Software Test-on-Demand - A Smarter Way

An Infuse Consulting White Paper

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INFUSE consulting

Excellence through Quality Assurance

PURPOSE STATEMENT

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INTRODUCTION

According to the Harvard Business Review paper, 2011 "Why your IT project may be riskier than you think" a surprisingly high number of technology projects are out of control and can sink entire companies and careers. It references:

- A $5 million SAP project that led to a charge of $192.5 million against earnings to compensate for the botched project.
- Months of relentless IT problems at Hong Kong airport, including glitches in the flight information display system and database for tracking cargo shipments reportedly cost the economy $600 million.
- One in six projects were described as a "black swan" with average cost overruns of 200% and schedule overruns of almost 70%.
- The German government lost $10 billion in revenues due to the failure of a consortium to deliver on time a system designed to collect tolls from heavy trucks using German roadways.

Yet change is critical to business innovation and enterprises often face the dilemma of balancing costs, resources and business risks when rolling out business transformation underpinned by technology. The CIO is more than ever being pressured to deliver measurable results for the business such as greater effectiveness and greater efficiency with fewer resources. By implementing software test automation correctly you can significantly increase the speed and accuracy of the testing process, provide a higher Return on Investment (ROI) from software projects, become more agile allowing you to cope with change more frequently and speed up project delivery all while reducing risks.

The CIO is more than ever being pressured to deliver measurable results for the business.

This white paper will review the importance of software testing, what is suitable for test automation, the alternative approaches available and how "Test-on-Demand" capability, such as is available from Infuse Consulting can offer you a smarter way to realise the greatest returns for the least risk. It will also include real life ROI examples to help you build your own business case for effective software test automation.

IMPORTANCE OF SOFTWARE TESTING

Software testing is a key component of the quality assurance and risk reduction process and typically consumes 30-50% of a project budget. How much effort is invested in software testing should be commensurate with the potential risk to the business, the complexity, and frequency of any changes made to the software or operating environment. For example, software used to control military equipment or aircraft will have potentially disastrous consequences should the software fail, so requires more rigorous testing than a simple non-critical business application.

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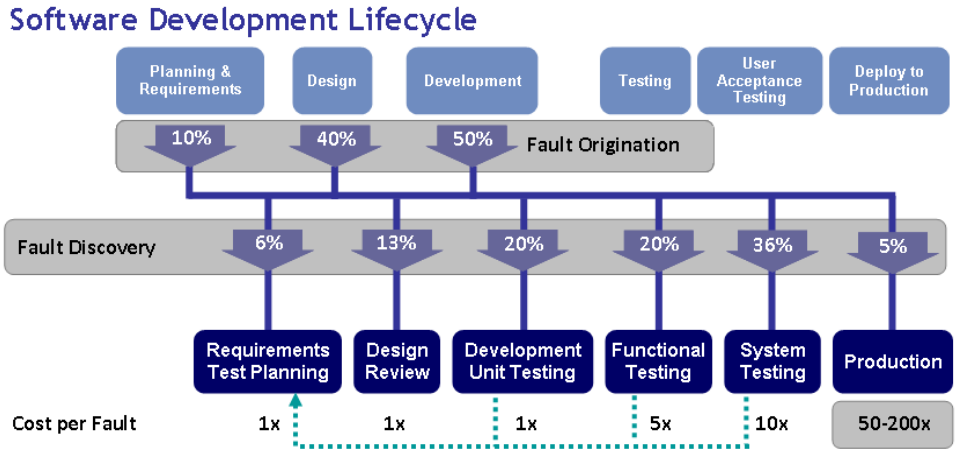
The following diagram based on a study by Carnegie Mellon University shows the fault stream analysis of typical fault injection rates during the SDLC and the associated costs of conformance (fault finding and fixing).



Source: Carnegie Mellon University

The Carnegie Mellon University study shows that 56% of faults (defects) are found in the test environment (functional, system and user acceptance testing) and 5% are found in production. Finding faults at this stage is clearly expensive both to find and fix and prohibitively so, when this is combined with current manual and automated test approaches thus making delivering IT effectiveness and efficiency a very difficult challenge.

WHY SHOULD YOU CONSIDER TEST AUTOMATION?

