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sense and simplicity

Challenges and solutions in test automation of medical visualization applications

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Oct 01, 2009

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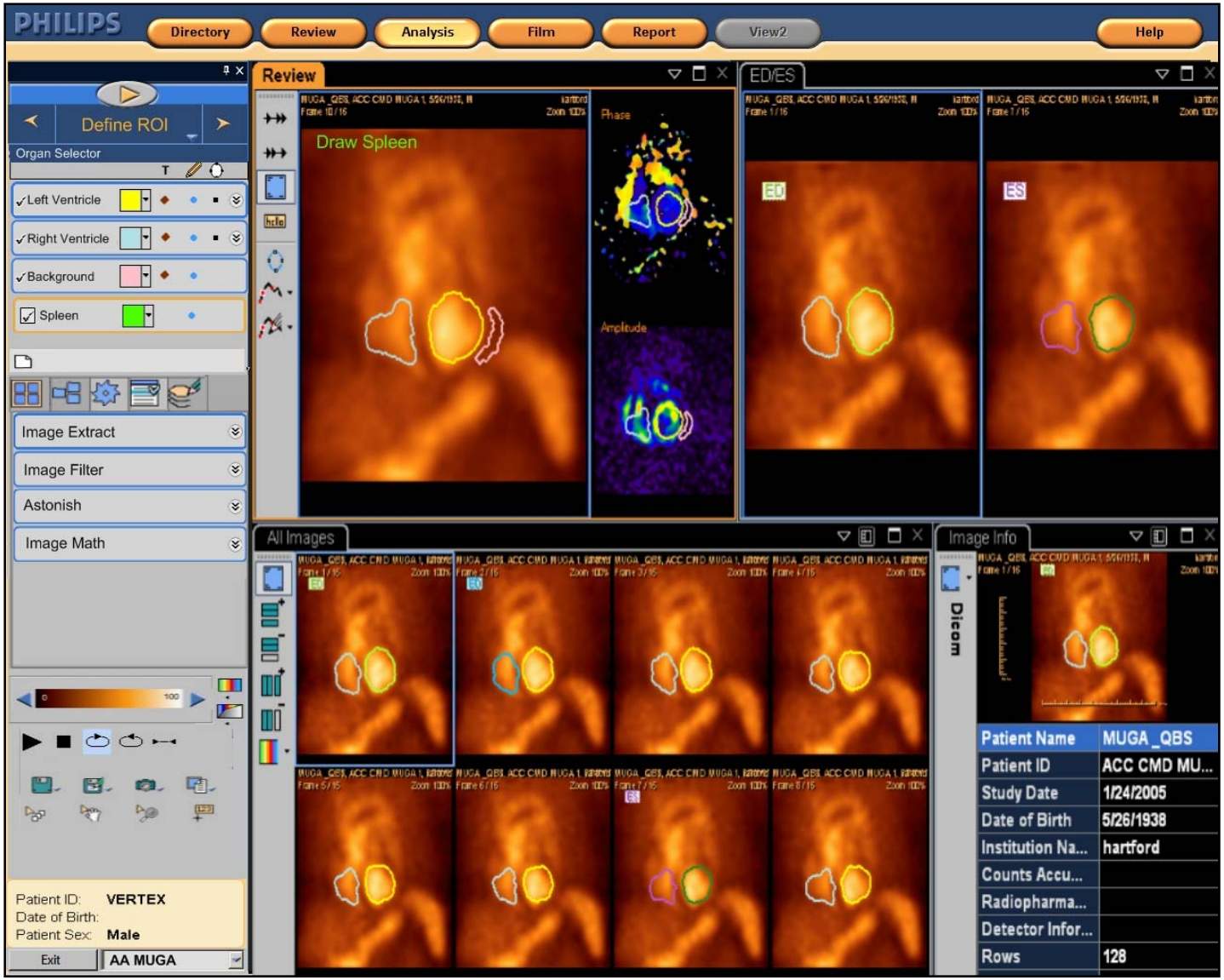
Agenda

- Motivation
- Challenges
- Details of test automation framework
- Results & Lessons Learnt
- References

