execution and Analysis

Benefits:

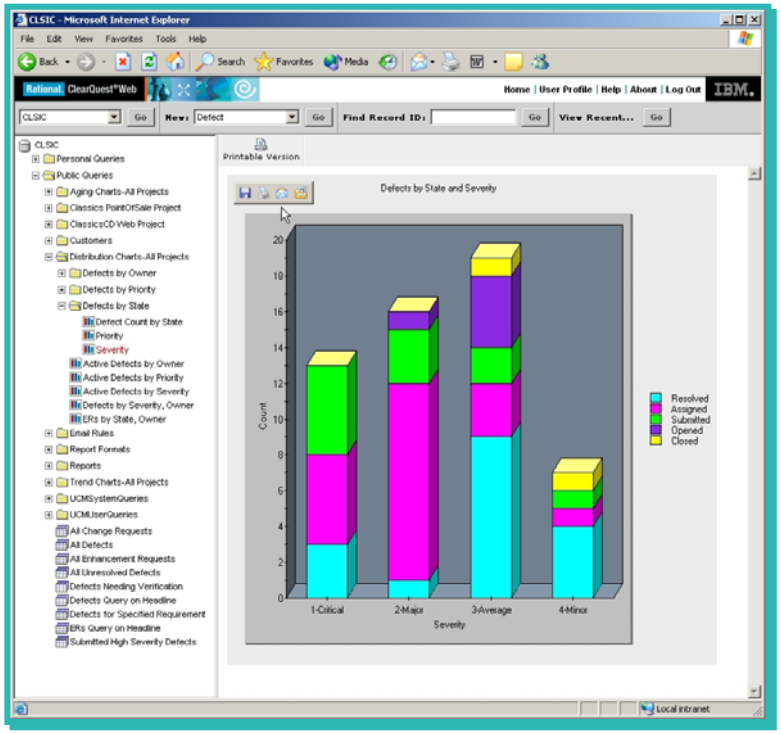
- Lowers the cost of test lab management
- Simplifies the management of tools from multiple vendors

  - Integrated with Rational Functional Tester, Rational Manual Tester and Rational Performance Tester
  - Integrates with SPI Dynamics QAInspect for security testing
  - Partner and customer extensibility
  - Open source plug-ins



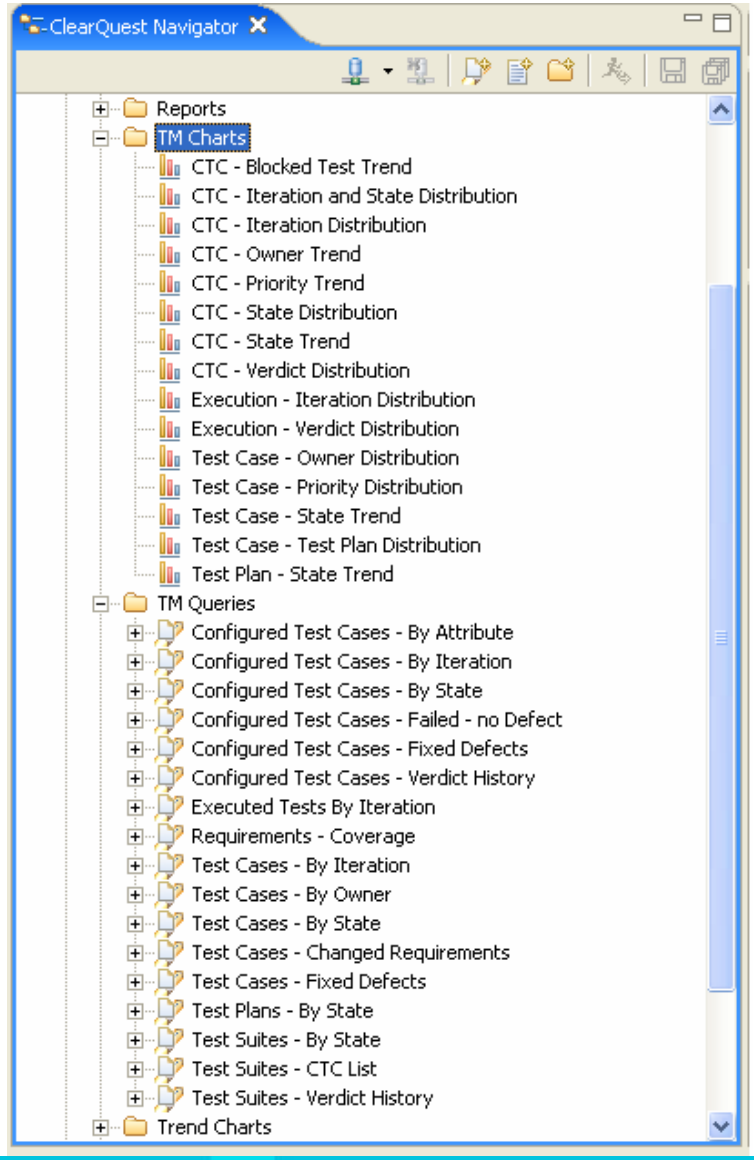
Analyze: Comprehensive quality metrics

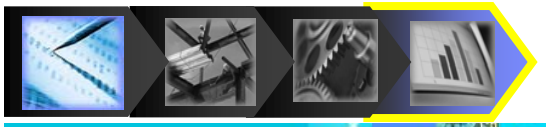
- Generate reports to monitor test progress
  - Run reports to summarize test case results
  - Run reports to measure requirements coverage
- Key considerations when creating schedules
  - Ability to report against test motivators
  - Ability to monitor current project status



Analyze: Test Reporting and Metrics

- **Built-in queries, charts, and reports:**
  - **Coverage/Suspicion**
    - Impact of requirement change on Test Cases
    - Impact of defects change on Test Cases
  - **Status**
    - Planned tests vs. implemented
    - Passed vs. failed in this iteration
    - Failed test cases without attached defect
    - Requirements without any test case defined
  - **Trend over time**
    - # of Test Cases
    - # of Passed vs. Failed Test Cases
- **Link test results to defects and requirements**
- **Web publishing of quality metrics**
- **Build or Customize your own!**





Global project coordination

Distributed and co-located testing and development support

Benefits:

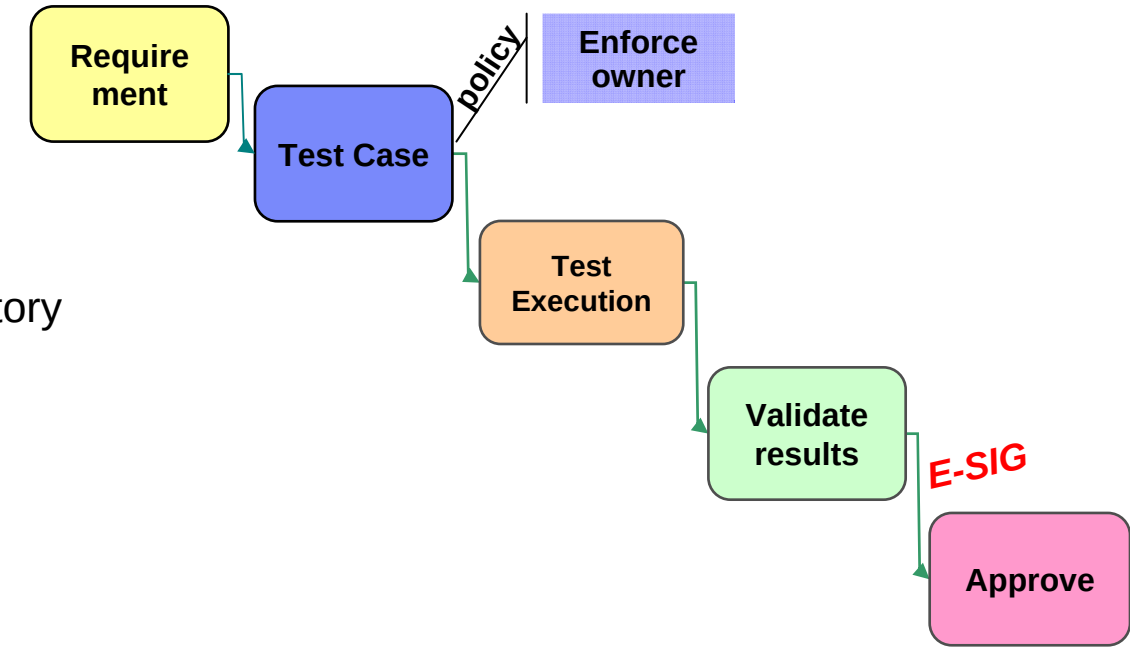
- Ability to leverage globally distributed talent
- Simplifies the complexities of geographically distributed test coordination
  - High scalability for large enterprise projects
  - Web-based test planning and quality metrics reporting
  - Automates sharing and reuse of distributed test assets

Configurable, enforceable process

Customize and enforce your test processes and workflows

Benefits:

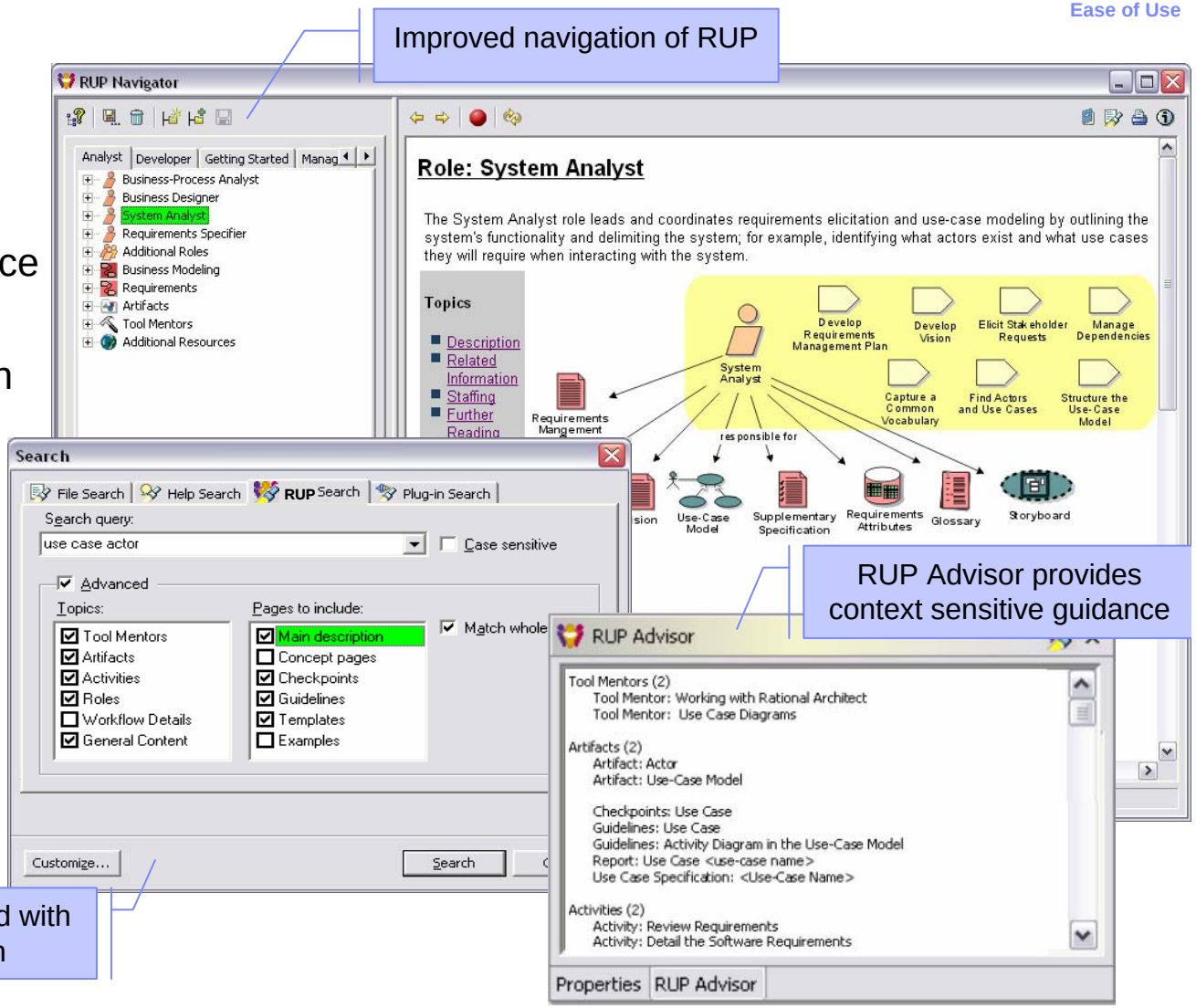
- Ensure compliance and enforcement of project and company policies
- Configurable for project-specific needs and workflow automation
  - Data collection and process customization & enforcement
  - Auditable test change history
  - e-Signature support for regulatory compliance
  - Project security



Process Guidance

Ease of Use

- Integration with Rational Unified Process for Systems Engineering (RUP-SE)
- Tool Mentors provide guidance for activities
- User customizable views with user defined content



What You'll See:

- Test Planning with IBM Rational ClearQuest
- Test plan creation and analysis
- Test Reporting and Analysis

Summarizing Key Features in ClearQuest

- **Comprehensive**
  - Increase productivity with a single, comprehensive solution for test and defect management.
  - Manage test planning, test results, test analysis, reports and defects
  - Common repository and integrated version control
  - Integrated quality metrics in project dashboards and reports
- **Support for distributed teams**
  - Scalable for enterprise wide projects with co-located, distributed, or outsourced test teams
  - Web UI
  - Replication
- **Extensible**
  - Integration with 3rd Party test tools through adapters
- **Configurable**
  - Ensure compliance , both internally and externally, through tighter process control and project customization.
  - Improved delivery mechanism, audibility and controls
  - Customize workflows and enforce processes to ensure compliance with your project's standards
  - User management & security

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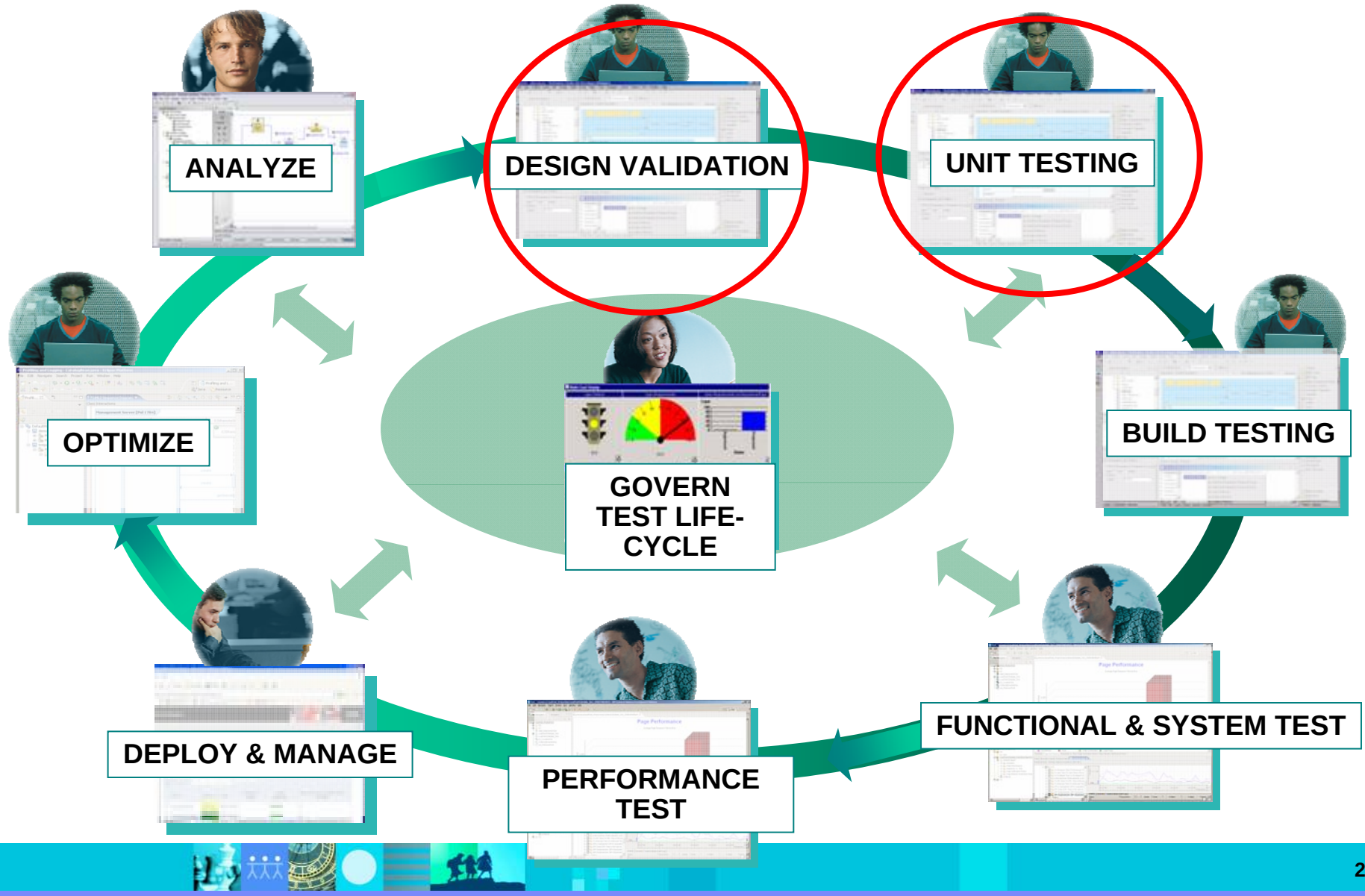
Integrated quality capabilities

