



IBM Rational Ada Developer

Measuring the Effectiveness of ACATS

ACM SIGAda 2004

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- **Intro**

- **Rational Software, part of IBM since Feb 2003**

- **Rational Apex**
 - now bundled as “IBM Rational Ada Developer”
 - 7 self-hosted platforms + embedded
 - Version 4.4.0 released Oct 2004

ACATS

- **Ada Conformity Assessment Test Suite**
- **Standard test suite for Ada compilers**
- **Required for certification**
 - “Certificate of Conformance”

But ...

How good *is* ACATS?

Measuring a Test Suite

- **Requirements Coverage**
 - white box approach

- **Structural Coverage**
 - black box approach

Requirements Coverage

- **For Ada, LRM95 = Requirements**

Algorithm:

Tally the Requirements

Count # covered by test cases

Coverage = # covered / # covered

Requirements Coverage - Methodology

- **Use the file COVERAGE.TXT provided with ACATS**
(downloaded from adaic.org)
- **Details tests by LRM95 paragraph numbers**
- **Adjust for non-requirement sections**

Structural Coverage

- **Structural coverage = how much code executed**
- **Statement Coverage**

```
if (A or B > 12) then
    Text_Io.Put_Line("yes");
    if (B > 20) then
        raise Program_Error;
    else
        Something_Something;
    end if;
end if;
```


Structural Coverage

- **Cover *what*?**

Anatomy of an Executable

```
procedure Hello is
begin
    Text_Io.Put_Line("Hello");
end;
```

Application code (user code)	
Predefined	Runtime

Structural Coverage

- **Cover what?**
 - Implicit
 - Provided by/with the compiler
 - Predefines + Runtime
 - Chose Linux (self-hosted) compiler

Structural Coverage - Methodology

- **Get the source for runtime & predefines**
- **Include runtime source in Ada closure
(Predefines are already in the closure)**

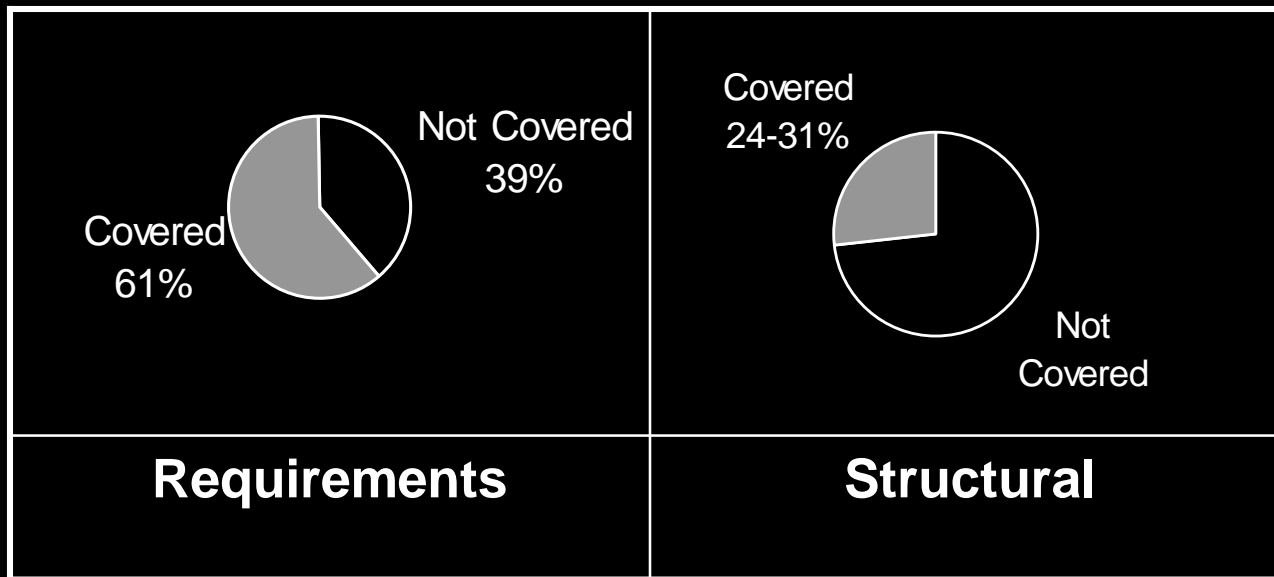
```
with Rts_Closure; -- add to report
```

```
package Rts_Closure is  
with Image_Funcs;  
with Tasking_Stuff;  
with Exception_Handler;  
with Storage_Manager;  
...
```

Structural Coverage – Methodology (Cont'd)

- **Use Rational TestMate
(Test manager/coverage analysis tool)**
- **It automates the execution of tests and coverage instrumentation/collection**
- **Limit coverage to predefines + runtime units**
- **Approx. 17,000 basic blocks**

Results



Conclusions

- **Requirements Coverage**
 - Over 60%
 - Not surprising, as ACATS were designed to the LRM
 - Actual coverage is higher (because “legacy” Ada83 tests are not detailed in coverage.txt)
- **Structural**
 - 24-31%
 - Very respectable for system test

Other Conclusions

- **Suggests Future Work**
 - Beef up ACATS
 - Map the “Legacy” Ada83 tests to LRM95

- **Safety-Critical Test Suites (full-coverage) are still valuable, should be run routinely**

Final Thoughts

- **Certification process is unique to Ada**
- **Should provide a competitive advantage for Ada**
 - ... but, vendors (IBM included) are neglecting it
 - The last certificates expired in September
 - Current situation is shameful
- **Let's revive it!**

(This slide has not been approved by IBM management, legal, or lackeys thereof.)