Successful Software test automation can help an enterprise be more agile, reduce testing effort and costs, and improve quality assurance

Successful software test automation can help an enterprise be more agile, reduce testing effort and costs, improve quality assurance, and deliver a measurable Return on Investment thereby enabling you to deliver product to market and/or implement new processes before your competitors do.

There is no doubt that test automation is a great idea but frequently it has failed to deliver the benefits claimed by tool vendors. According to "Test Automation" issue on Testing Experience (December 2008); it is claimed that 63% of test automation projects fail (to deliver). This is because:

- There exists disconnect between the business (the users) and IT (test automation)
- Test automation is seen as too technical, it is not agile, it takes a long time to setup and so the users still want to execute tests themselves.
- You can only automate regression tests after the first release
- It will impact project timescales if it fails

The key here clearly is to identify what testing is suitable for automation, what should be performed manually and how to deploy test automation.

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WHAT TESTING IS SUITABLE FOR AUTOMATION?

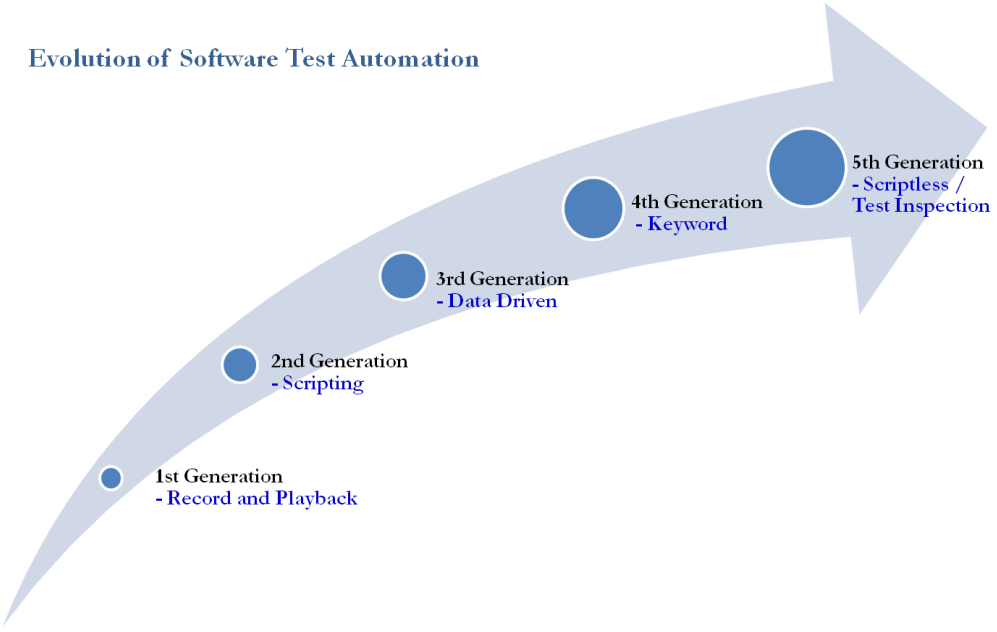
Robust manual testing will always play an important role in the total Quality Assurance process. However, in general, test automation makes sense for:

- Functionality which is critical to the business or supports many concurrent users;
- Functionality that has been assigned specific service-level agreements (SLA);
- Functionality which touches multiple areas of the application (or other applications);
- Tasks which are either repetitive or error prone, such as data loading, system configuration, etc;
- Testing that involves multiple hardware or software configurations.
- COTs based enterprise systems such as SAP, Oracle (Siebel, PeopleSoft, JD Edwards, Hyperion, Retek, Demantra, Transportation Management) Chordiant, etc

Infuse Consulting and its Test on Demand service provide a smarter way, especially for agile projects.

TEST AUTOMATION APPROACHES

Test automation delivery has evolved over the years through a number of generations to reach the current scriptless generation.



1st Generation - Record and Playback

The Record and Playback approach uses tools that record the actions of a tester in a manual test, and allow tests to be run unattended for many hours each day, greatly increasing test productivity and eliminating the tedious repetition of manual testing.

However, even small changes to the software under test require that the test be recorded manually again. Therefore this first generation of tools is not efficient or scalable and ROI is never realised

2nd Generation – Scripting (Use / Re-use of functions in test scripts)

Scripting, a form of programming in computer languages used in software test automation, alleviates many issues with capture/ playback method. Often this is done by capturing functions/use-cases and then storing them as reusable modules to be executed by a calling script. However, the developers of these scripts must be highly technical and specialized programmers who work in isolation from the testers actually performing the tests.