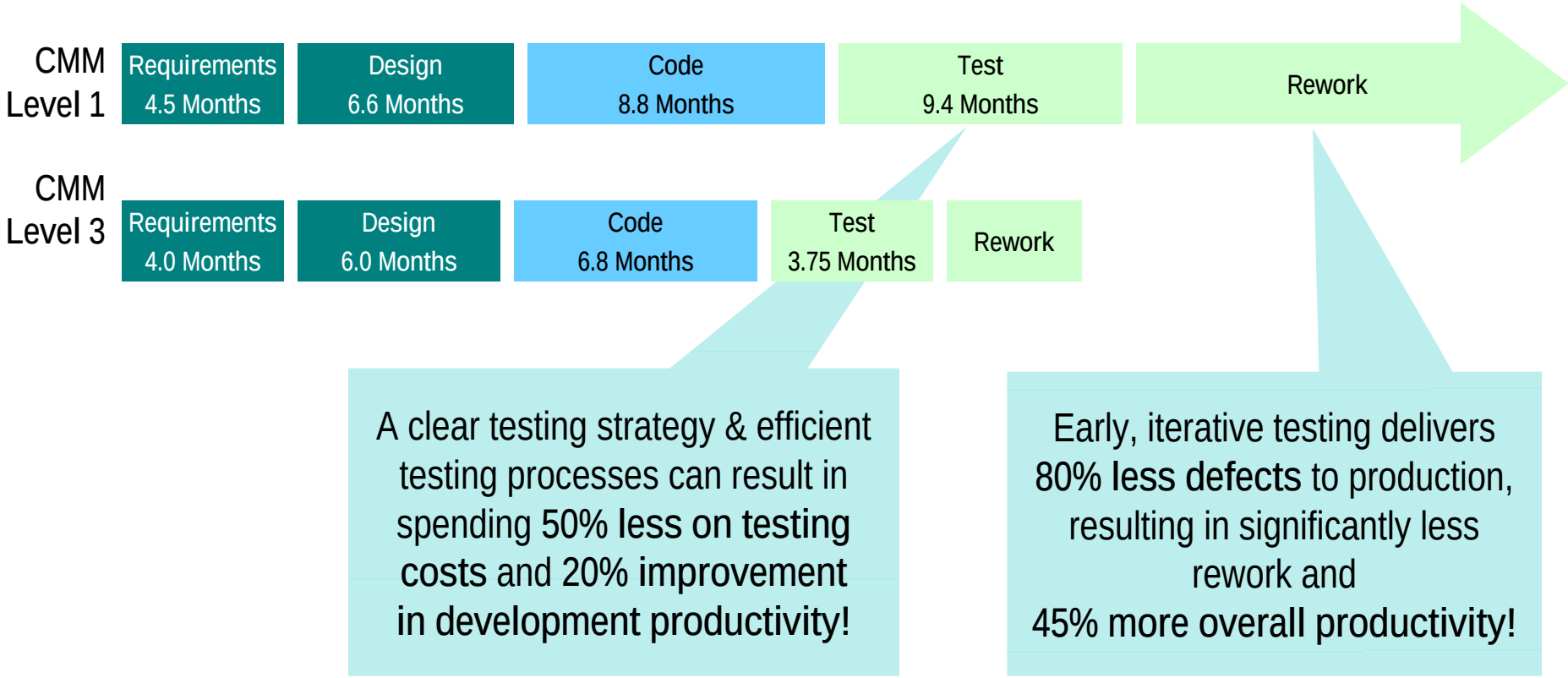


Challenge: Reliable Software Is Critical To Success

Challenges:

- Customers expect delivery of reliable applications
  - Application quality can be a key differentiator
- Building reliable applications is hard!
  - Difficult to validate component and code quality
  - Too much time do you spent tracking down memory corruption problems
  - Integration always takes longer than planned
  - Developers spend too much time tracking down “irreproducible” errors?
- Tracking down just one problem can take a developer days or even weeks!
- Late Discovery of Defects increases rework

Challenge: Reduce Rework Costs

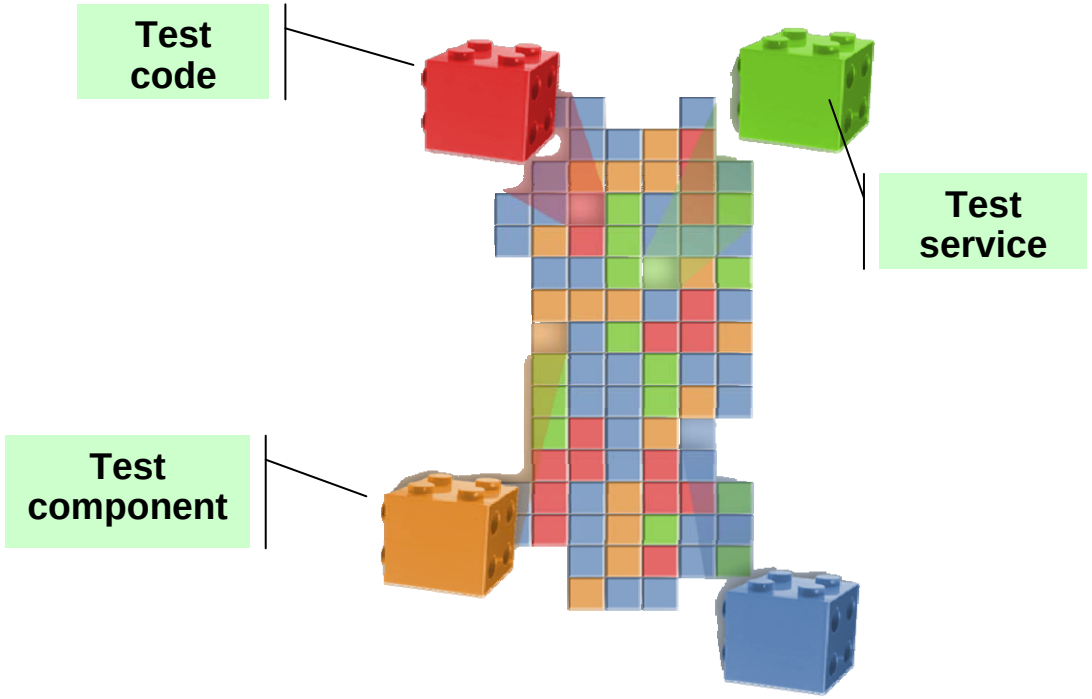


Note: CMM Level 1 organizations spend 30%+ of project dollars on testing.
CMM Level 3 organizations spend 15%.

Services, Business Processes & Component Tests

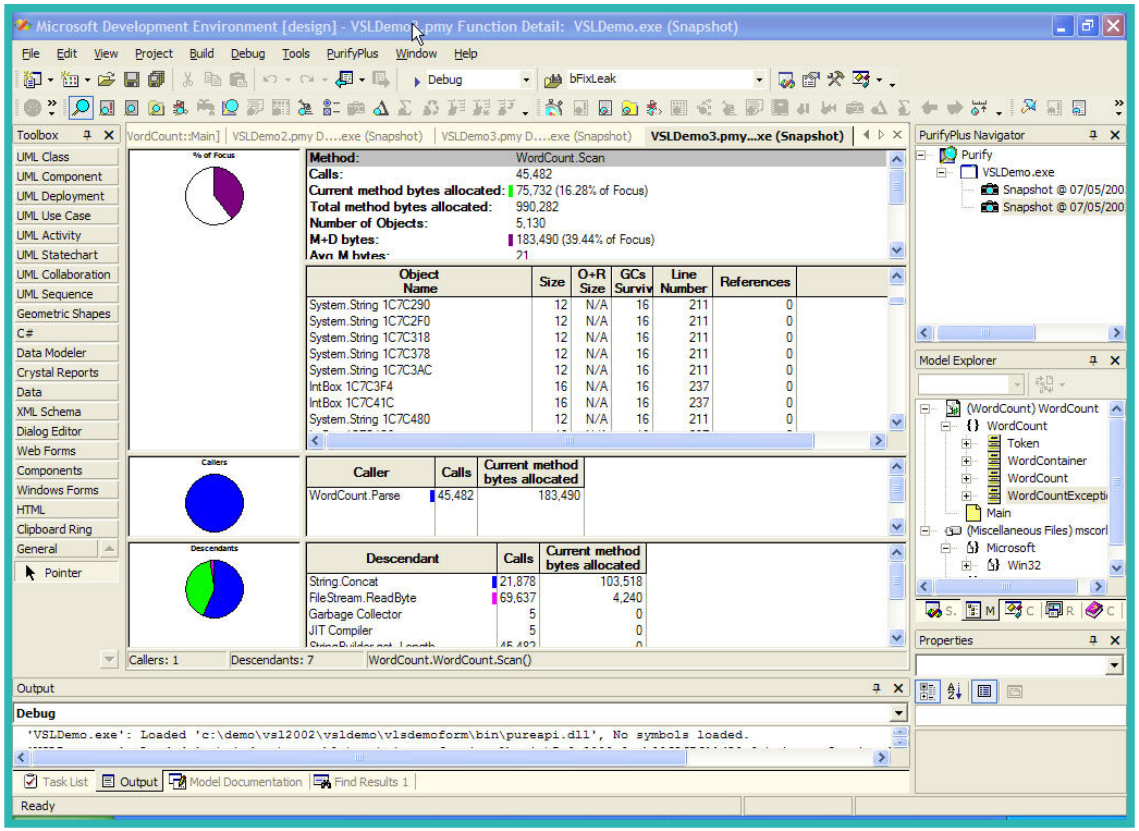
Benefits:

- Reduces risk of late defect discovery
- Validate component and code quality
  - Create test scenarios from WSDL files
  - Support data-driven testing and stubbing
  - WS-I conformance of WSDL files
  - Validate SOAP message
  - Automated code review
  - Run-time analysis
  - Embedded systems testing



Develop fast, reliable code
IBM Rational PurifyPlus

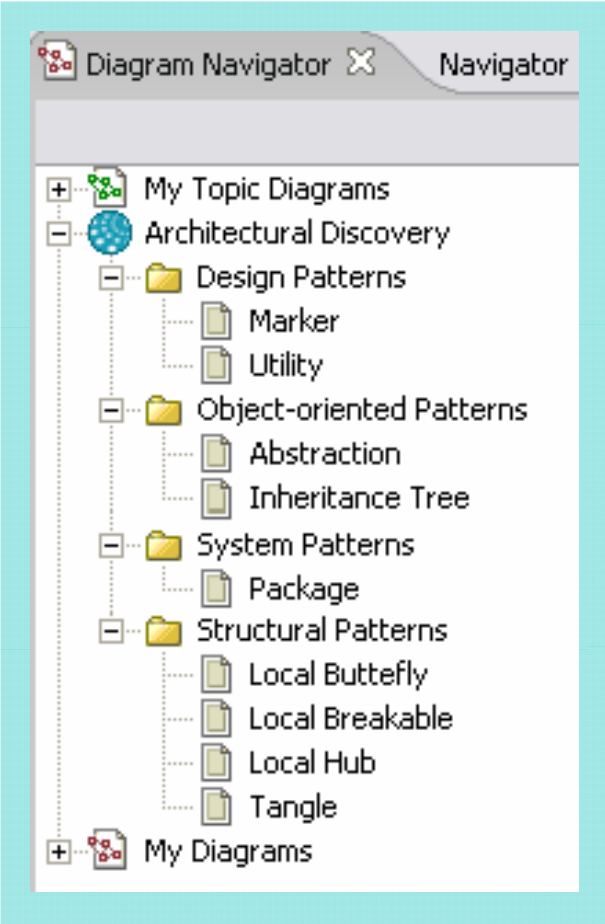
- Developer test solution to ensure creation of fast, reliable code
- Memory corruption and leaks – even in third party code
- Graphical view of performance data to identify bottlenecks
- Identify untested and dead code
- Multi-platform and multi-language support for Unix, Windows, Linux, Java, .NET, VB6, C/C++, and more



Architecture review and rules-based analysis

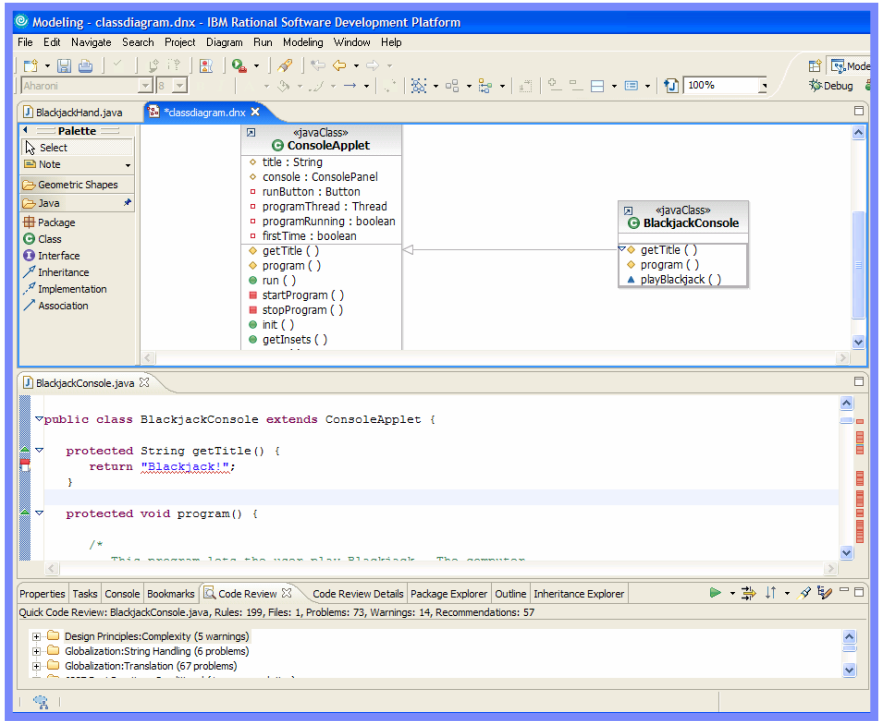
IBM Rational Software Architect

- Automatic detection of design patterns and important Object Oriented structures
- Structural anti-pattern detection of tangles, hubs, butterflies
- Automated refactoring of tangles through QuickFixes
- Verification of architectural integrity
  - The architect defines architectural constraints for the packages, classes, interfaces or their relationships
  - These architectural constraints are recorded as rules based on pre-defined templates
  - The rules verify the integrity of the architecture and report all violations of the architectural constraints



Test Web services, Java, J2EE, and Portal applications
IBM Rational Application Developer

