An Analysis Framework and Additive Software Analysis

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Outline

- A Framework for Software Assurance
- Additive Software Analysis
Framework for Software Testing and Assurance

Analyzer A
Checker Q
Tester T
Analyzer F
Checker B
Reporter M

Standards for Information Exchange
Functions of a Framework

- Aggregate tool outputs.
- Allow software assurance checkers to interoperate.
- Pass program information between tools.
Benefits of a Framework

- Modular and distributed development.
  - Existing modules may be replaced by superior ones.
  - Facilitate synergy between groups of researchers.

- Enable development of “hybrid” tools.
  - A tool uses a static analyzer module to find problematic code locations, then uses a constraint satisfier module and a symbolic execution engine to create inputs that trigger failures.
Framework for Software Testing and Assurance

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Possibly Useful Information

- Location in code
  - File name, class file, method/function name, line number, etc.
- Variables visible at a location
- Possible variable values at a location
  - Intervals? enumerations? relations (e.g. $x < y$)
- Data flows
- Paths
- Stack traces
Additional Information

- Origin of binary chunk in source code
- Warnings of possible problems
- Assertion, pre- & postcondition, invariant
- Function signatures
Much of This Already Exists

- LLVM
- Clang
- gcc
- Rose compiler infrastructure
- findbugs
- Yasca
- TOIF, SAFES
- Code Dx

XKCD cartoon used with permission. Permanent link is http://xkcd.com/927/
ADDITIVE SOFTWARE ANALYSIS
Case 1: More Information

Each analyzer or checker added gives the programmer more information.
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Case 2: Confirmation

Results are correlated or compared to provide better information than either one alone.
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Another example: tie static analysis with execution monitoring and constraint solving to get a hybrid analyzer.
Additive Software Analysis Benefits

- Checkers and analyzers work together.
- Foster an “ecosystem” for tools.
- Growing set of problematic and virtuous programming patterns and idioms may be checked by tools.
Possibly Useful Information

● A descriptive taxonomy of checkers.
  – Inputs needed.
  – Languages/constructs handled.
  – Checking/analysis performed.
  – Outputs provided.

● A catalog of publically-vetted checkers and analyzers.

● A publicly accessible repository of checkers.
Framework and Additive Software Analysis Together Are Powerful

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