Scripting is best suited for GUI testing and doesn't lend itself easily to embedded, batch, or other forms of systems. As changes to the software under test require complex changes to the associated automation scripts, maintenance of ever-larger libraries of automation scripts becomes an overwhelming challenge. The ROI using this approach is difficult to achieve as well.

3rd Generation – Data driven Scripts / Functions

Data-driven testing is often considered separately as an important development in test automation. This approach simply but powerfully separates the automation script from the data to be input and expected back from the software under test. This allows the data to be prepared by testers without relying on automation engineers, and vastly increases the possible variations and amounts of data that can be used in software testing. This breaking down of the problem into two pieces is very powerful. While this approach greatly extends the usefulness of scripted test automation, it requires stable processes to be defined so cannot be used early in the SDLC. In addition the huge maintenance chores required of the automation programming staff remain. The test automation footprint is often 20-25%; if it is any higher then ROI cannot be realised.

4th Generation - Action Word / Keyword Scripts / Functions

Fourth generation test automation frameworks were initially piloted by Hans Buwalda while at CMG in 1994 and extended by Infuse Consulting in 2003 in a solution called KATF (Keyword Automated Test Framework) which was heavily utilised in the telco arena by many customers. In generic terms some may refer to action words as keywords, or test actions in JAVA. HP/Mercury's equivalents are "business components" in their Business Process Testing (BPT) solution. Infuse eventually merged its solution into BPT in 2004.

This is a functional test automation system based on the concept of creating test cases from re-usable business components.

The keyword based approach ensures that the maintenance is performed at the keyword level. Any change to a keyword is reflected in all the places where it is

being used. This is still quite a low-level approach to building reusable assets though.

The keyword based driven approach, however, simplifies the process of test case creation, allowing non-technical subject matter experts to focus on creating high-level business process test flows, while test engineers concentrate on enabling test automation.

The efficiency of test case creation is further enhanced as the business components are highly reusable stored in a central repository to aid test case maintenance.

Using this approach some customers have managed to implement test automation successfully. However, executives are still reticent to sanction spending on what is perceived to be a high-risk, high reward venture. The main issue is that these frameworks are often developed from scratch and can take up to 12-18 person months development with no guarantee of success.

5th Generation – Scriptless or Test Inspection

With scriptless test automation a test analyst does not need to create an automated test script. Neither does a test automation developer need to create action word functions to implement an action word test case. It is, however based upon an evolution of the keyword based test design and automation approach.

Test Inspection by Infuse is a true scriptless approach, which involves pre-built libraries of components for your business applications. The idea of an inspector is that it examines a form on a GUI or interrogates the database to pick up customisations and then create the automated test components (like Lego® blocks) that can be organised into test cases. The inspector approach and libraries are built on an object-oriented paradigm of objects, interactions and reuse / inheritance.

Infuse is at the forefront of software test automation with its "Test-on-Demand" service

Whilst this technology is a great enabler, Infuse has invested considerably and built upon 5th generation principles with a more sophisticated and cost-saving evolution that has enabled it to develop and deliver to its customers an automated "Test-on-Demand" service incorporating advanced test inspection.

WHAT IS TEST-ON-DEMAND?

Often automated test cases can only be executed on the environment they were created on because of compatibility issues with object repositories or the time to modify scripts and functions. So, although they execute tests quickly in the system test of system integration test environment, they are hardly, if ever, used within the development environment from where 50% of software faults originate.

The principle of Test-on-Demand is to execute tests when you want in any environment. Test-on-Demand incorporates service excellence, next-generation technology and process in which test cases are rapidly created, easily maintained and can be executed within any environment i.e. development, system test, system

integration test, pre-production and production using the same scripts with no modifications at all.

Once automated tests are created, the Test-on-Demand approach divides tests into 4 sets as follows:

- Master Test Set – A suite of automated tests that sets up all master or pre-requisite data for all the subsequent test runs
- Core/Intake/Smoke – A suite of automated tests approved by the business / business users that determines the minimum acceptance criteria that must be met before a development release is accepted into the formal testing environment
- Full – A suite of automated tests that contains all of the automated tests (that can be executed in any environment)
- Change Impact – A targeted set of automated tests that focuses on aspects of business change

The execution times of these tests are dependent on the number of automated test execution machines, so the more machines you have, the less time it takes to run. When the service is mature and in full-flow the Infuse Test-on-Demand can often enable you to run full automated tests within 2 hours and certainly in no more than 48-hours, thereby working well with continuous integration environments.