- Code Analysis Tools
  - Both static code analysis and dynamic runtime analysis
  - Sequence diagram runtime trace with performance, thread and code coverage
  - Advanced memory leak detection
  - Remote data collection across multiple servers
  - User-defined run-time probes
  - Interactive reports and metrics
- JUnit support



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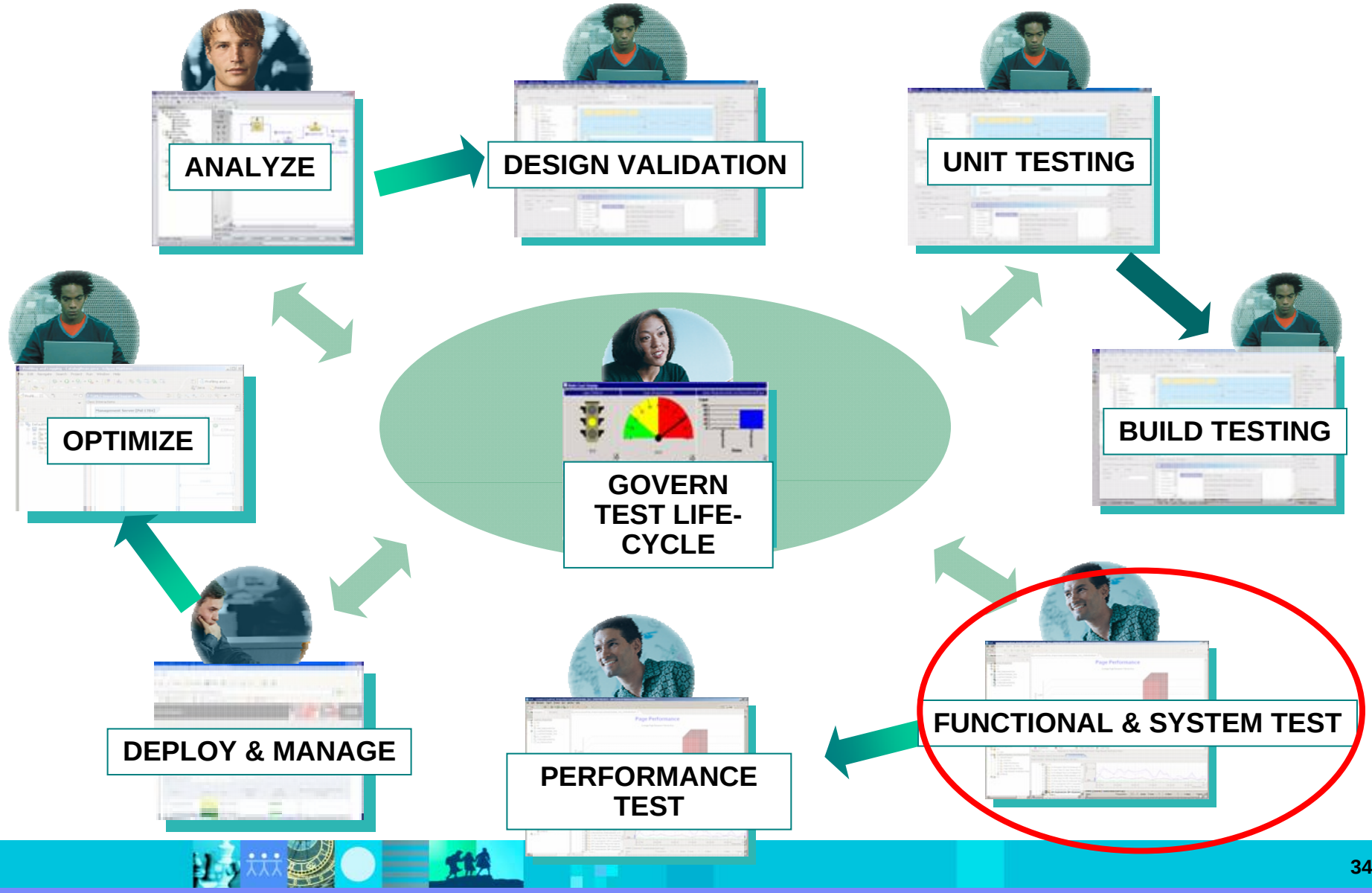
Integrated quality capabilities



What is Manual Functional Testing?

The manual process of ensuring fitness for use

- Using human labor to validate the business use cases and fitness for use of an application, system or device
- Includes labor to plan, design, execute and evaluate the status of the application or device under test
- Experience indicates over 75% of the testing done today is performed manually

Challenges of Manual Functional Testing

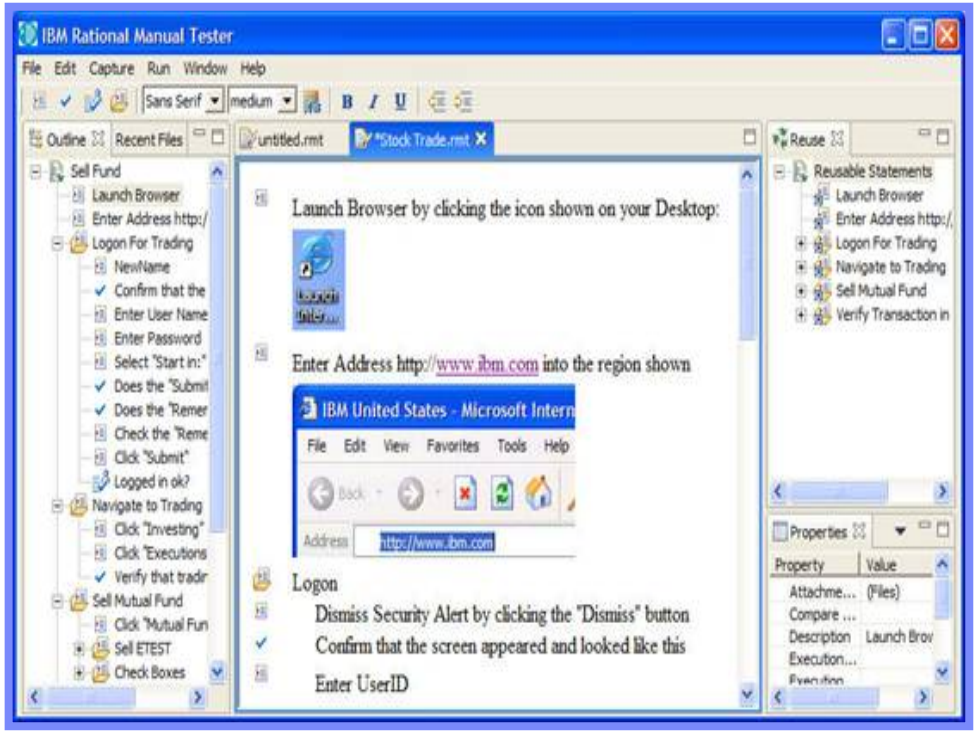
Three things that complicate the life of a manual tester

- **Labor Intensive**
  - Too much time is spent maintaining manual test documentation for application changes
- **Resistant to Change**
  - Each project has diverse processes, tester skill sets and types of applications and devices under test
- **Unreliable**
  - Accidental human-error with data entry and validation often skews test results

Transform Manual Testing with IBM Rational Manual Tester

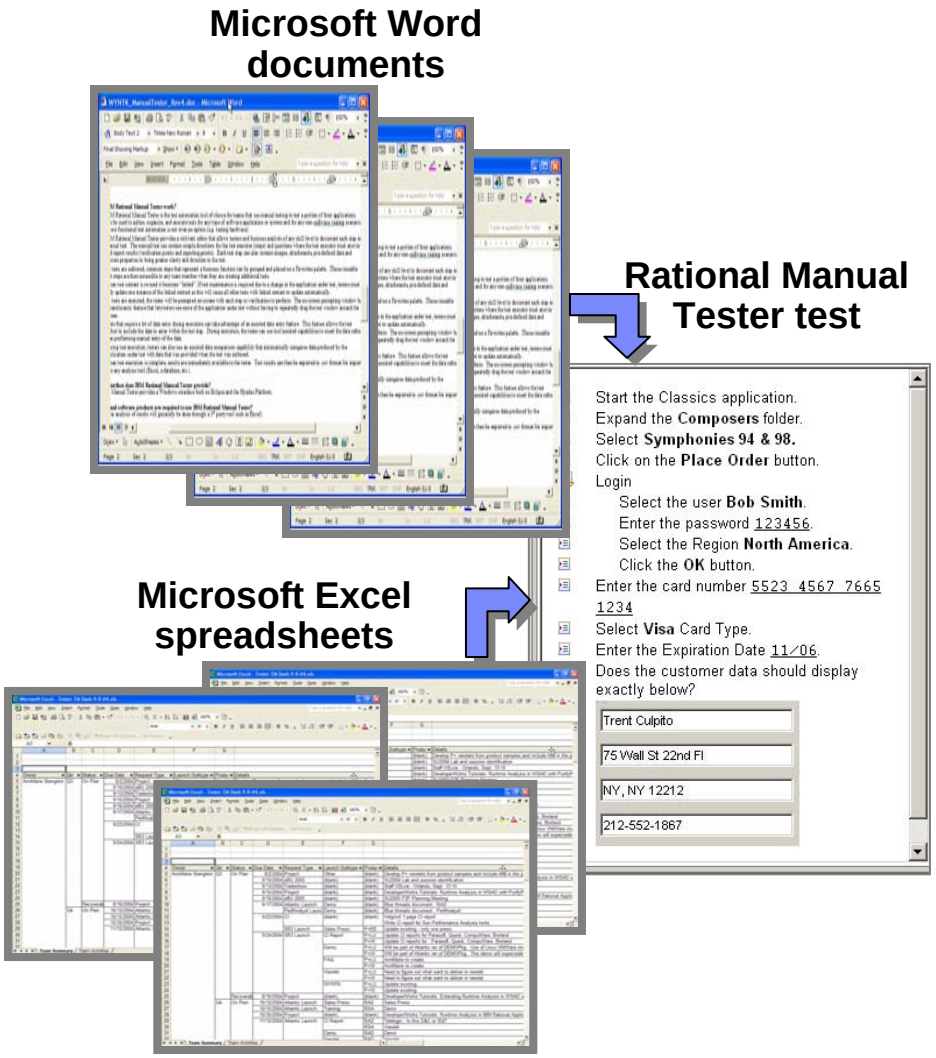
From ad-hoc testing to controlled and efficient testing

- **Labor Intensive**
  - Minimizes test maintenance with linked content. Make changes in only one location to update all tests.
- **Resistant to Change**
  - Provide a consistent interface that can be used to document tests for any device from can opener to computer
- **Unreliable**
  - Automate data entry and data validation during test execution to minimize human error
  - Rational Process advisor provides guidance and expertise to enhance tool experience



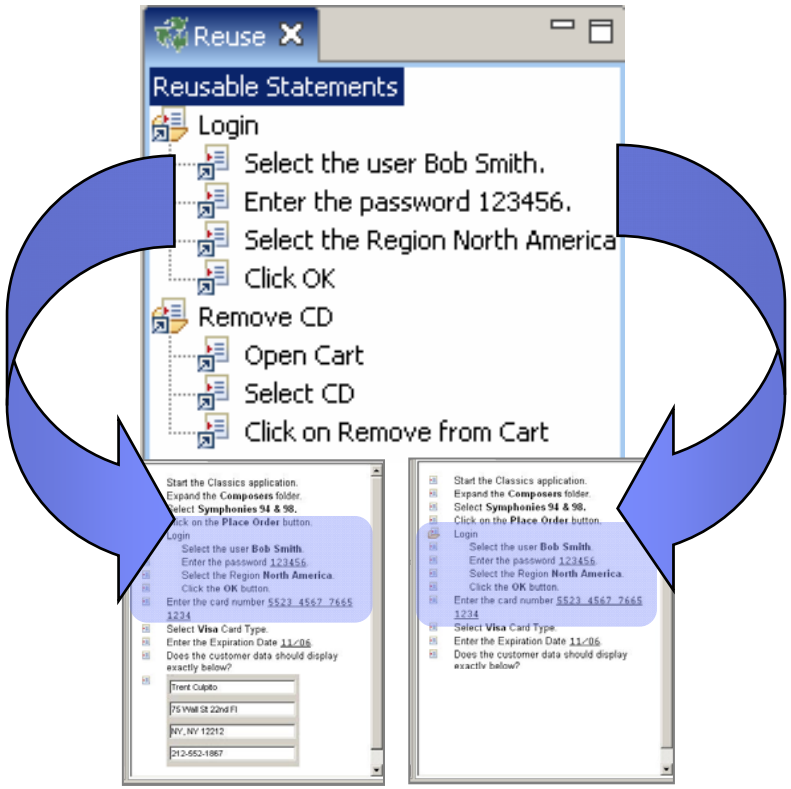
Consolidate Test Creation and Maintenance

- **Benefits:**
  - Leverage Existing Test Documents
  - Rich Editing Environment
  - Jump-start adoption of Rational Manual Tester by leveraging existing assets
  - Bulk import manual tests documented in Word or Excel
  - Provides a rich text editing environment to document clear, easy to understand tests
  - Allows embedding of images or attach files to add clarity and detail
  - Provide a consistent Test Interface



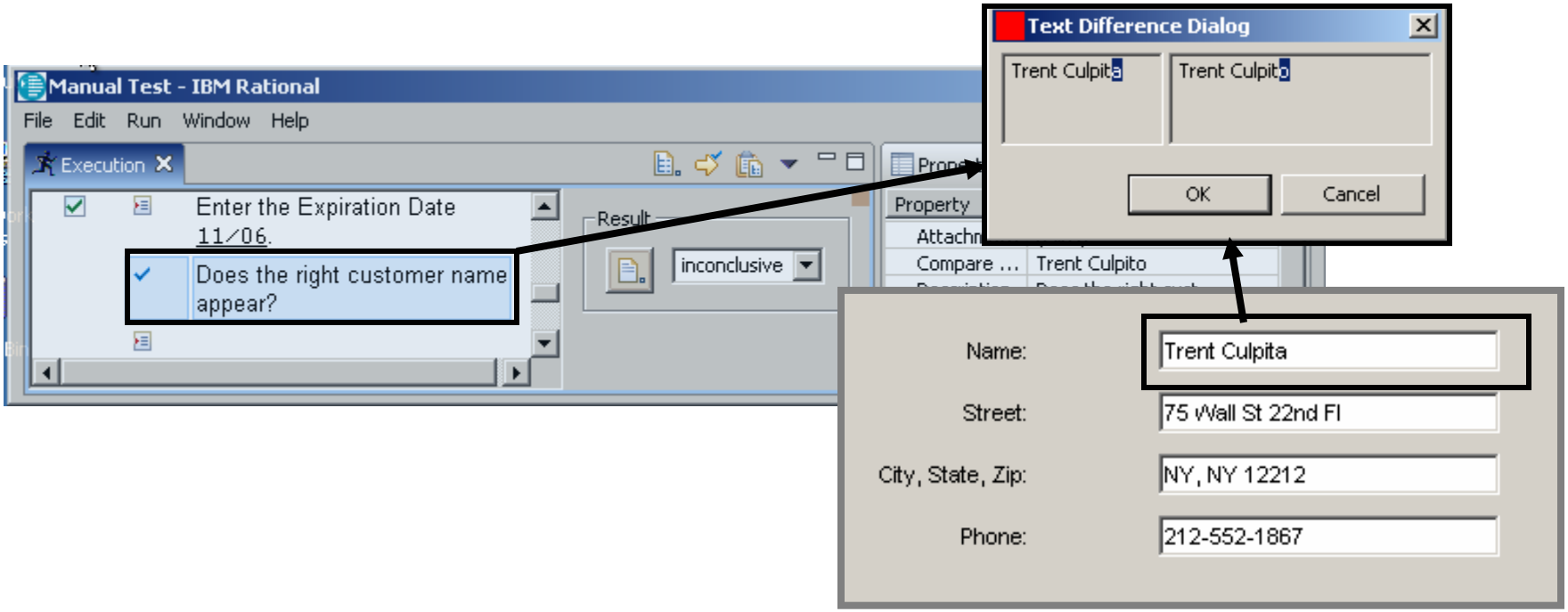
Reduce test maintenance and ensure consistency

