

Test Generation from System-level Requirements Specifications

Ph.D. Thesis Research of
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Industrial Context

- ★ System-Level Requirements-Based Testing
 - system-level : system components, not just software
 - requirements-based : tests are derived from a given requirements specification
 - no design or implementation considerations
 - distinct differences from code-based testing

Motivation

- ★ System-Level Requirements-Based Testing:
 - an essential task in systems development
 - demonstration that every requirement has been implemented
 - COMPASS '97
 - Offutt - system level important to industry
- ★ Predominantly manual task
 - light tool support, address bookkeeping only
 - manual = people = expensive

Formalization Essential for Automation

- ★ Formal logic provides a medium for test *calculation*
- ★ Readability is key (ref. Kendra Cooper)
- ★ Q - TCEL's cousin
 - provides readable, industrial front-end with a mathematical foundation
 - for any {intruder} {{target} and {intruder} are separated according to vertical separation rules}

The Semi-Automated Process

★ Test frames based on:

- current spec,
- coverage scheme, and
- current test suite.

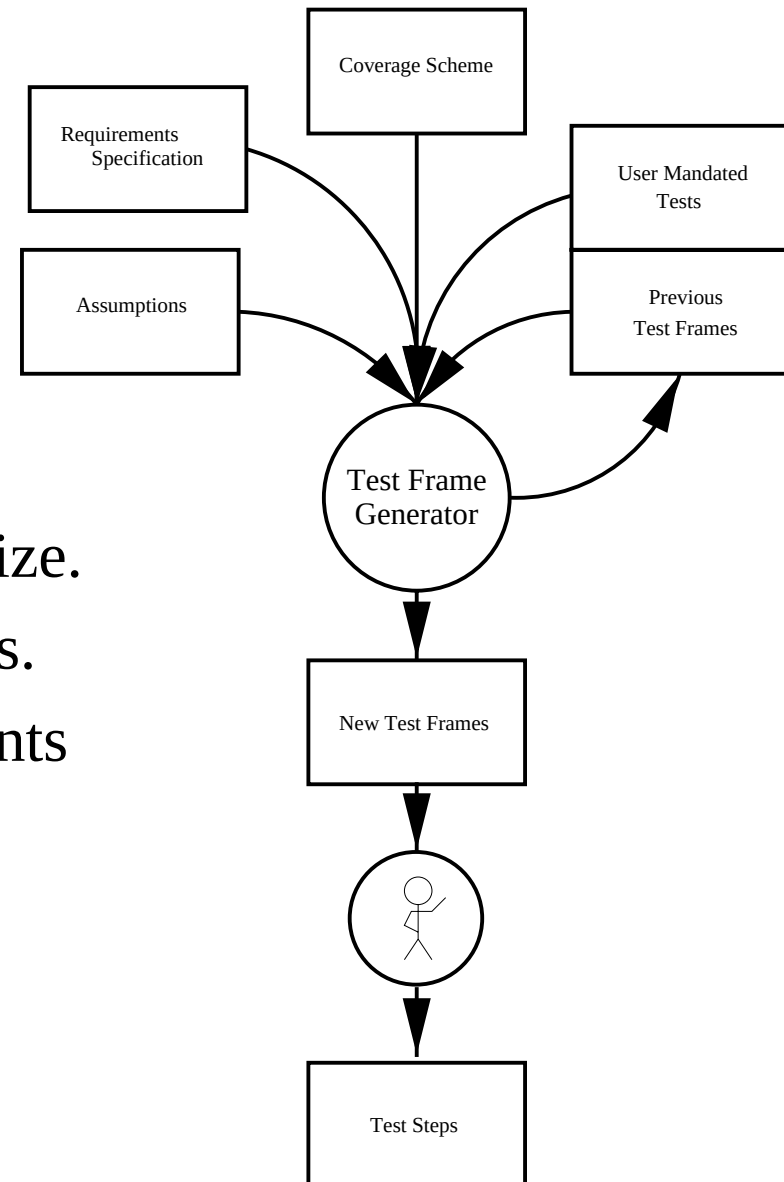
★ Coverage controls test suite size.

★ User can mandate certain tests.

★ Reduces impact of requirements changes.

★ Test case elements are instantiated test frames

- done manually.



Advantages

- ★ Less manual effort required = (< \$\$\$)
- ★ Formal logic = assurance of correctness
 - reduces human error
- ★ Coverage consistency
- ★ Mechanized traceability
- ★ Requirements changes impose minimum re-work

Disseminating Results

- ★ TAPSOFT '97, France (renowned European conference)
- ★ Tech report (forthcoming)
- ★ Current submissions to ISSTA '98 and FMSP '98
- ★ Industrial example : CAATS SRS (proprietary)
- ★ MDA experiment with an early TCG (Jamie Andrews)
- ★ Conversations with individuals:
 - COMPASS '97: industry/military, FM + testing dominated
John D. Musa (SRE Consultant), Jeffrey Voas (RST), Jane Hayes, Mark Blackburn
 - Herbert Hecht (SoHaR) contact via Jeff Joyce, ISESS '97
- ★ <http://www.cs.ubc.ca/spider/donat> (non-proprietary)

Expected Results & Status

- ★ Result: TCG algorithms for S-L R-B Testing
 - automated test frame generation
- ★ Future Applications
 - basis for formal industry standards for coverage
 - early requirements validation
 - formal verification of critical parts of designs (safety)
- ★ prototypes TCG(S)/QTCG(Q)
- ★ minimum impact to be implemented
- ★ CAATS example in progress (ROIDs tracing)
- ★ Expected completion: January 1998