What this means is that if the development team advise that release is available, the Master Test Set is executed and the Intake Test Set is executed in the development environment. If the tests pass, then the release is taken into the formal testing phase.

If the tests do not pass then the defects are found, captured and fixed in the development environment. As they are automated, the cost of execution is minimal and the quality consistent. More importantly - the cost of conformance is less (at least one-fifth of the cost of finding it in the testing environment and then fixing it).

Such quality gates can only be applied this effectively and efficiently using the Infuse automated Test-on-Demand approach. Other techniques (manual, risk-based manual, keyword) do not easily lend themselves to this due to a variety of issues such as:

- Manual Testing (risk-based) – not agile, costly, takes time and is prone to risk of human error
- Keyword – normal testing technology will require significant maintenance to execute tests in different environments, in effect increasing your costs of maintenance, whereas Test-on-Demand tests execute on any environment with no modification (other than data).

BENEFITS OF TEST-ON-DEMAND

Test-on-Demand enables your business to control the quality of your applications through the following:

- Forces implementation partners / development to deliver acceptable quality
- Ensures minimum acceptable business functionality is being met
- Ensures your business doesn't own defects not related to the release
- Minimizes double testing and rework
- Finds defects earlier and prevents defect entry into test environment
- Reduces your testing costs. If defects are found beyond the development phase, costs can increase significantly as indicated below:

Phase where defects found	Costs increase by
Functional testing	5 times
System Testing/UAT	10 times
Production	50-200 times

Even for customers on fixed price build and testing contracts with partners/ System Integrators (SIs); it pays to invest in a suite of automated Test-on-Demand Intake tests. This will ensure your partner deliver quality to your business rather than spending time and money finding the defects in your test environment. Even if your programme is fixed price; the time and cost to find a defect in your environment have cost you at least 5-10 times what it would have cost to run the intake test in the partner's environment.

For System Integrators there is a clear benefit to reduce costs, increase profit margins and give your customers some value added assets that can be reused in UAT. Infuse has delivered significant Net Present Value (NPV) adjusted annual returns of over 35% for its SI partners which has added to their fixed contract margins.

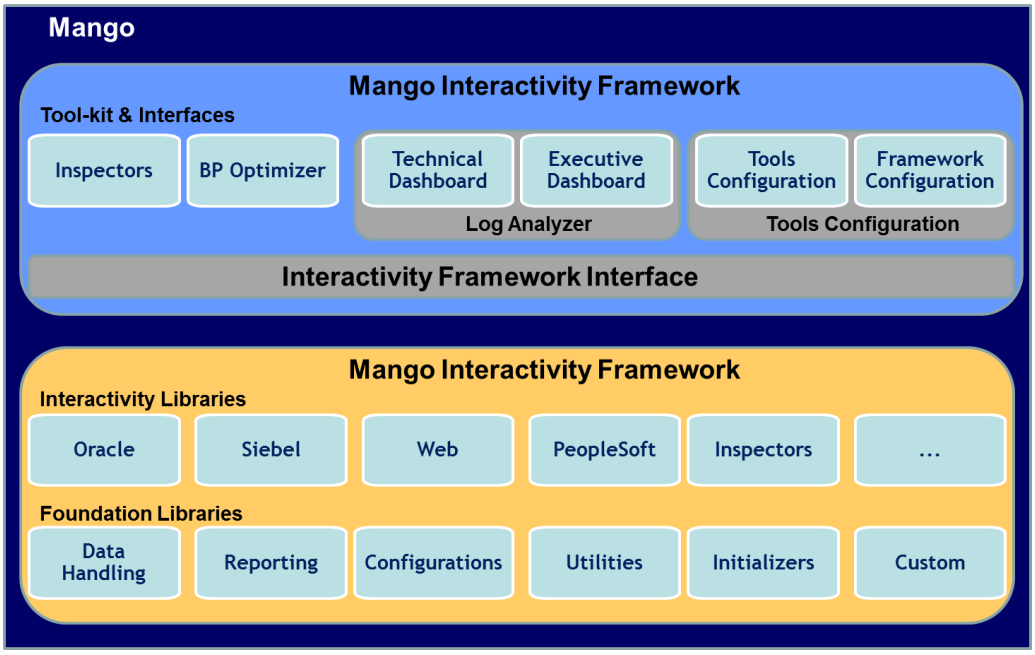
The key enabler for delivering Test-on-Demand is Mango – the proprietary utilities and test automation framework from Infuse Consulting. Test-on-Demand is not possible to deliver using any other test automation approach. We will now examine Mango in more detail.