- **Benefit:**
  - Enable Shared Content Across Multiple Tests
  - Create commonly used test statements once
  - Reuse statements across multiple tests through simple drag and drop
  - Maintenance of shared content is efficient with single-point updating of shared content
  - Ensures consistency and reduces test maintenance



Assisted Data Entry and Data Verification

- **Benefit:**
  - Reduce human error
  - Store critical data used during the test as part of the test instructions
  - Automate data entry during test execution to speed entry and reduce errors
  - Automate data validation during test execution to ensure accurate results



What You'll See:

- Manual testing with IBM Rational Manual Tester
- Test creation, reuse and execution

Summarizing Key Features in Manual Tester

- **Advances manual testing**
  - Rich text editor for test authoring
  - Test step reuse palette
  - Test script import from Microsoft Word or Excel
- **Satisfies diverse needs**
  - Supports usage by distributed teams
  - Generates spreadsheet-ready results data
  - Multiple validation points
  - Custom data fields
- **Minimizes Test Maintenance**
  - Assisted data entry and data verification during test execution

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What we've seen so far:

- Test Planning challenges, tools and demo
- Code and Unit testing challenges and tools
- Manual Functional Testing challenges, tools and demo

What's coming up next:

- Automated Functional Testing challenges and tools
- Performance Testing challenges, tools and demo

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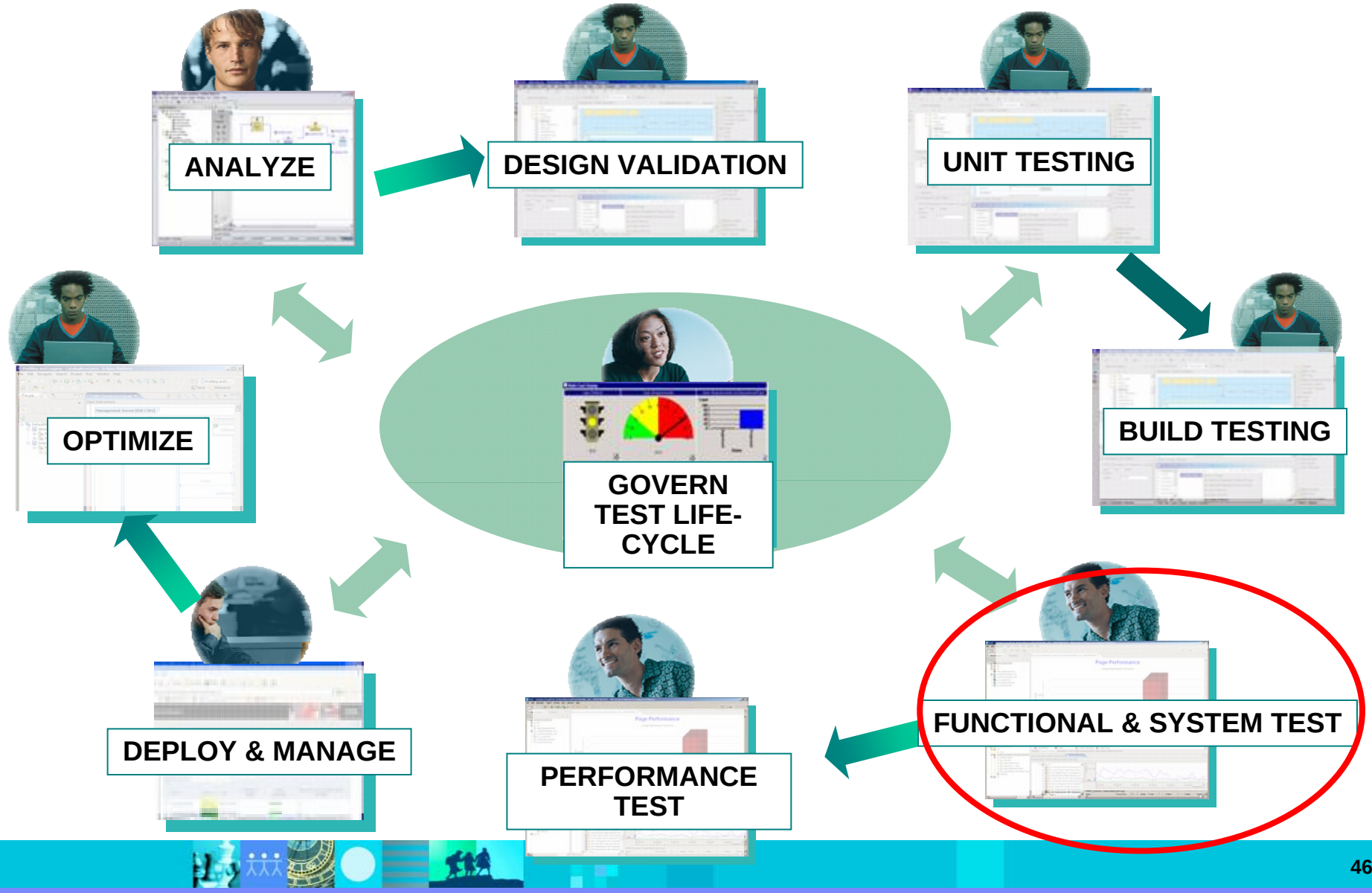
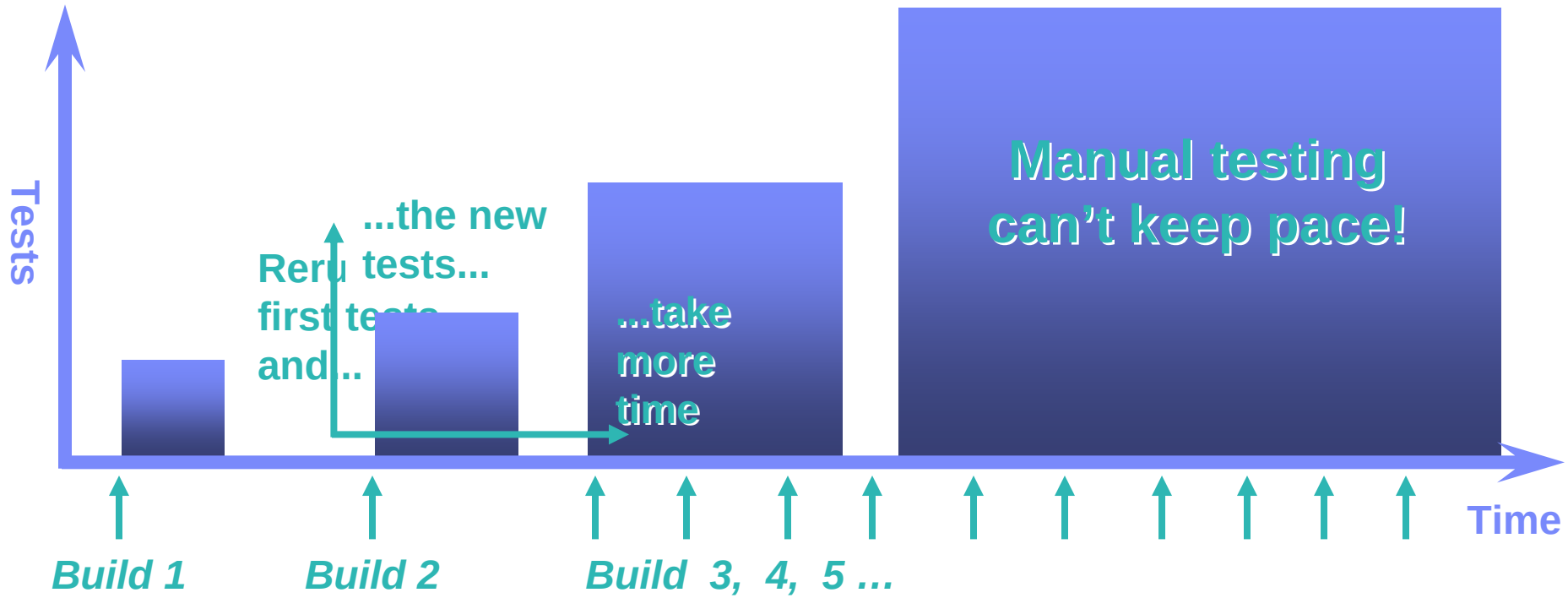


What is Automated Functional Testing?

The automated process of ensuring fitness for use

- Using automation tools to capture actions taken against an application in script format.
- Three Step Process
  - Record actions into a script format – either VB.NET or Java
  - Optionally enhance scripts with custom coding
  - Execute scripts – ideally overnight to increase test productivity to 24/7

Challenge of Manual Functional Testing with Short Test Cycles



- Manual testing alone can't keep pace with the rapid development of applications…..
  - Quality will be sacrificed to keep on schedule

Challenges of Automated Functional Testing

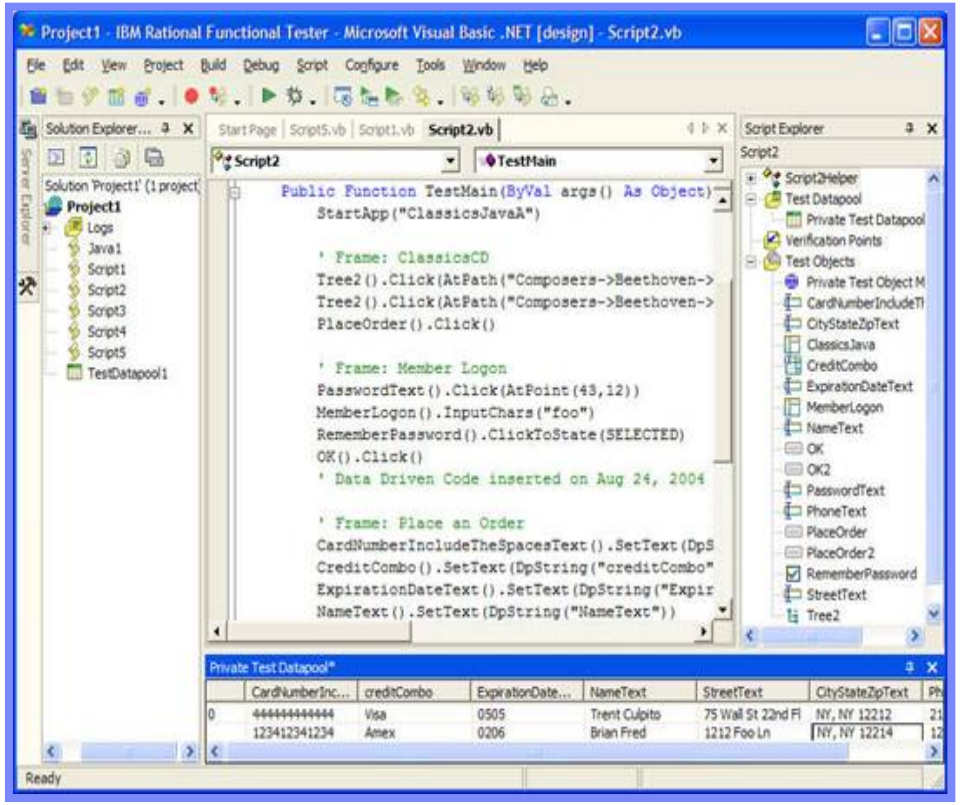
Three things that complicate the life of an automated functional tester

- Control cost of test automation
  - Inexperienced testers face steep learning curve for tools
  - Test maintenance grows with project
- Testing Tools Lack Flexibility
  - Power users hands are tied by tool limitations
- Test Team Integration
  - Managing script changes with parallel development
  - Sharing test assets with the larger software team

Functional Testing with IBM Rational Functional Tester Plus

Test automation for the novice and the professional

- Control cost of test automation
  - ScriptAssure technology ensures test script playback even with changes in application geography
  - Wizard assistance for common tasks such as data driven tests
- Testing Tools Lack Flexibility
  - Full flexibility of Java or VB.net to address all application testing challenges
  - Firefox browser support v1.5 and v2.0
- Test Team Integration
  - ClearCase LT included to incorporate support for parallel development and geographically distributed teams
  - Rational Process advisor provides guidance and expertise to enhance tool experience



Control of Test Automation

Recording Scripts

Benefits:

- Lowers cost of application testing
- Improves test productivity and accuracy

- Creates a Test Script that captures all system-user interaction
- Test scripts are recorded on the fly, as user navigates application
- Verification points are inserted to validate system response
- Formalize end-to-end tests that exercise business processes
- Automate functional testing of composite applications
- Broad support for modern and legacy application environments
- Minimize test maintenance with tests resilient to frequent changes

Flexibility: Recording Scripts

Environment Support

- IBM Rational Functional Tester Plus supports the following environments:
- Web
- Java
- Any VS.NET application running under the .NET Framework
- Support for .Net 2.0 controls

- Terminal Emulation*
  - Add-on support for 3270/5250/VT100 terminal-based applications
- Commercial Packages
  - Support for Siebel 7.7 , 7.8 Implementations
  - SAP 7.8

- Legacy Applications:
  - Visual Basic
  - C/C++
  - PowerBuilder
  - Delphi
  - Win32

*support available late Q1

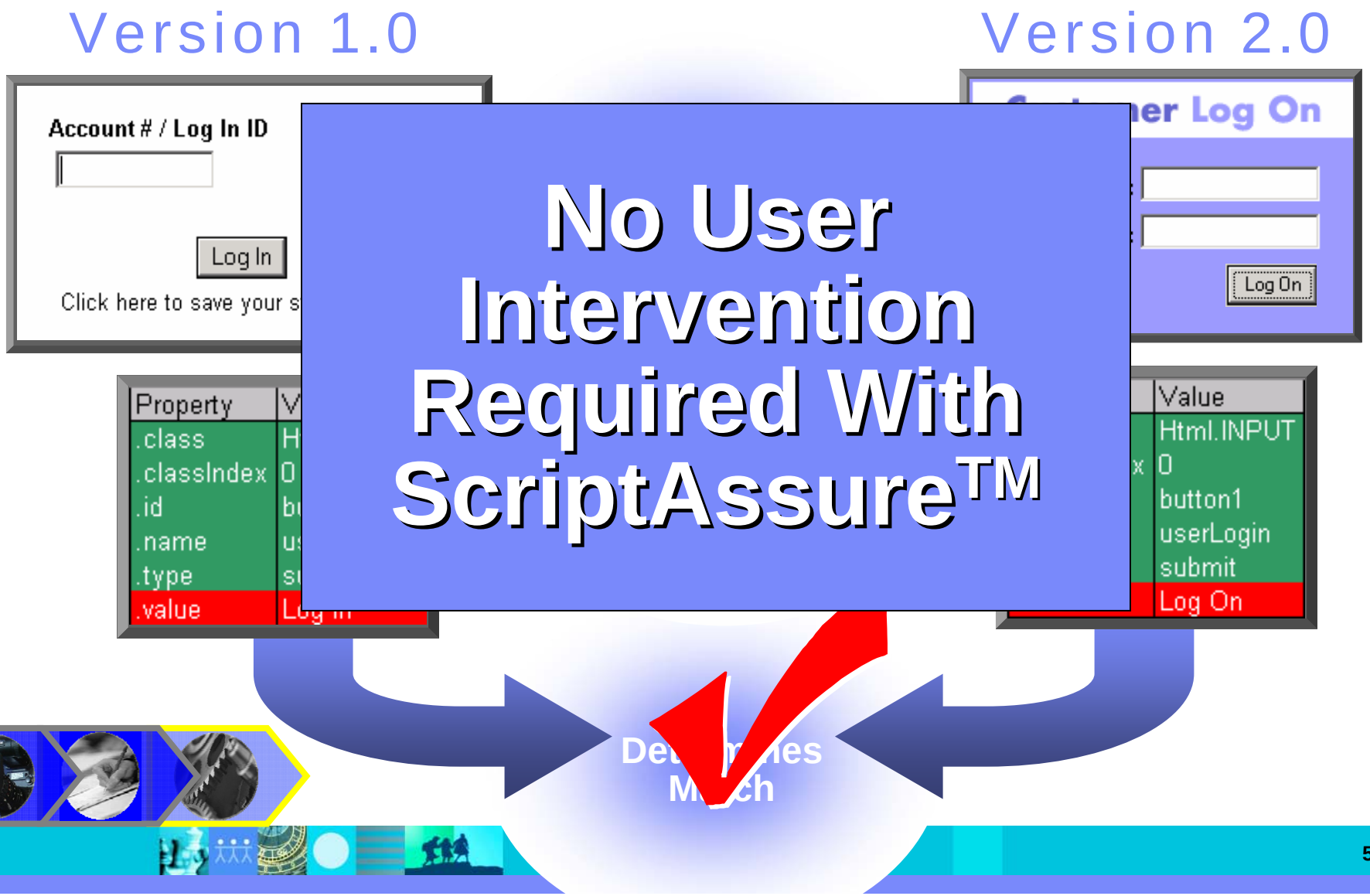
Flexibility: Enhancing Scripts

Flexible Coding Language

- IBM Rational Functional Tester uses Java or VB.net for scripting
  - Standard language syntax
    - Not a custom version of Java or VB.net
  - Augments language commands with test specific functions
    - Click, Verify, Select, etc…
- Flexible power to enhance scripts
  - Programmatic access to all GUI objects
  - Datapool facility enables data driven tests
  - Leverage existing code and resources from a variety of sources
    - Books, Internet, developerWorks, etc…