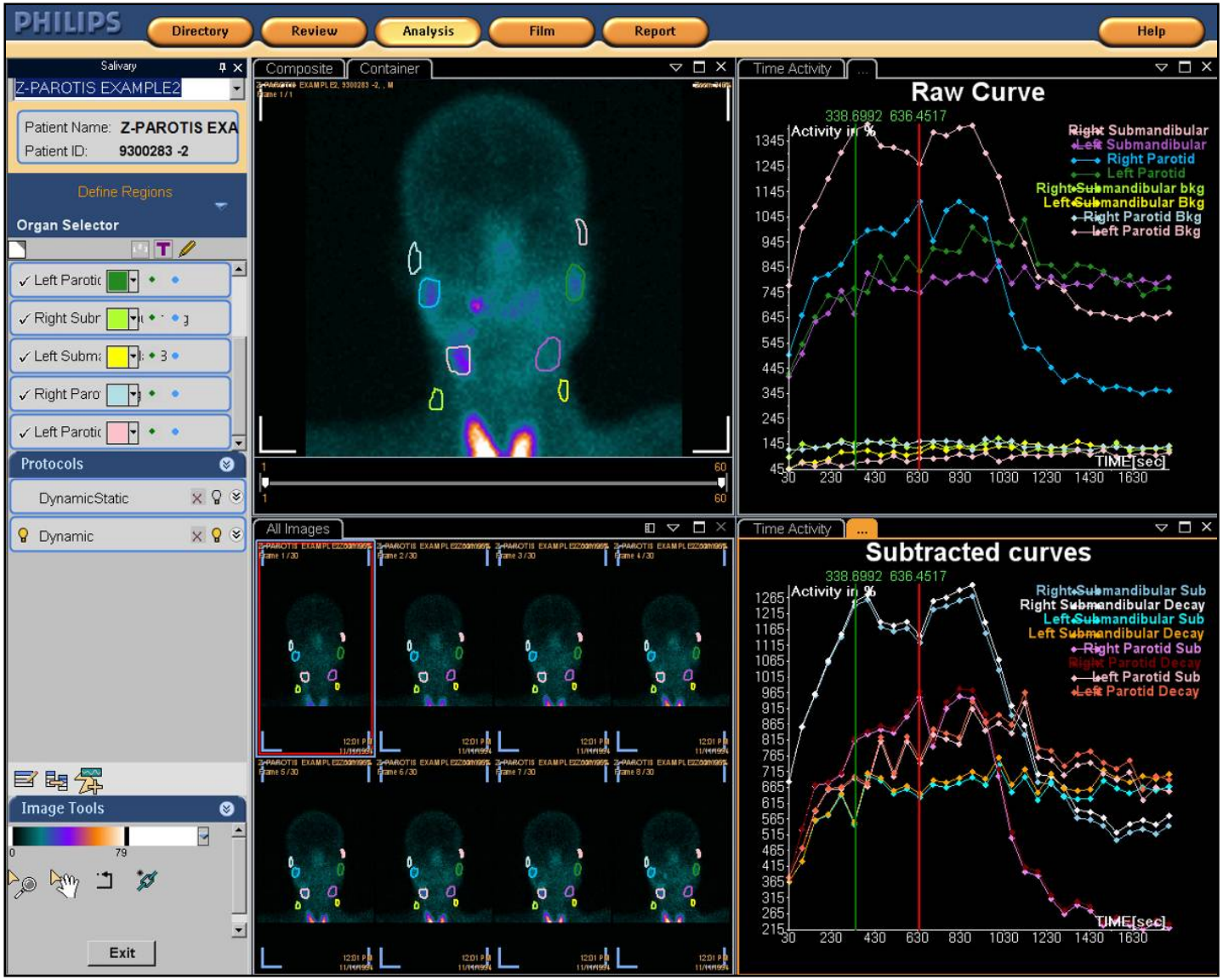
Motivation

- Most PH applications(Application Under Test) are GUI intensive and built on homegrown frameworks.
- Issues in using COTS tools
- Complete test automation solution of these applications is not possible with Commercially Off-the-Shelf(COTS) tools alone

Example of Clinical Application



Example of Clinical Application – contd.



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Challenges in using COTS tools

- Automation scripts built using COTS tools will not function on applications built against PH specific strong names
- Recording is in analog mode for custom GUI Controls
  - Record and playback test scripts are not reliable and need frequent modifications
- Does not meet more than 50% of our needs

Control Types in Our applications	Standard Vendor Support
Standard Controls(35%)	Supported
Compound Controls(20%) .(ex: ComboEditBox,ListView with Tree view Embedded in each row)	Not supported
Custom Controls(45%)	Not Supported

- Relatively big foot print on test systems
- Lack of seamless integration with development environment

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Challenges specific to visualization applications

- Recognition of “Image Viewer” control along with its nested controls.
- Recognition of graphic and textual annotations on images
  - Ellipse
  - Point
  - Polygon
  - Line
  - Text
- Validation of image data (image quality and algorithm results)

