

Collaborative Research Programme Project Definition (1 of 3)

Project Number:	SWE003
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Project Title:	Automatic Test Generation
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Relation to Research Areas:
Automated Testing

Background of Project Provider:
Jade Software Corporation is the main beneficiary of this project, due to them proposing the project and providing the funding to support the project.

Statement of Need:
<p><i>Overview</i> Automatic generation of test case scenarios based on existing prototype test scenarios and definitions of testing objectives applied to a given development environment.</p> <p>The process can be divided into the following steps:</p> <ul style="list-style-type: none">• Develop a formal framework to enable semantic rules to be described. An example in the context of Schema Evolution might be “remove the last inverse from a reference where the inverse reference has multiple inverses”.• Search the given development environment to find one or more examples of situations where the semantic rule can be applied.• Generate related-test scenarios similar to the prototype scenario. In the context of Schema Evolution these might be scm files to load or actions to be performed in the development environment. <p><i>Research Interest Areas</i> Possible applications of:</p> <ul style="list-style-type: none">• Intelligent discovery process: The discovery of new test cases could be seen as specialized queries over a new test base. Those queries are based on the semantics of the development system.• Artificial intelligence techniques could be used for the generation of the tests. For example genetic programming.• Possible application of research conducted by the University in system semantics. For example such research might provide the framework required to allow the description of the semantic rules. <p><i>Jade Interest Areas</i> Expand testing activities by automatic ‘extrapolation’ of test cases, allowing the breeding of new test cases in realistic systems. Such tests could be used both for identification of bugs and continued regression testing.</p> <ul style="list-style-type: none">• Integrated Development Environment testing that simulates the usual situation during development.<ul style="list-style-type: none">○ Single User. Isolated scenarios involving single simple steps.

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- Multi User. Including interleaved operations among multiple users. One user might add a property to a class while another user is deleting a property from its subclass.
- Bach-oriented loading of specifications that simulated the usual situation during deployment. This approach is also more conducive to the automation of the testing and is particularly important for regression testing.

The interaction among simpler single step tests can produce complex interactions. These occur in realistic situations but are time consuming and complex to generate by hand.

Use case:

Although a large number of unit tests have already been developed, these are built-in to an existing development system and cannot be used in other systems. A particularly productive use of these has been to use them in random order which suggests the current proposal would be equally productive.

When large schemas with many changes are loaded, these changes interact in complex ways and can result in situations that produce unforeseen consequences. Such failures can result in an error during a schema load or reorganisation. In practice, when any such failure is identified it often turns out that a small unit test can be constructed to reproduce it but no one thought to construct a test for the combination of circumstances. This is compounded if multiple loads of the same schema is performed before reorganizing, the system is un-versioning part way through the series of loads, or if the loads include partial schemas definitions. During such a partial load the compiler is only presented with certain entities and must infer that other entities that are not present need to be versioned.

Although much of this proposal describes the generation of tests for Schema Evolution, the approach is also applicable to the testing end user applications. Perquisites of such an approach would be that external data streams could drive the application and a clear representation of the applications semantics is available.

Implementation consideration

Creating test scenarios by hand is both time consuming and runs the risk of only testing situations that are thought might be a problem. Creating them automatically can explore a greater range of possibilities but can result in situations that may not 'make sense' or represent illegal states.

For example if the scenario required the previous example of "remove the last inverse from an reference" then the analyser would search the development environment to find references with only one reference and then generate a scm (or cls or jcf) file where that last inverse was removed. Care would need to be taken that any resulting scm file was the same as would be generated by a real schema extract including and secondary consequences of removing the reference that may have been used as a key or used in methods.

Potential for Follow On Work:

Dependant on the outcomes of the research, there is the potential of follow on work to build on the findings the research undertaken in this project or to investigate related other related areas.

Anticipated Duration:

The anticipated period for undertaking this project is 12 months, although the industry partner expects continuous engagement with the researchers, in order to make use of findings as early as possible and to transfer knowledge in the subject area to their staff and the WRC.

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Project Budget:	\$?? (This is a nominal figure, the actually funding provided will be finalised once the project has been fully scoped.)
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Key Dates:	
Closing Date for Letter of Interest :	
Notification of Request for Full Proposal :	
Closing Date for Full Application :	
Notification of Award of Project :	

For further information Contact:	
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Appendices

Schedule A – Non-Disclosure Agreement

Schedule B – Intellectual Property Agreement