Control Cost of Test Automation

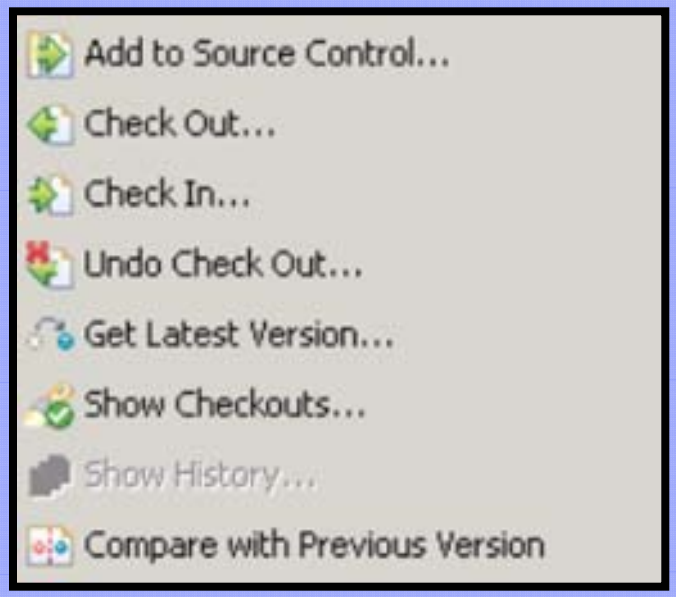
Reliable Playback with Script Assure



Test Team Integration

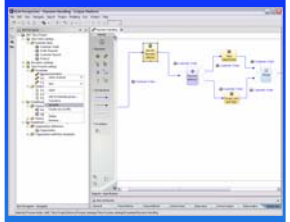
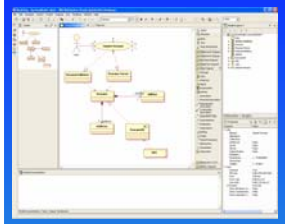
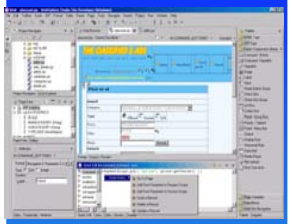
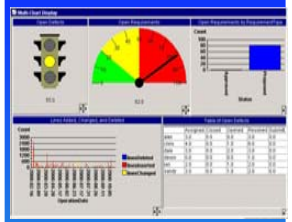
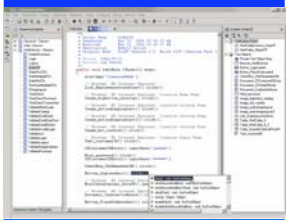
Version Control of Scripts

- Functional Tester includes ClearCase LT for test script version control
- ClearCase LT enables parallel script development
  - Work simultaneously on multiple releases
  - Coordinated workflows across the team
  - Secure, versioned software test assets



Test Team Integration: Leverage open standards

Expand test ecosystem and practitioner productivity

Analyst	Architect	Developer	Tester	Project Manager	Deployment Manager
					

IBM Rational Functional Tester built on Eclipse
Eclipse Test and Performance Tools Platform (TPTP)
Support for open source SAFS keyword driven testing framework
Ability to leverage community created add-ons
Custom code for advanced testing extensions
Shared environment with development teams for improved team asset sharing

What You'll See:

- Functional Testing with IBM Rational Functional Tester
- Test creation, modification and execution

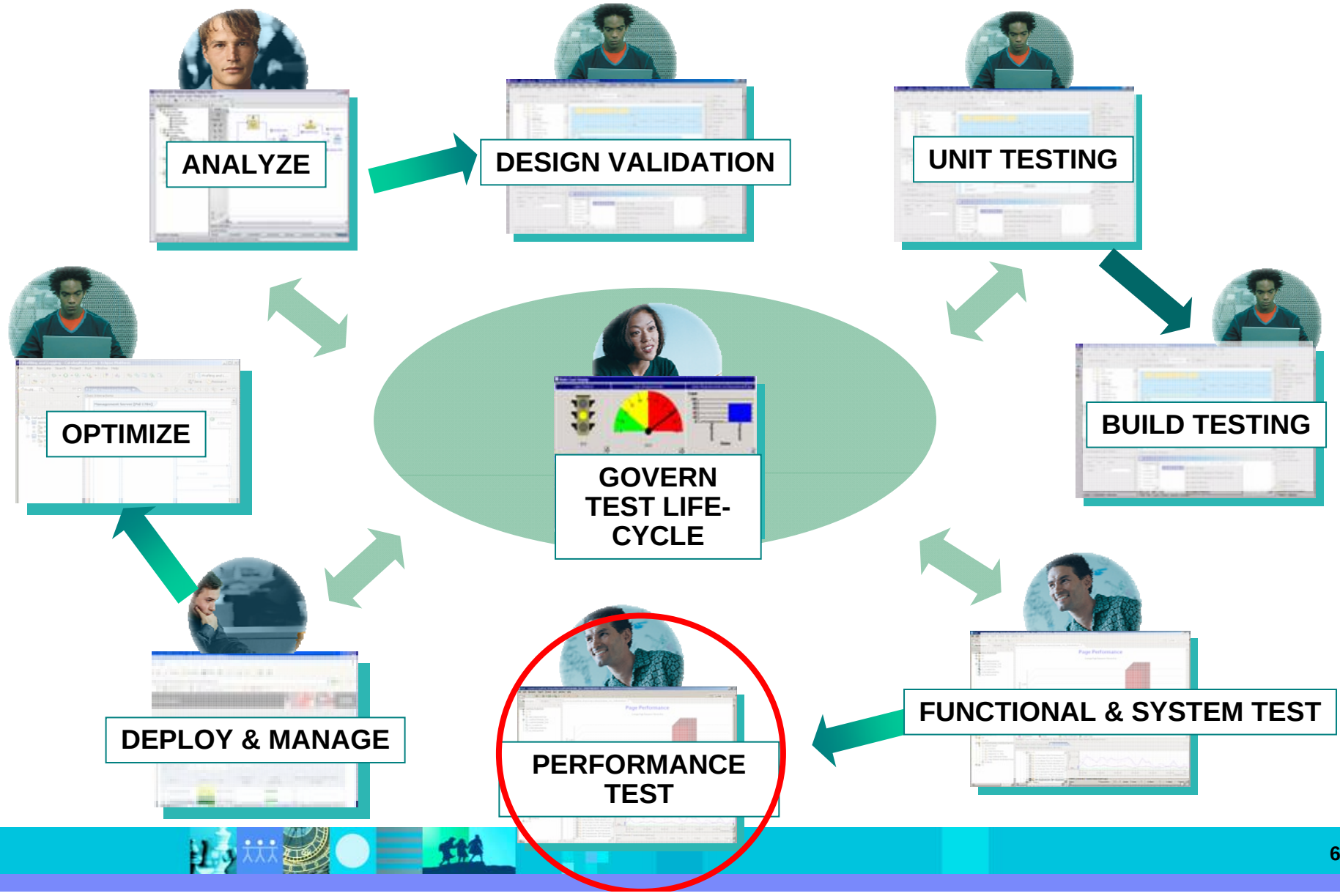
Summarizing Key Features in IBM Rational Functional Tester Plus

- **Control Cost of Test Automation**
  - Create data driven tests without coding
  - Static data and properties verification
  - Dynamic data validation without coding
  - Reliable playback with ScriptAssure
  - Remote and local playback on various platforms
- **Flexibility**
  - Flexible coding language
  - Broad Environment Support:
    - Web, Java. .net, IE and Firefox
  - Powerful, professional debugger
  - Object map editing flexibility
- **Test Team Integration**
  - Version control of scripts

Agenda

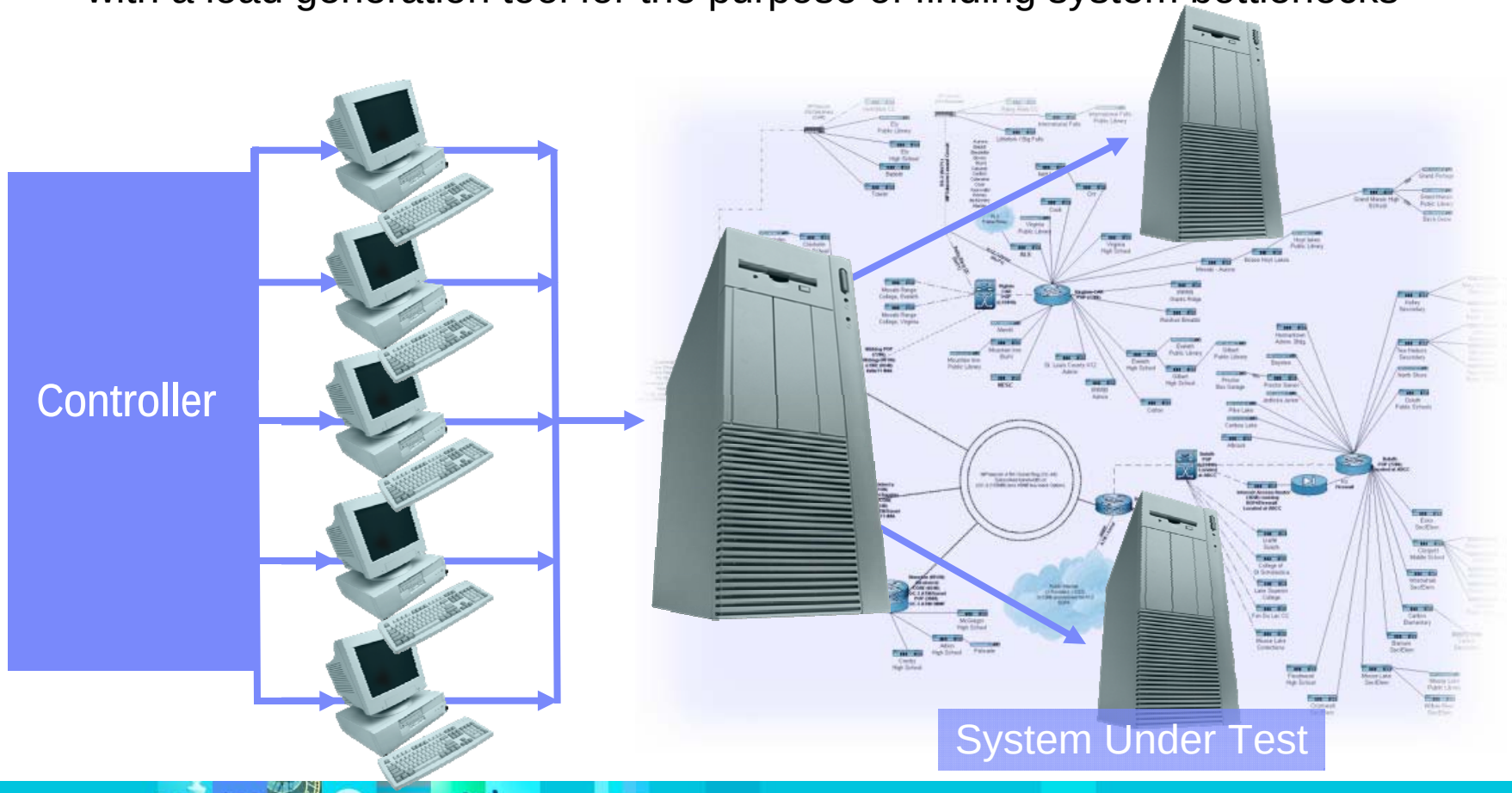
- Business Driven Development
- Test Management
- Code and Unit Testing
- Manual Functional Testing
- Break
- Automated Functional Testing
- **Performance Testing**
- Wrap Up & Resources

Integrated quality capabilities



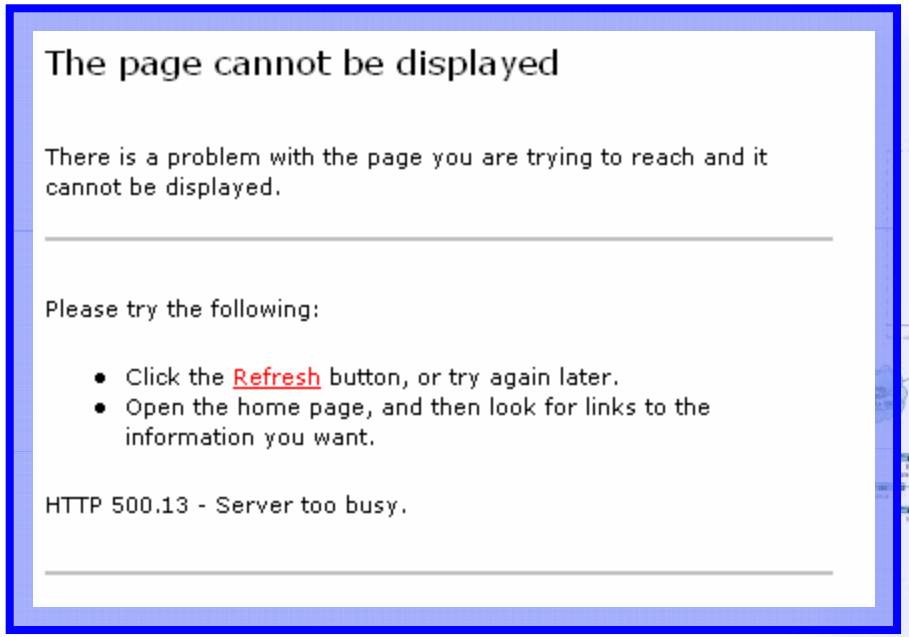
What Is Performance Testing?