What is the Mango utility and framework?

Critical to the success of the delivery of Test-on-Demand is the unique proprietary toolkit from Infuse called Mango - Infuse Test Automation Solution.

The Mango utility consists of the following components:

- Foundation libraries - for handling data, business level reporting, exception handling and test intializers
- Interactivity libraries – application specific libraries (plug-ins) that contain all the technical information to drive a test case
- Interactivity Interface – the XML interfaces that allow the libraries to talk to the tool-kit and interfaces
- Tool-kit and Interfaces comprising:
  - Application Inspector – The Inspector that creates all the get, set and verify components for the application under test
  - BP Optimizer – The Business Process Optimizer that enables reusability and speeds-up execution
  - Log Analyzer – For debugging and executive level reporting of test results
  - Configuration – For configuring the tool-kit and interfaces for specific applications



Test-on-Demand uses Mango to rapidly create robust, reusable test cases that are then executed using market leading test tools.

The Mango framework helps the tester create all the action objects for a given GUI technology to create automated tests out-of-the-box that can then be dragged-and-dropped together to create test cases.

Test-on-Demand with the key Mango advance is the ability to assemble business processes on the fly via components. Components are simply building blocks used to assemble different business processes. The components don't change with each business process test script; it is the order in which they are placed that determines the different script flows. Using components, subject matter experts can quickly

create multiple user scenarios, validate each one, and optimize the business process flow without ever having to touch any procedural code or keywords.

For example, subject matter experts can create a test case that finds customer records by placing a 'Search Customer' component after the 'Login' component. The same 'Search Customer' component can then be used in any other test case. For example, a much more complex test case that searches for a customer and then performs actions on the customer's record.

Each component includes all the user steps required by that process, entering values in edit fields, selecting from drop-downs, and pressing buttons, for example.

Once the components have been built, they can be used and reused in every test case that requires similar functionality. As a result, you can use a single component in hundreds of different test cases with little to no extra effort. By simply selecting the appropriate component via drag-and-drop, subject matter experts can mix and match components to create multiple scenarios and test sets for different needs.

This eliminates the thousands of lines of redundant script code that used to be created, stored and maintained for each instance of the application. The result is that project teams can build automated tests for complete business processes in a fraction of the time previously required.

This is the reason why an Automated Test Pack for a single system can be generated very quickly, even if our customer has many thousands of tests to automate.

How does Test-on-Demand work?

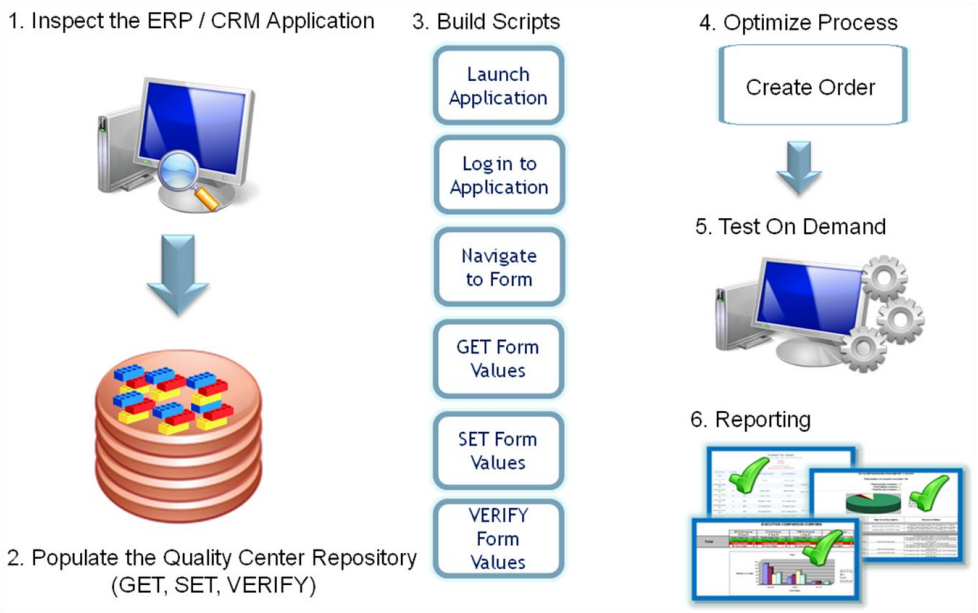
The initial step is to use Mango to inspect the application to create the Component Libraries that map to the Application under test. It doesn't matter to what level the customization has taken the application away from its Vanilla state; the Inspector can handle this and will create a setup of components to get values, set values and verify values on a form.