Key aspects of the solution

- Hybrid solution combining aspects of the Microsoft automation framework and home-grown automation mechanisms
- Comprehensive custom recognition mechanism for GUI and non-GUI objects
- Application Programmable Interface (API) support for frequently used clinical operations on medical images
- Extensibility mechanism for modality(CT/US/NM/CV) specific plug-ins.
- Customized reporting mechanisms compliant to regulatory requirements (e.g. FDA)

Key aspects of the solution

- Tools to build test cases and clinical workflows
- X-Copy deployment across multiple test nodes
- Mechanism that enables concurrent execution across multiple test nodes
- Low foot-print

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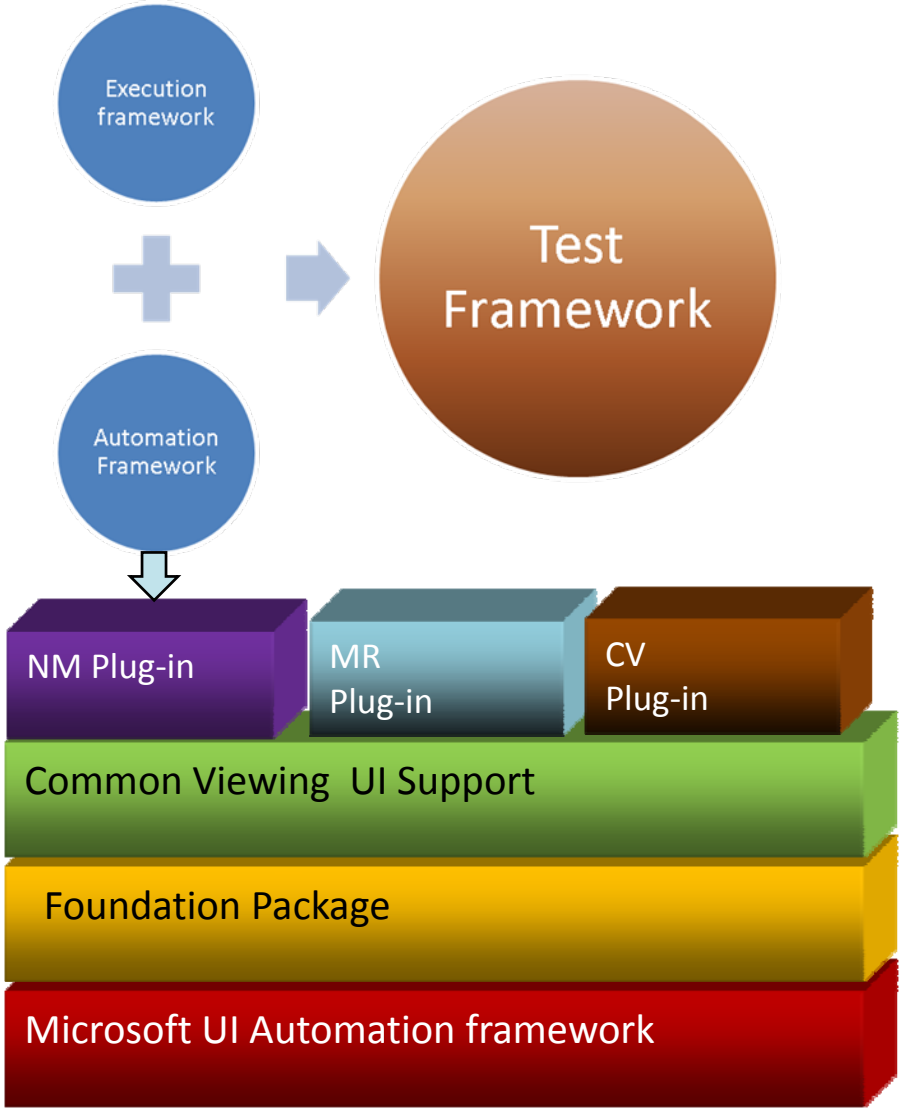
Architecture of the test framework