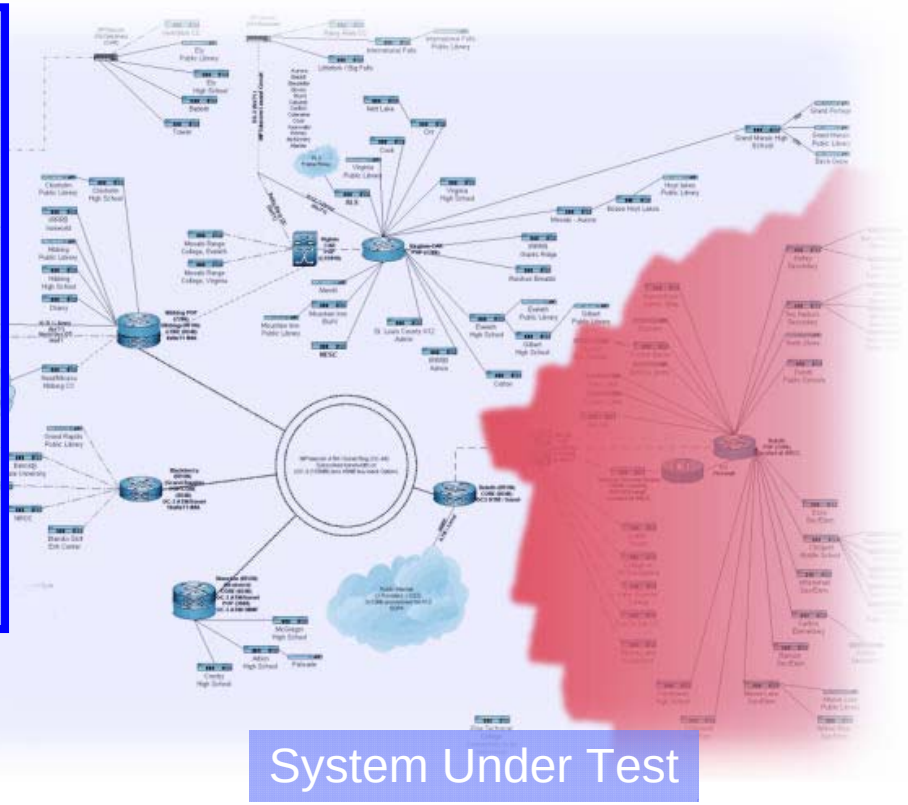
- The process of exercising an application by emulating actual users with a load generation tool for the purpose of finding system bottlenecks



Why do Performance Testing?

- Because a break at any point in your system means your customers are not getting the service you think they are





Creating a Performance Test

Creating a performance test is a three step process

Build Scripts **Schedule Workload** **Execute & Analyze**

- **Test Creation Considerations**
  - Visual test editor, varying input data & correlating server responses
- **Scheduling Considerations**
  - Accurately representing a true user workload
- **Execute and Analyze Considerations**
  - Validating responses & finding the bottleneck

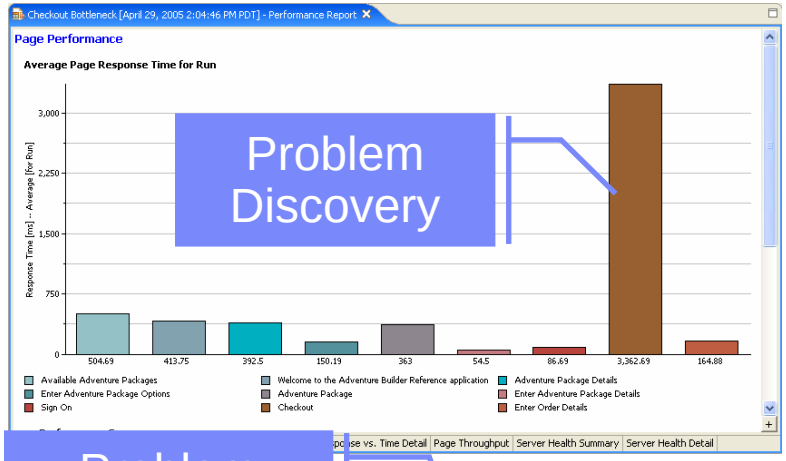
Challenges of Performance Testing

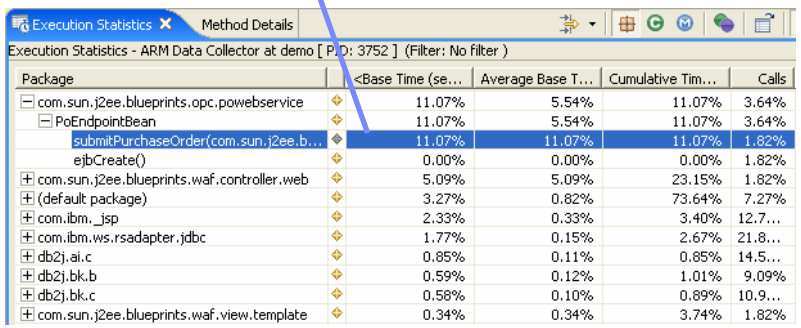
Three things that complicate the life of a performance tester

- Complex Tools & Complex Task
  - Tool complexity and lack of experience intimidates many first time users
- Testing Tools Lack Flexibility
  - Power users hands are tied by tool limitations
- Problem Discovery and Diagnosis
  - Pinpointing the problem is only the first step
  - The real challenge is determining the cause

Performance Testing with IBM Rational Performance Tester
Problem discovery and diagnosis with Day 1 Productivity

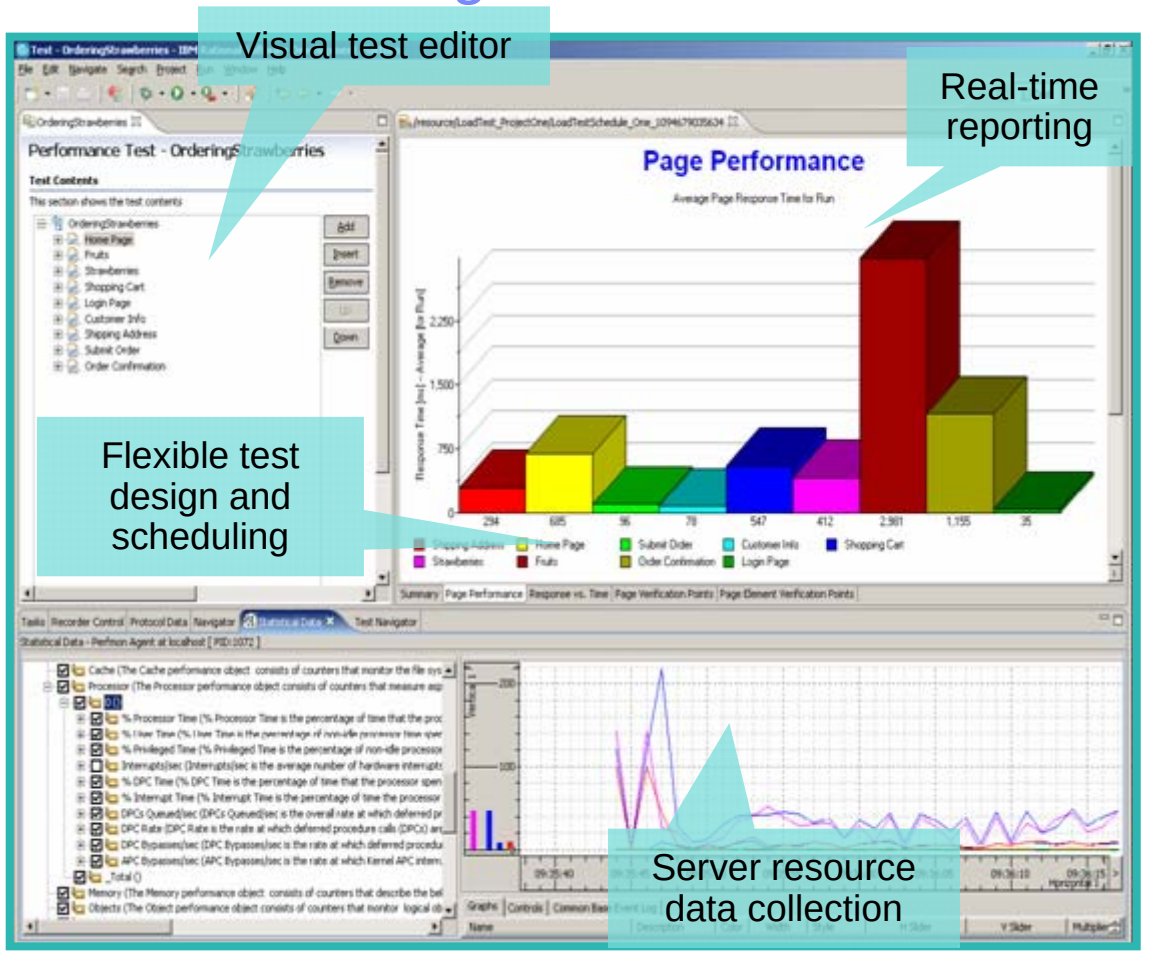
- Complex Tools & Complex Task
  - Performance Tester masks complexity of scripts and automates task of ensuring data consistency
  - Rational Process advisor provides guidance and expertise to enhance tool experience
- Testing Tools Lack Flexibility
  - Performance Tester tests use Java to enable custom coding solutions to application specific challenges
  - Firefox browser support v1.5 and v2.0
- Problem Discovery and Diagnosis
  - Pinpoint cause of application slow downs for J2EE applications
  - Interface with Tivoli products for complete environment analysis





Reduce Complexity with Performance Tester:
Create Performance Tests without Coding

- Create simple, tree-based tests
  - Remove the need for programming
  - Tests are represented in a tree view as a sequential flow of web pages
- Flexible modeling and emulation of diverse user populations
- User interface enables:
  - Data pooling
  - Automated identification and variation of dynamic data
  - Looping
  - Conditional events

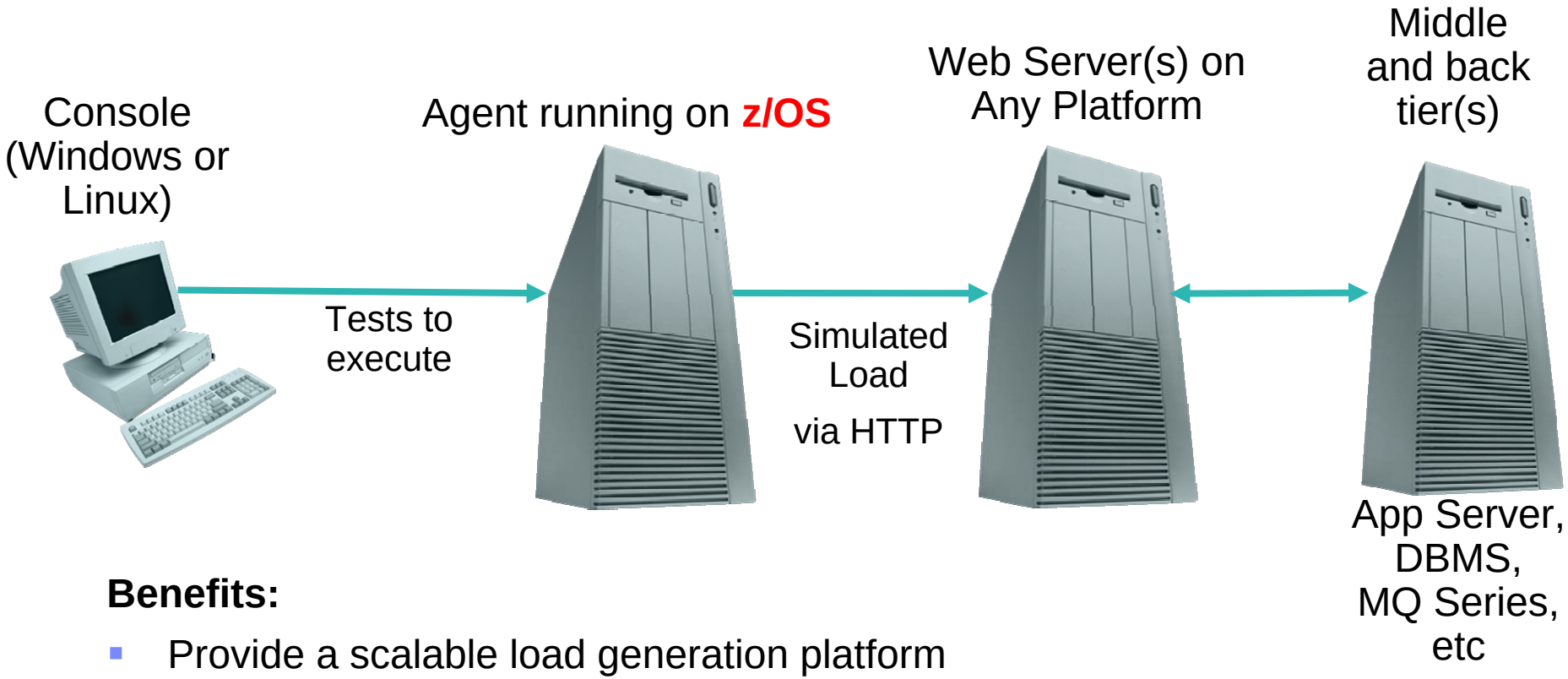


Testing Flexibility with Performance Tester

- Performance Tester provides support for the following Environments:
  - Web
  - Siebel
    - Siebel 7.7, 7.8
  - SAP
    - SAP 4.6C & R/3 Enterprise (4.7
    - SAPGUI for Windows 6.20 & 6.40
    - mySAP support (SAP HTTP interface)
  - Citrix Presentation Server
  - Partner BSD offering for Oracle eBusiness
- Provides cross-tier transaction breakdown and resource monitoring to pinpoint bottlenecks
- Optional insertion of Java code for advanced customization
- Use Windows, Linux, and UNIX servers or z/OS hardware to generate load

Testing Flexibility with Performance Tester

Deployment of Rational Performance Tester for z/OS



Benefits:

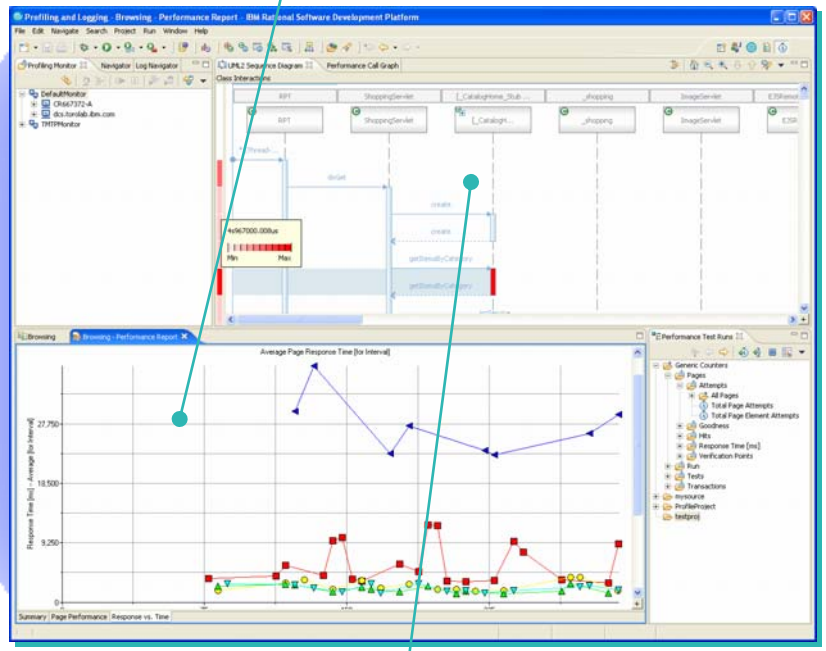
- Provide a scalable load generation platform
- Leverage customer investment in z/OS

Solution: Root Cause Analysis

New!