Once a library of components has been created by the Inspector this is imported into the test management tool repository. The components are now visible and can be used to drag and drop into robust business process tests in a matter of minutes.

Business process tests can be further consolidated into single components for use in other tests. For example – you may have dragged-and-dropped 10 components together for the "sales order" business process. Now you can compile this test into one component and reuse it across other tests rather than dragging and dropping components all the time. This speeds up execution and enables re-use much like an object orientated framework would.

The tests are now available to add to your "Test-on-Demand" test set.

Infuse Inspector and Framework



Execution takes place utilizing market leading test tools which acts as an engine to drive the test script, providing a much more detailed and targeted series of reports specifically for your business.

A BETTER WAY - NEXT GENERATION TEST AUTOMATION

Until now, test automation approach and technology has meant that automated tests have normally been at least one release behind, and manual tests are only automated once a business process is fully tested manually several times. Tradition has also meant test automation is used for regression testing.

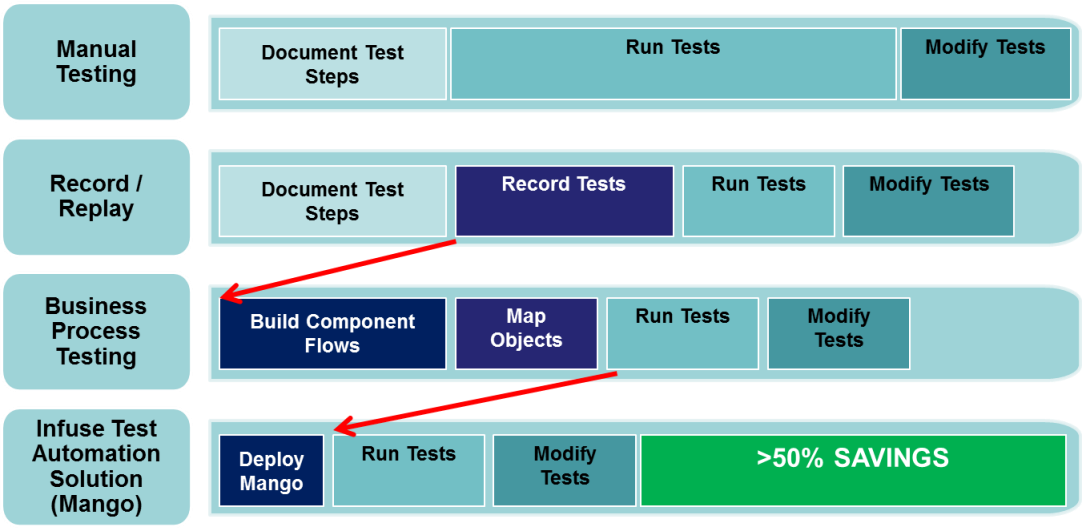
The Infuse methodology and technology breaks that mould and enables businesses to have automated test scripts in sync with their current release and have the ability to automated testing within the development cycle. This not only rapidly accelerates ROI significantly but makes test automation work within a collaborative agile framework.

The Infuse Consulting approach is built on the Business Process Testing (BPT) approach by providing you with pre-built BPT application and business process libraries for:

- Oracle Siebel
- Oracle E-Business Suite (often referred to as Oracle Financials)
- Oracle PeopleSoft
- Oracle JD Edwards EnterpriseOne
- Oracle Hyperion
- Web / Web 2.0
- PowerBuilder

... thereby considerably reducing the time to develop and automate test cases. The Infuse Test Automation Solution (Mango) is fully integrated with HP's Quality Center, Quick Test Professional and BPT tools to deliver rapid Test-on-Demand results and rapid return on investment, leveraging any existing investments you may have in these tools. The Infuse tools and techniques can also be used to accelerate testing of bespoke applications through the extension of the interactivity libraries.

