Automated Package Testing
A FormalWare Project

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Talk Overview

- Goals
  - reduce the cost of unit testing
  - reduce effort and elapsed time
  - address both development and maintenance costs
- Testing packages
- The Automated Package Exerciser (APE) tool
- Technology transfer issues

Testing Packages

- Generic testing tasks
  - stimulate the CUT
  - observe actual behavior
  - compare actual to expected behavior
- Package testing tasks
  - stimulus: a sequence of subprogram calls on the CUT
  - actual behavior: a function call return value
  - expected behavior: a value
- Package testing offers excellent opportunities for automation not currently exploited in industry

Test Case Language

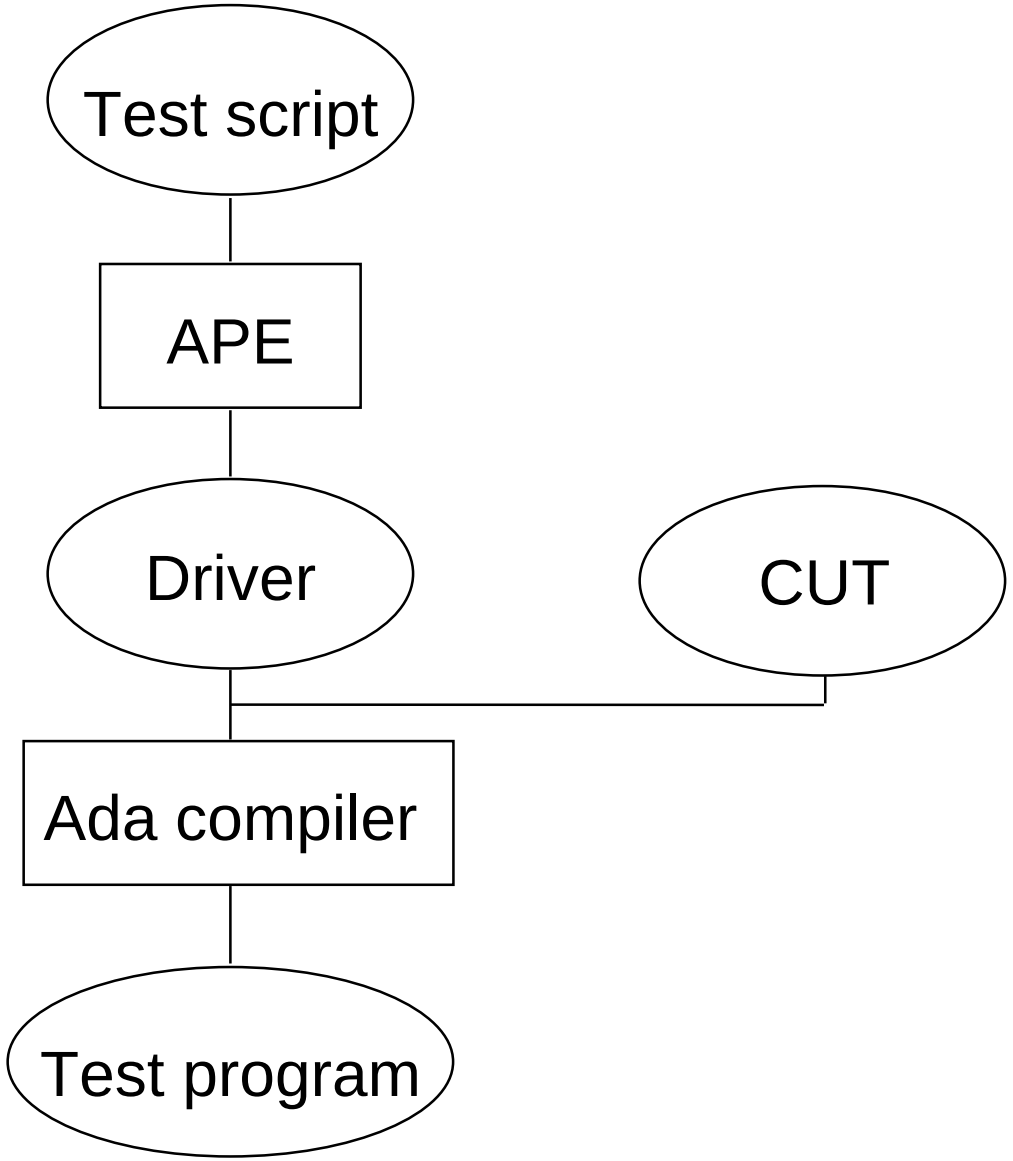
Test case: < *trace*, *expExc*, *actVal*, *expVal*, *type* >

- *trace*: a trace used to exercise the package
- *expExc*: exception that *trace* is expected to generate
- *actVal*: expression evaluated after *trace*
- *expVal*: the value that *actVal* is expected to have
- *type*: the data type of *actVal* and *expVal*

Two Test Cases

- For testing normal case behaviour
  - `< push(5), noexc, top, 5, integer >`
  - call `push(5)`, monitoring exception behaviour
  - issue a failure message if any exception is raised
  - call `top`, monitoring exception behaviour
  - issue a failure message if any exception is raised
  - issue a failure message if 5 is not returned
- For testing exception behaviour
  - `< pop, emptyExc, dc, dc, dc >`
  - call `pop`, monitoring exception behaviour
  - issue a failure message if `emptyExc` is not raised
  - issue a failure message if any other exception is raised

Test Driver Generation



Experience with Automated Unit Testing

- The APE tool at Hughes
  - APE: our C driver generator converted to generate Ada
  - APE scripts written and run in APEX environment
  - APE drivers are shorter: cheaper to develop and maintain
  - For a commercial Map class
    - » Hand coded driver : 400 LOC
    - » APE script: 125 LOC

Technology Transfer Issues

- The key is to reduce costs
  - new approach must integrate smoothly in existing environment
  - training costs must be modest and predictable
  - ongoing tool and methodology support are essential
- The embedded researcher paradigm
  - have one researcher onsite for access to company environment
  - tool and methodology development done offsite
- Embedded researcher:
  - summer ‘97: tool adaptation to APEX; pilot script development
  - *fall ‘97: develop scripts for packages under development*

Talk Summary

- The importance of unit testing
  - recognized at Hughes; ignored at most other companies
- Opportunities for automation in unit testing
  - still available at Hughes
- The APE tool for testing Ada packages
  - automates the most tedious and repetitive aspects