- **Benefits:**
  - Ability to perform detailed analysis and breakdown of J2EE transactions when a system is under load.
  - Helps testing teams to pinpoint the component responsible for the bottleneck.
  - For IT organizations that use Tivoli ITCAM solutions, detailed performance data can be delivered directly to the developers desktop to help the developer pinpoint the source code causing the bottleneck.
- **Key Features:**
  - Problem Analysis Tools
  - Response Time Breakdown
  - Agentless Resource Monitoring
  - Resource Overlays with Response Times
  - IBM Tivoli Monitoring Collectors Additions

IBM Rational Performance Tester decomposes poor response times identified during a performance test…

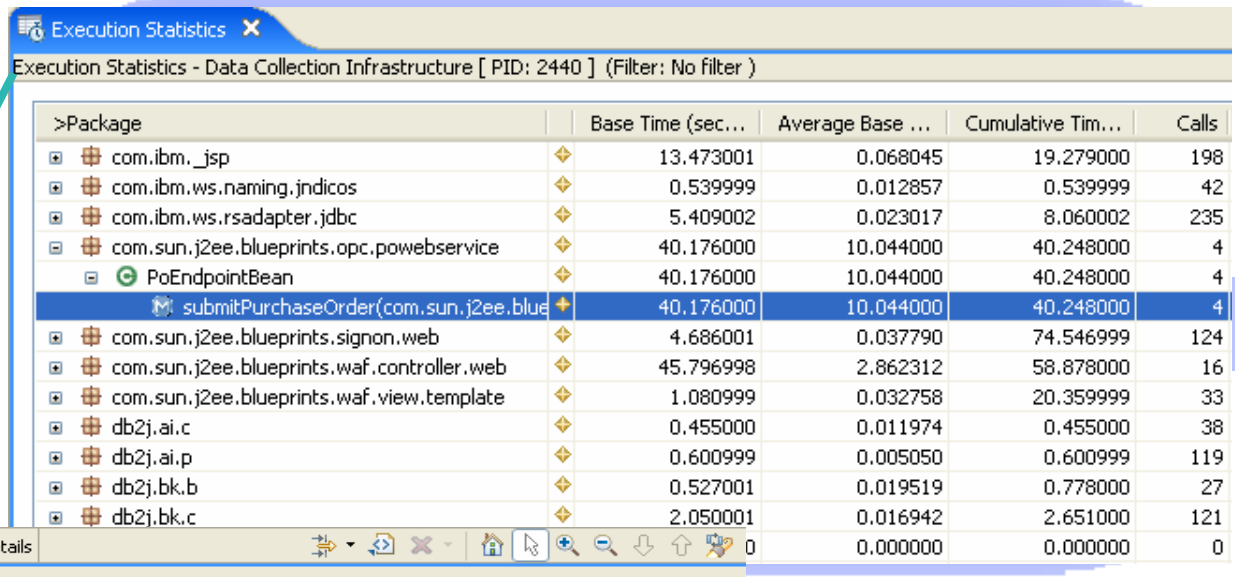


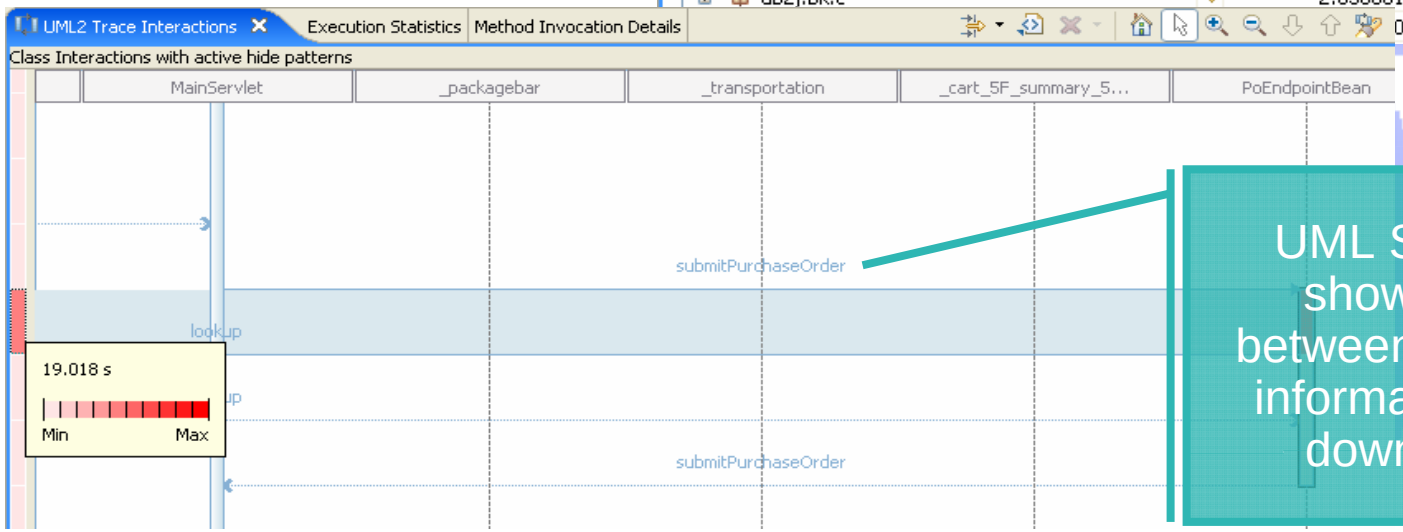
…into the amount of time spent within each application component.

Deep Diagnostic Data

Providing the details you need to solve the performance problem mystery

Execution Statistics
Shows response time for every method





UML Sequence diagram showing method calls between classes with timing information. User can drill down to source code.

What You'll See:

- Performance Testing with IBM Rational Performance Tester
- Test creation, modification and execution
- Response and Resource Utilization Analysis

What You Won't See:

- Programming or Code

Summarizing Key Features in Performance Tester

- **Built for Day 1 Productivity**
  - Create code free tests
  - Mask complexity to get the job done
- **Advanced Data Access & Manipulation**
  - Create code free schedules
  - Automated data variation and synchronization
- **Lower Cost of Performance Testing**
  - Low resource requirements
  - Desktop IDE integration

SOA Testing: Web Services/SOAP Testing

Two new products for SOA testing

- **Test Creation**
  - Test recording using an existing client application
  - Test Recording via Eclipse Web Service Explorer
  - Interactive test creation from Service description (WSDL)
  - Business Process Testing - Create test cases from BPEL models
- **Test Enhancement**
  - New data correlation, data pooling and verification points
- **Test Execution**
  - Functional and regression testing
  - Command line test execution
- **Test Analysis**
  - Root cause analysis of SOA performance problem
  - Integration with Tivoli tool (ITCAM for SOA)

SOA Testing: Regression and Performance

- IBM Rational Tester for SOA Quality
  - Automates creation, execution, and analysis of functional and regression tests for service-oriented architecture (SOA) applications.
- IBM Rational Performance Tester Extension for SOA Quality
  - Provides load and performance testing capabilities for those same SOA applications
  - Automated generation of Web service performance tests
  - Validate SOA system scalability

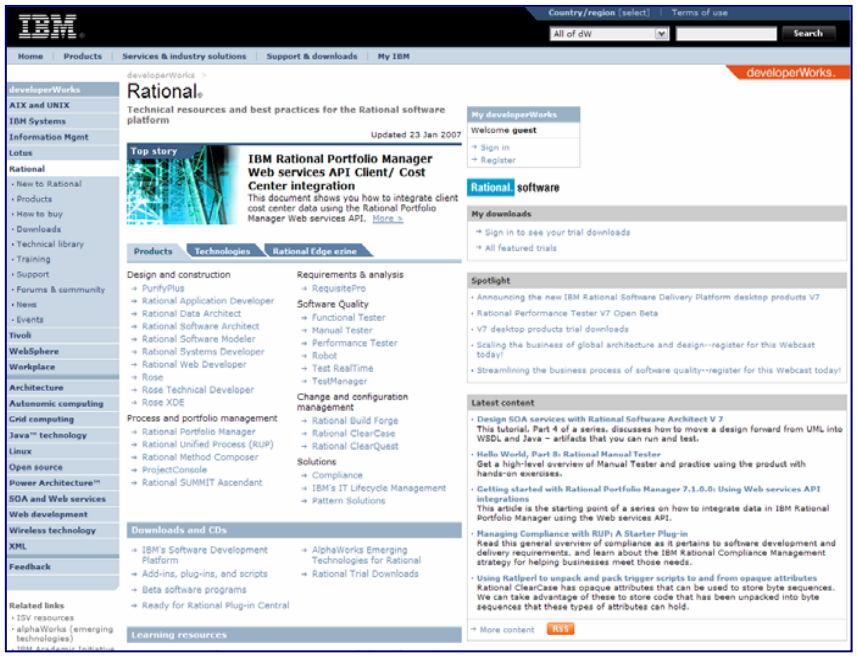
Agenda

- Business Driven Development
- Test Management
- Code and Unit Testing
- Manual Functional Testing
- Break
- Automated Functional Testing
- Performance Testing
- **Wrap Up & Resources**

Moving Forward:
Additional resources from IBM developerWorks

Take advantage of the many other software testing resources IBM developerWorks has to offer:

- Check out the Rational zone on developerWorks for a complete overview of all Rational-related offers.
- Subscribe to a newsletter and stay up-to-date on the most current offers from IBM developerWorks.
- Get instant access to a wide range of technical articles and IBM Redbooks in developerWorks technical library.
- Connect with other members of the IBM Rational community through developerWorks forums and communities.



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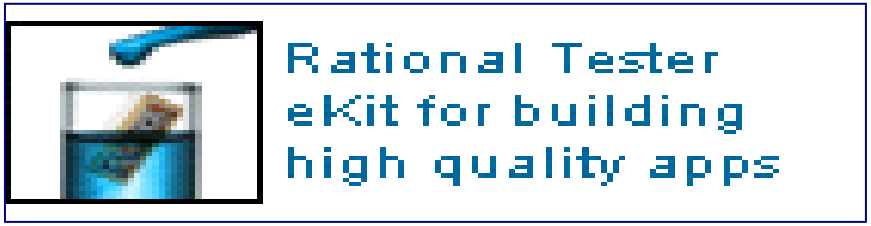
New! IBM Rational Tester eKit

It's never been more important to achieve predictability and quality in business-critical applications. The IBM Rational tester kit provides a collection of tools and best practices across the life-cycle to make your job easier.

The kit contains:

- Rational product demos
- Case studies
- Webcasts
- Articles
- Tutorials designed to help you optimize manual testing
- Datasheets on IBM Rational products



Register for the complimentary IBM Rational tester kit and make quality an integral part of all aspects of the application life-cycle:

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Complimentary events from developerWorks

IBM Rational Software Delivery Platform webcast series:

View technical webcasts covering quality management solutions. See what's coming up in our 2007 schedule or browse the library of more than 80 recorded titles. Topics include:

- Streamlining the Business Process of Software Quality
- Enterprise Test Management
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2007 Planned Briefings

IBM developerWorks Live!

- IBM Middleware on Linux
- Information on Demand Live!: Building the Next Generation of Database Applications
- Architecture, Design & Construction using the IBM Rational Software Delivery Platform
- Effective Software Testing: Tools and Strategies for Project Success
- Open Community Tools: An Open Stack Development Platform
- Open Source Development: Tools and Open standards
- Eclipse: Empowering the Universal Platform
- Achieving Enterprise Application Security
- The developer and the IBM Environment
- Rational's Business Developer Extension
- Accelerating Global Software Delivery
- SOA Governance: Implementing the IBM method
- Rational vs Mercury
- Rational vs Microsoft
- Collaboration with Lotus
- Get Started on SOA with WebSphere's Proven, Flexible Entry Points
- Experience the Power of Information Management Solutions
- A fresh look at the mainframe

2007 Briefings (page 1 of 3)

- **Achieving Enterprise Application Security:** This briefing covers application security end-to-end. It covers the goals of application security with a review of basic security concepts and shows how the basics are applied to building of security stacks, to add additional layers of defense, using Java / J2EE as the programming language and environment to illustrate technologies and techniques. – ½ day
- **Architecture, Design, and Construction using the IBM Rational Software Delivery Platform:** This briefing will demonstrate the latest version of the IBM Rational Software Development tools, their broad range of functionality and their use throughout the entire software development process, focusing on application modeling, design, development, coding, and testing. – ½ day
- **Eclipse: Empowering the Universal Platform:** This briefing takes a deep dive into some of the most important and feature rich projects that the Eclipse community is developing. From multi-language support to plug-in development, it shows how Eclipse has evolved into a universal platform complete software development.– ½ day
- **Effective Software Testing:** Focus on variety and thoroughness of IBM Rational's Software Quality solutions and best practices and demonstrates the framework and tools needed in software testing as a strategic business advantage. – ½ day

2007 Briefings (page 2 of 3)

- **IBM Middleware On Linux:** This briefing includes an overview of Linux as the premier open computing platform and the value it brings to any business. It introduces key IBM middleware products that run on Linux with a focus of products in the development space. – ½ day
- **Information on Demand Live! - Building the Next Generation of Database Applications:** A demonstration of IBM Information Management tools & services available to support rapid development of integrated solutions for managing expanding volumes of data by efficiently handling XML and relational data with ease to build agile applications faster. – 1 day
- **Open Community Tools: An Open Stack Development Platform:** This briefing explores the innovation of Open Source solutions available from IBM and illustrate the power and flexibility of IBM's Open Community development tools.– ½ day
- **Open Source Development: Tools and Open Standards:** Focus on IBM's role in "Open" source tools and Open standards – ½ day briefing/workshop

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2007 Briefings (page 3 of 3)

- **Accelerating Global Software Delivery:** This briefing provides an overview of the need for Business Driven Development in addressing topics including Software delivery challenges, Compliance and Monitoring. It introduces the IBM Rational Software Development Platform's team products and focuses on their value of providing the development team's capability to better manage value, maintain flexibility, and control risk and change – ½ day
- **SOA Governance: Implementing the IBM Method:** Provides an in-depth look at Service Oriented Architecture governance, from the basics to the business case focusing on IBM Rational's tools for the designing and constructing of an SOA governance framework to span the entire application development lifecycle – ½ day

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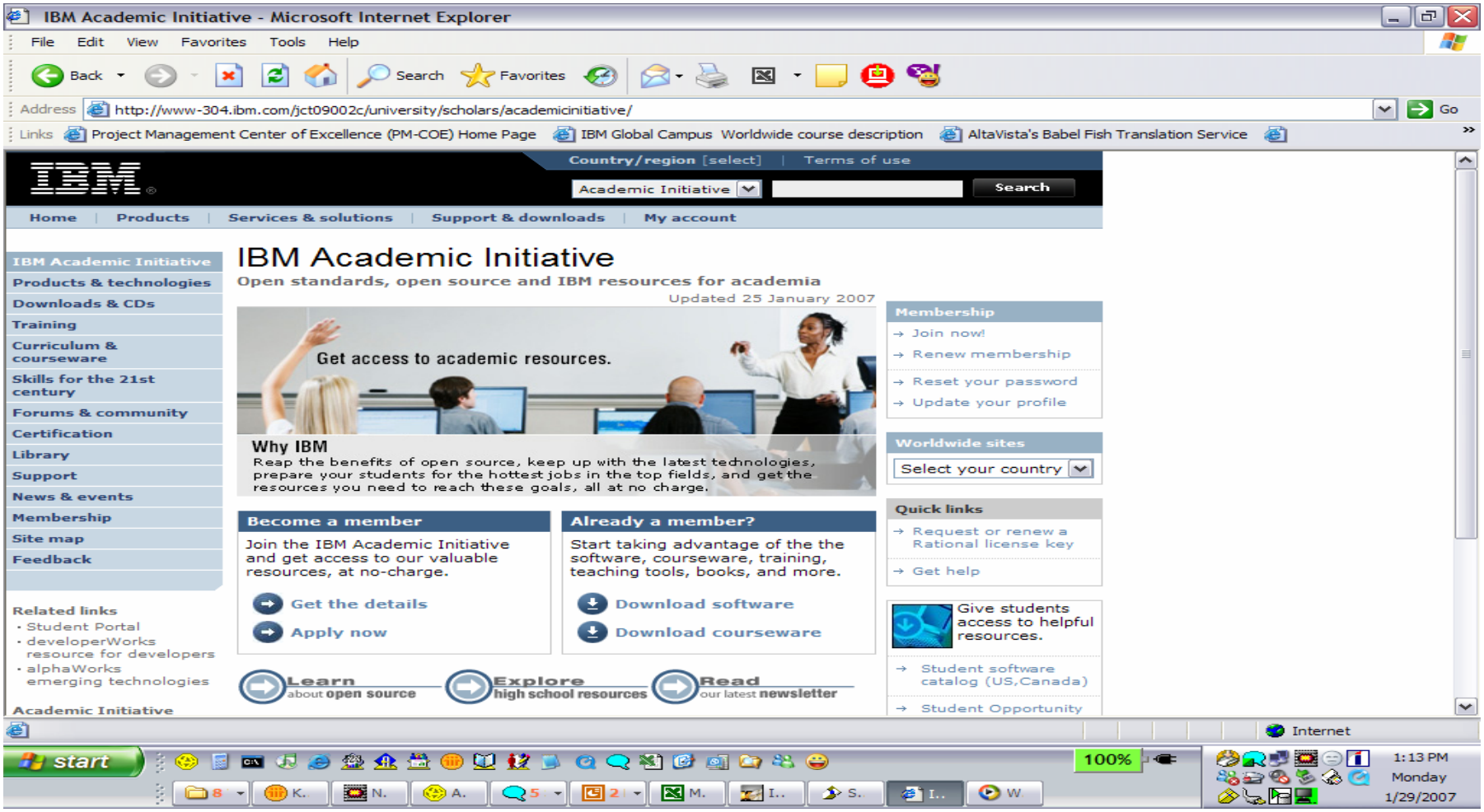
IBM Academic Initiative