The Infuse solution includes test scanning tools to significantly accelerate the whole testing process, making it practical to use test automation tools even on the first release of an application. Time savings in excess of 50% are typically achieved as shown by the diagram below.



Highlights include:

- Library of pre-built test components
- Automatically scans the application metadata to generate all necessary test components
- Eliminates record / play activities
- Significantly reduces upfront development time while speeding time to achieve a measurable Return on Investment
- Greatly reduces on-going maintenance due to re-scanning capabilities.
- 100% implementation success
- ROI in less than 12 months

Furthermore, the Infuse approach has numerous advantages over the keyword approach as summarized in the table below.

Activity	Keyword Framework	Inspector Automation
Walkthrough & Understand Manual Process	0.5 – 1 hours	0.5 – 1 hours
Record or Update Keywords (or Inspect Screens) in Process	0.5– 1.5 hours depending on screen complexity	5 – 20 **seconds** per screen
Update Recorded Code / Object Rep	0.5 – 1 hours	NA
Create Function Library (Optional)	Ongoing Effort	Already Done
Create Component Library (Optional)	Ongoing Effort	Automatic
Place components / functions in sequence	2 - 4 hours	2 – 4 hours
Parameterize Data	0.5 hours	Automatic
Input Data	0.5 - 1 hours	0.5 – 1 hours
Add Logic (including unit testing logic)	0 - 2 hours	Occasional
Add Checkpoints	0.5 hours	Automatic
Add Screenshots (Optional)	0.5 hours	Automatic
Execute / Debug Script	1 - 2 hours	1 - 2 hours

Further testimony to the outstanding business benefits of the Infuse approach are provided in the Customer Case Studies below.

ROI CASE STUDIES

The following case studies are all from real life situations from clients benefiting from using the Infuse Consulting software test automation solutions.

Telco Customer

Technology:	Web/J2EE
Customer products / services:	Mobile Network Provision
Solution used:	Infuse Inspectors for Web Applications
Objectives:	▪ Enable an increase in the release by reducing test cycle times ▪ Reduce or eliminate manual testing ▪ Implement a test-on-demand service ▪ Build a fixed price model for testing
Approach:	▪ Assess current state of testing using Infuse Test Authority Model ▪ Implement Infuse Inspectors and Framework for Web Applications ▪ Extend Inspector and Framework based on to support the application headless layer
Results:	▪ Automation of 800 business process test cases ▪ Reduce manual test estate by 88% ▪ Reduction of test cycles times by 60% ▪ Reduction of testing costs by 35% ▪ Reduction in manual FTE headcount by 75% ▪ Enablement of quarterly release from half-yearly releases

Pharmaceutical Customer

Technology:	Siebel Sales
Customer products / services:	Medicines
Solution used:	Infuse Inspectors for Siebel
Objectives:	▪ To decrease time to market ▪ To reduce testing costs ▪ To automate regression testing in multiple locales and 29 Siebel SRF's ▪ To provide UAT with better confidence in new releases

Approach:	▪ Deploy Inspectors for Siebel ▪ Enhance customized reports for UAT ▪ Handover assets to client SI team for execution/maintenance ▪ Infuse provide expert services around library enhancements
Results:	▪ Test Effort reductions (compared to manual effort) – Patch Releases ▪ Major – 47% ▪ Minor – 38% – Major upgrades ▪ 72% effort reduction ▪ Elapsed time cycle time reductions (compared to manual effort) – Patch Releases ▪ Major – 85% reduction ▪ Minor – 72%reduction – Major upgrades ▪ 68% reduction ▪ Ongoing Cost Savings (compared to manual testing) of – Patch Releases ▪ Major – 49% ▪ Minor – 41% – Major upgrades ▪ 71% ▪ In addition business testers receive consistent business level HTML reports increasing confidence in quality and avoiding rework