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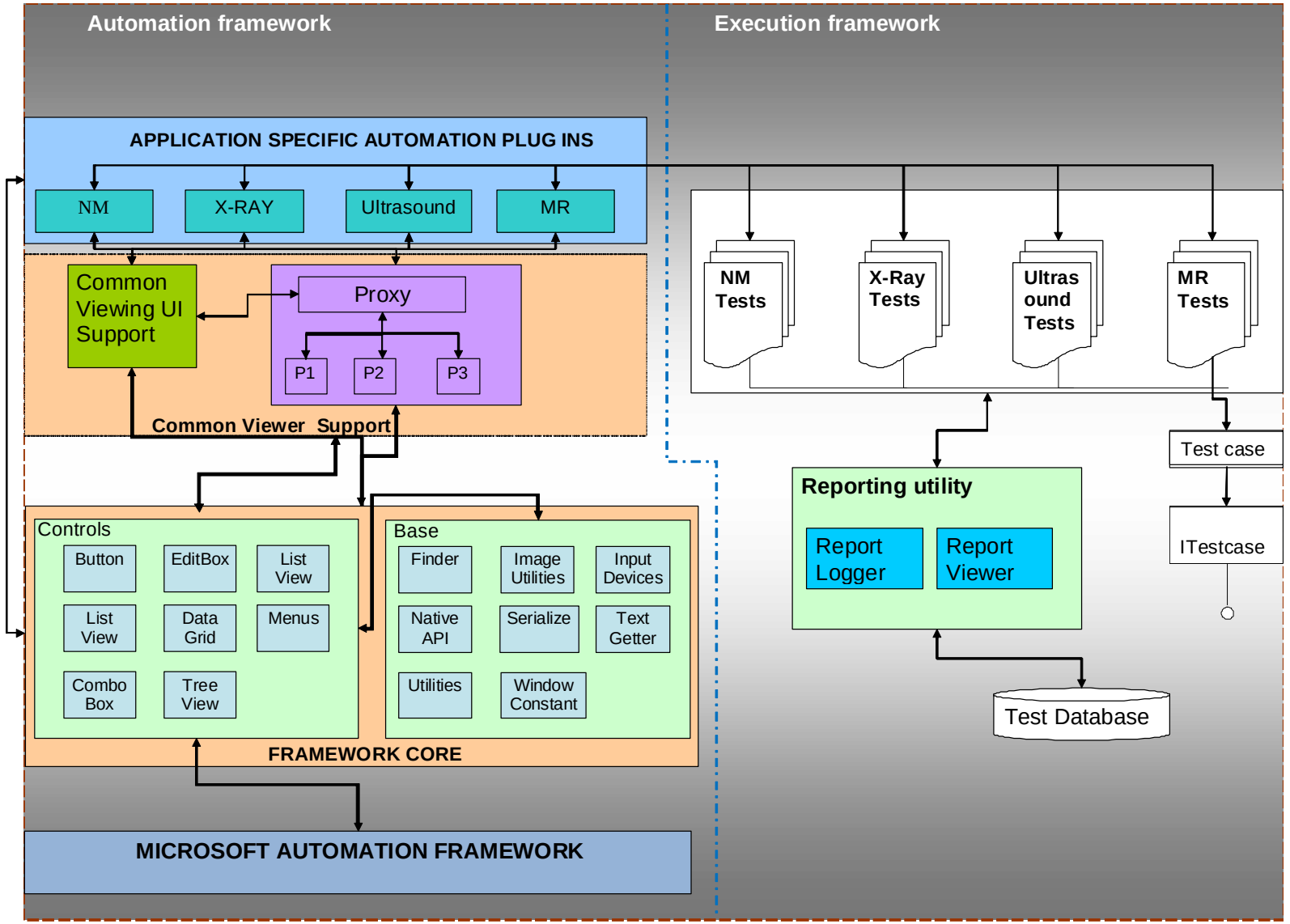
Architecture of the test framework - contd



Steps in developing a test case using test framework

- Segmented Test Automation Approach
  - Test is divided into 4 parts
    - Pre condition
    - Action
    - Verification of Action Performed
    - Post Condition
- Define a test Case Model.
- Every test (each Test case is an Object) will be atomic in nature to enable work flow chaining
- Support execution from Standard runners like NUnit by providing interface generators.