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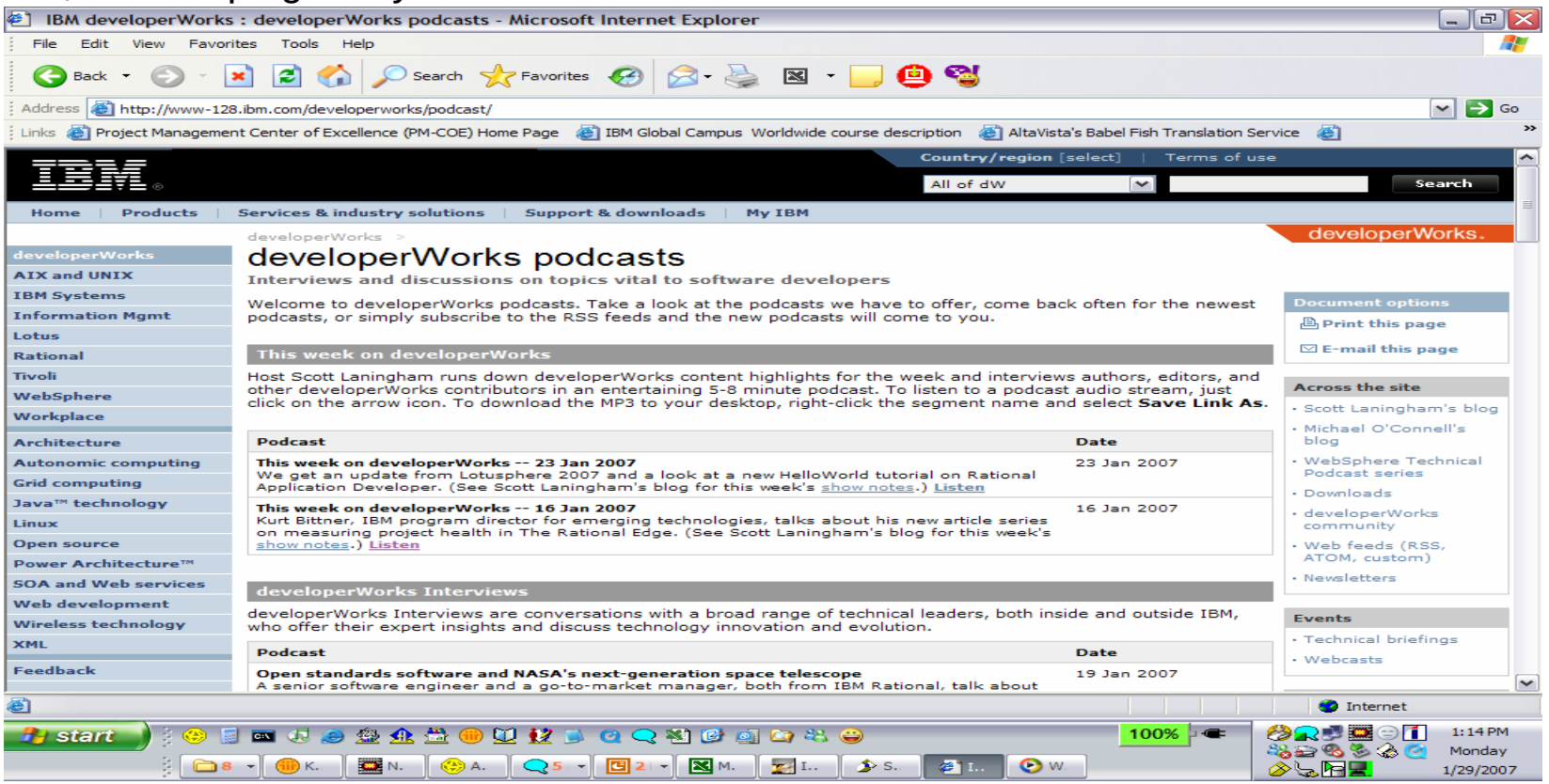
dW Podcasts

- We offer Podcasts as well. Podcasts are downloadable MP3 recordings on various technical subjects by subject matter experts and industry luminaries
- For example: IBM Fellow Grady Booch discusses innovation and evolution in IT, being an IBM Fellow, and keeping an eye on the horizon.



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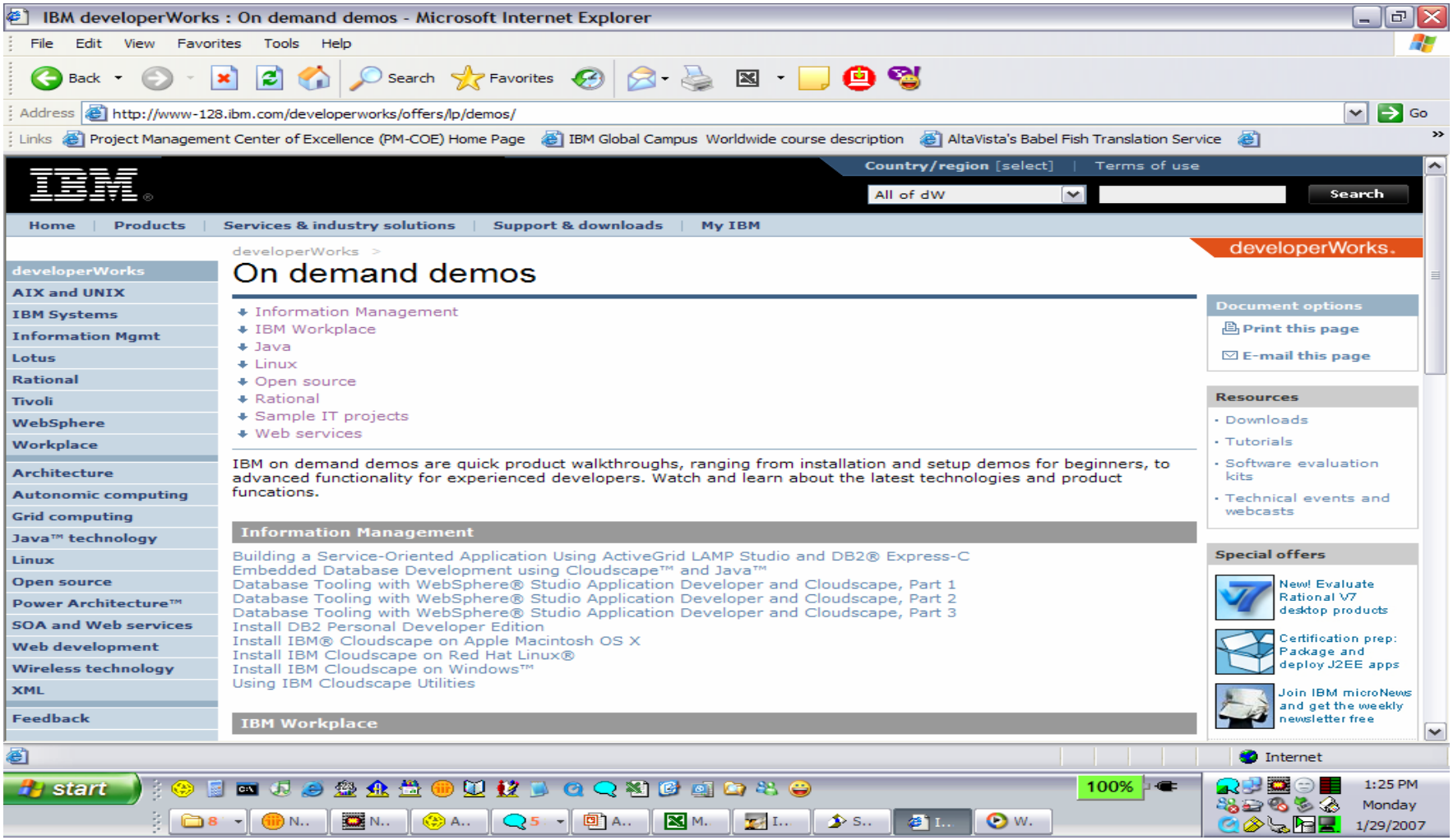

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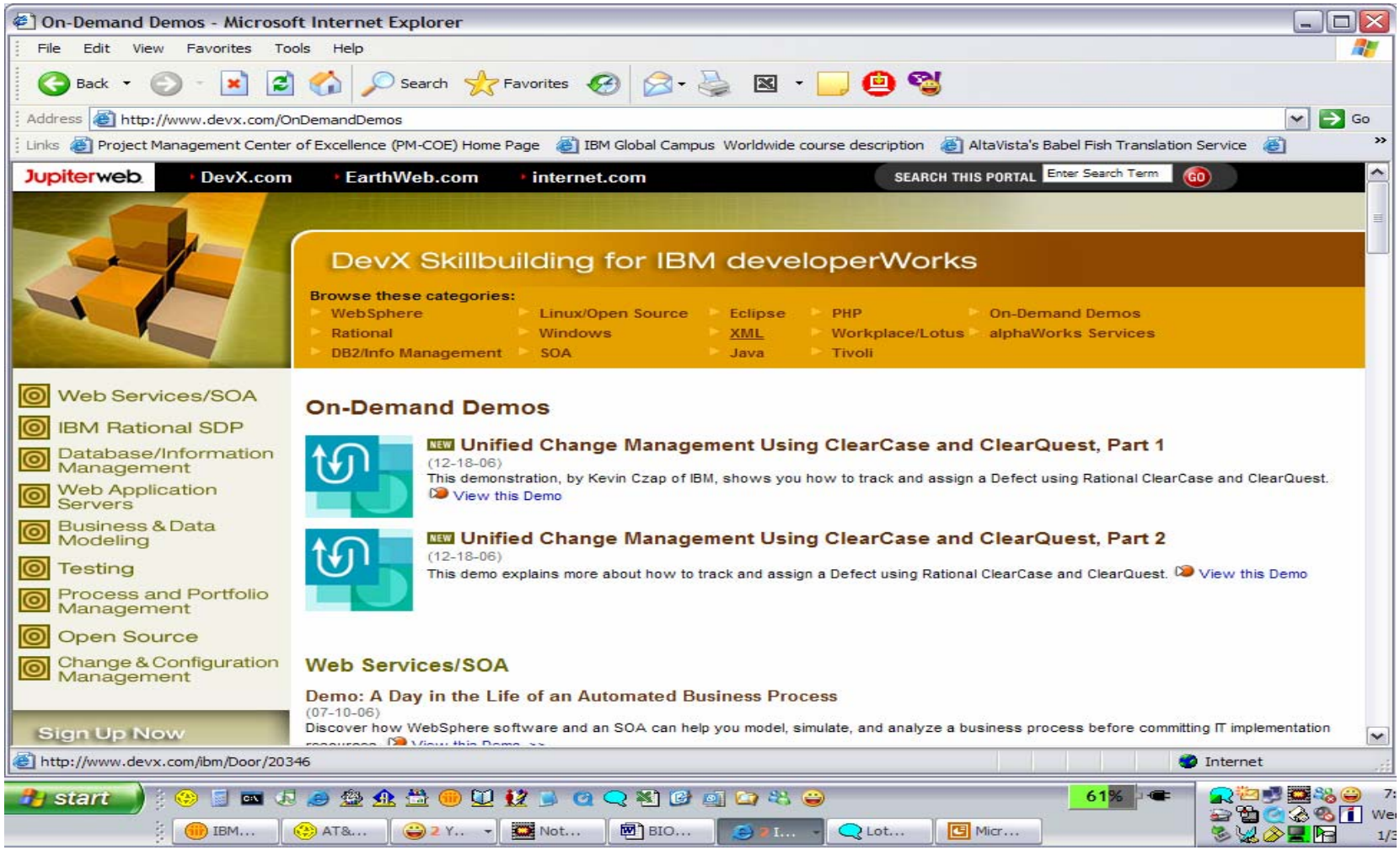
On Demand Demos on DevX



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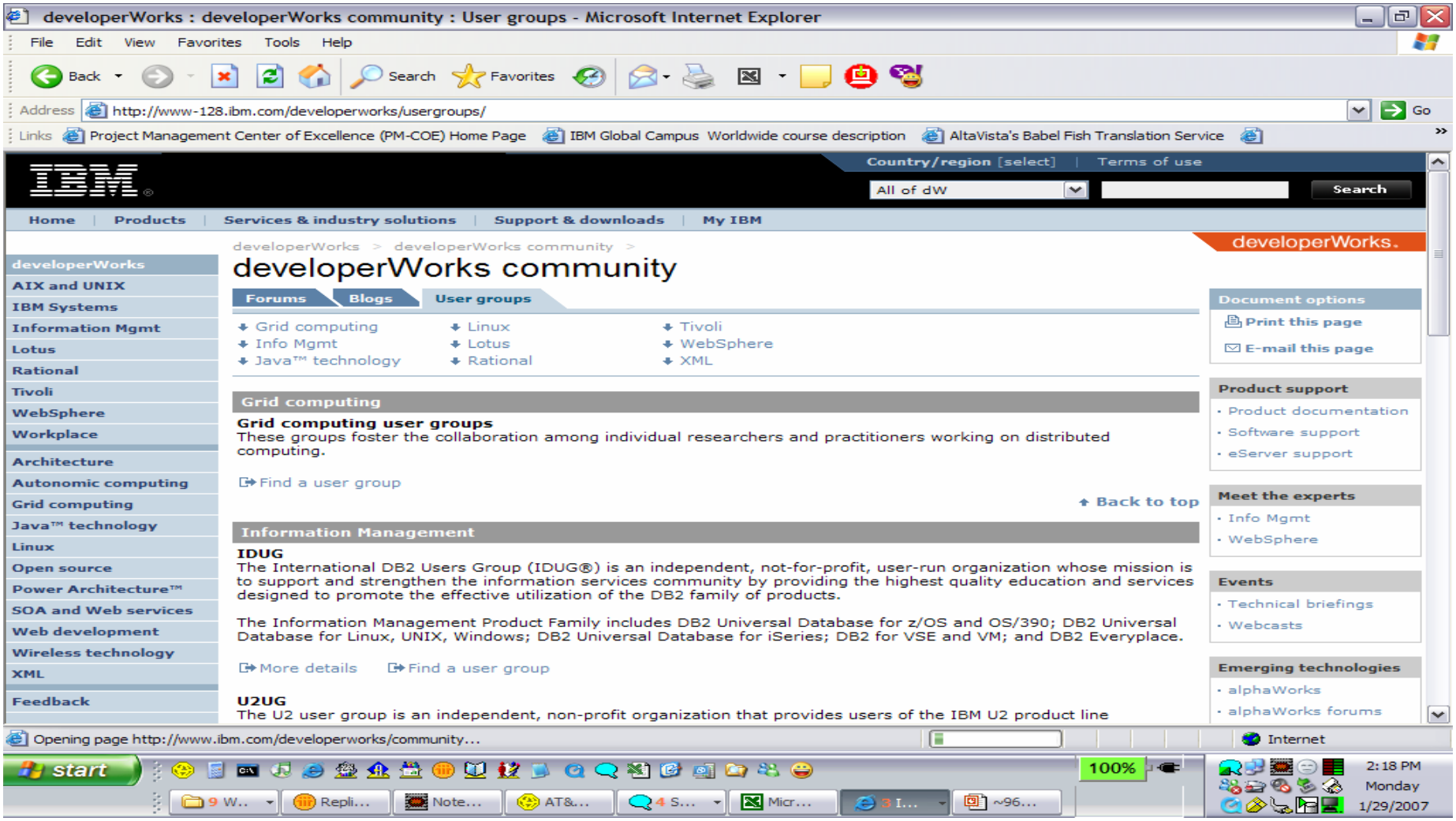
User Group Communities



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