Financial Services Customer

Technology:	Java/Web/J2EE
Customer products / services:	Wholesale Banking
Solution used:	Infuse Inspectors for Web and Java Applications
Objectives:	▪ Test Automation of Wholesale Banking Applications ▪ Automate 4 separate platforms simultaneously & in parallel ▪ Implement a test-on-demand service

Approach:	▪ Inspectors for Test Automation ▪ Extend Inspector Framework based on HP QC with BPT ▪ Automate 587 Business Process Test Cases
Results:	▪ Reduction on manual effort by 45% ▪ Reduction of test cycles times by 66% ▪ Test Automation Results within 24 hrs

Logistics Customer

Technology:	Oracle E-Business
Customer products / services:	Transport
Solution used:	Infuse Inspectors for Oracle E-business
Objectives:	▪ Build a consistent regression test approach ▪ Reduce test cycle times ▪ Reduce overall testing costs ▪ Increase releases of Oracle E-business ▪ Implement a test-on-demand service
Approach:	▪ Inspectors for Test Automation ▪ Deploy HP QC/QTP/BPT ▪ Automate 3600 Business Process Test Cases in 41 e-business modules ▪ Deliver test-on-demand near shore (Romania
Results:	▪ Infuse helps reduce: – regression test costs by 60% – testing effort by 90% – test cycles times by 66% ▪ Test Automation Results within 48 hrs ▪ Payback in 7 months

SUMMARY AND CONCLUSIONS

In the world of dynamic software, which changes every day to adapt to customer demands, the quality is always of prime concern, especially if the consequences of software failure could have serious detrimental impact on your organization.

With each new generation of test automation the possibilities for a return on investment has improved. This is important as automation is becoming increasingly critical to an organization's risk management strategy to prevent technology projects getting out of control with potentially devastating consequences.

The next generation of Test-on-Demand services as provided by Infuse Consulting is well proven to deliver rapid and significant measurable Return on Investment whilst both reducing your business risk and improving the agility of your software delivery capability.

The Infuse approach is an important solution that truly helps the CIO and QA Manager deliver added value for their organization with fewer resources.

ABOUT INFUSE CONSULTING

Infuse Consulting (Infuse) is a leading provider of Quality Assurance and software testing services to organizations operating throughout Europe, the Middle East and South Asia.

Infuse has presence in London - UK, Amsterdam – Holland, Bucharest – Romania and partner delivery capability in Saltillo – Mexico and Pune – India.

The wide range of services from Infuse is designed to optimize the performance, quality and reliability of IT-enabled business systems, enabling them to be deployed with confidence. Our service offerings will also help you to minimize risk, reduce development costs, shorten time-to-market and work to predictable outcomes - factors essential to success in a competitive marketplace.

Partnerships

Our services and solutions are further complemented by strategic partnerships with a number of market leading companies, including HP Software, Oracle, SAP and Microsoft.

We are a trusted partner of HP Software and Oracle. Infuse is a global HP Education Partner and besides being experts in the usage of the HP suite of tools, we contribute to HP's R&D program, notable achievements being development of the Infuse Inspectors.

Infuse is also the preferred testing partner for Oracle Advanced Customer Services (ACS) UK. Our processes and methodologies are used as the underlying foundation for Oracle ACS Test Services which are also delivered by Infuse.

Infuse is a key delivery partner company for the market defining Testing Maturity Model (TMMi) and is respected by our customers and partners in providing the best support, recommendations and delivery available. We have a solid track record of delivering within budget, with high quality and within timescales.

Company Highlights

2002: Company founded

2004: Awarded ISO 9001 certification for quality managed systems and BTO service delivery

2004: Awarded partner status by Microsoft

2005: Announces strategic partnership with ITM for Middle East co-operation

2007: Awarded Silver Partner Status by HP Software

2008: Awarded Gold partner status by Oracle

2008: Saudi Arabia joint-venture Al-Kanar Arabia Ltd created in partnership with Prince Fahd Bin Migrin Al Saud and Nihilent Technologies

2009: Oracle ACS announce Infuse as go-to testing partner for Oracle

2010: Major contracts won around Infuse Inspector Solution

2011: Romanian test factory opened

REFERENCES / SUGGESTED READING

Harvard Business Review - paper "Why your IT project may be riskier than you think", 2011

Alliance Global Services: Guidelines to create a Robust Test Automation Framework.

HP white paper: Agile automation: A primer on test automation in agile projects.

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