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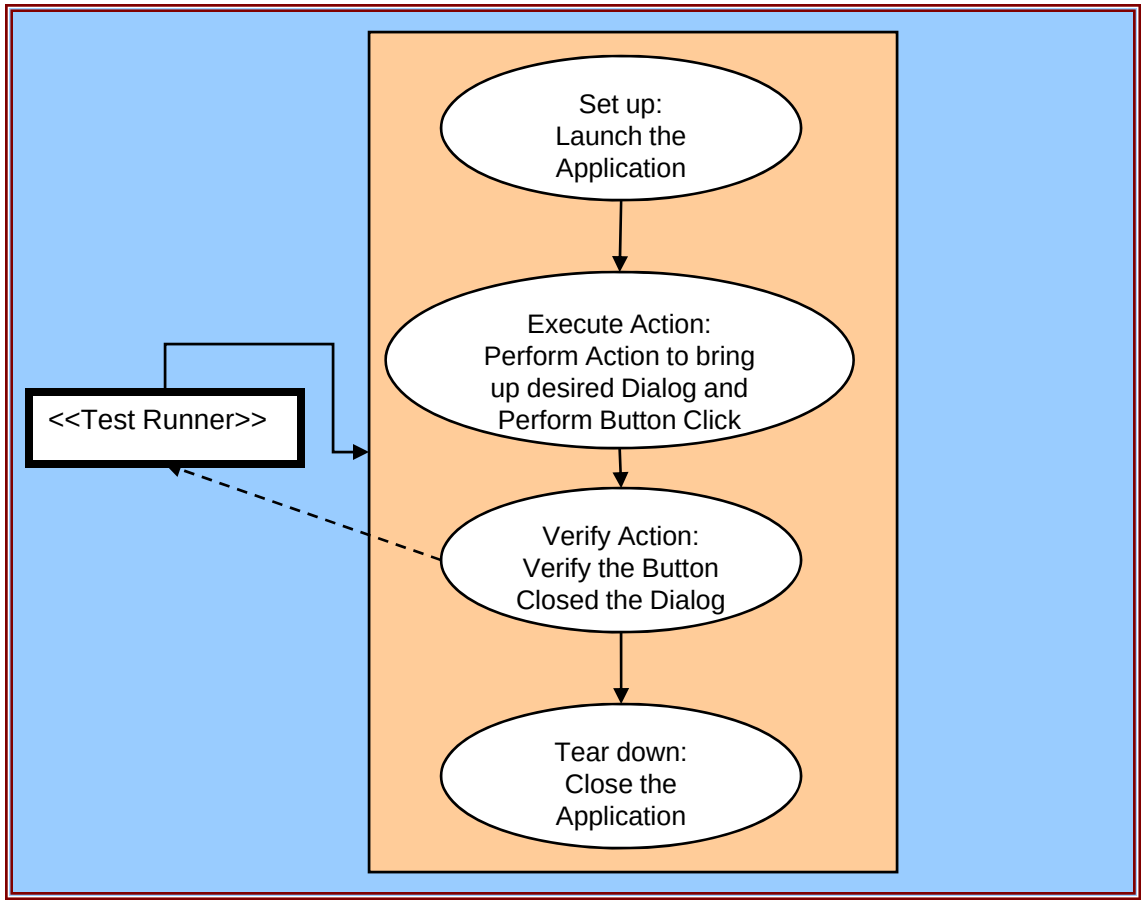
Example of a test case written using test automation framework



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Example of a test case written using test automation framework

```
public class Test001 : TestCase, ITestCase
{
    #region ITestCase Members
    [TestcaseSetup]
    public override object Setup(params object[] parameters)
    {
        ClientApplication.LaunchApplication(true);
        return null;
    }
    [TestcaseExecute]
    public override object ExecuteAction(params object[] parmaters)
    {
        return null;
    }
    [TestcaseVerify("VERIFY")]
    public override object VerifyAction(params object[] parameters)
    {
        bool isDisplayed =
             Navigator.IsDisplayed(Navigator.Button.Forward);
        return null;

    }
    [TestcaseTeardown]
    public override object Teardown(params object[] parmaters)
    {
        ClientApplication.CloseApplication();
        return null;
    }
    [ReUsable]
    public override object ReusableFunction(params object[] paraters)
    {
        return null;
    }
    #endregion
}
```

Results

- Deployment scenario1:
  - 4700 integration test cases automated, with an execution time of 26 hours
  - manual effort of 80 person days.
  - Also deployed against five versions of the product.
- Deployment scenario 2:
  - one suite of clinical applications automated, i.e. about 750 test cases, with an execution time of about 5 hours
  - manual effort of 8 person days.

Lessons Learnt

- End-to-end-automation solution: A hybrid solution combining aspects of standard automation solutions (e.g. Microsoft UI Automation) and home-grown solutions is more likely to address end to end automation needs
- Plug-in architecture: The concept of an automation framework to provide plug-in mechanisms so that application specific extensions can be met, is an important design consideration
- Cost Benefit: Initial investment on the framework development is high, which pays off during subsequent test case development
- Ease of use: the framework should be so designed that it can be made an integral part of the testing activity; should not call for special skills from the testing community (e.g. programming) to use

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References

- www.codeplex.com
- UI Automation Overview: http://msdn.microsoft.com/en-us/library/ms747327.aspx
- Nunit: www.nunit.org


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