Bill J. Ellis
October 29, 2004

Praxis trip III: System S

1 Introduction

System S is much larger than System T and contains older Ada 83 style SPARK. A large amount of type information is asserted which is now automatically inserted by the Examiner.

2 Strategy

Individual packages are considered in isolation. More relevant packages are considered first. Note that the packages considered typically contain many subprograms that will benefit from annotations, however this rarely applies to all of the subprograms.

2.1 Considered

System S contains 114618 lines. The adb files considered contain 7507 lines. For reasons unknown the size of the corresponding ads files were not gathered[1]. These collected numbers indicate 6.5495821% of code coverage, this is probably closer to 7% if adjusting for the ads files. System S contains 692 subprograms, 82 of which are in the considered examples. This indicates 11.84971098 % coverage. The different values for code coverage is not surprising given that both of these metrics are quite rough. About 9 % of system S was subjected to focused analysis.

Note that it is not fair to say that the gains seen in these files are reflective of expected gains in other parts of the system. Although the size of system S prevented a thorough examination, there were no more obvious examples that require annotations. Accepting this caveat there is little merit in discussing a subset of system S. Rather we target all of the interesting examples of system S. This is in line with the analysis of system T.

2.2 siotypes.adb (297)

NoAnnotation-Total	**NoAnnotation-Examiner**	**NoAnnotation-Simplifier**	**NoAnnotation-After**
47	**11**	**33**	**3**
Annotation-Total	**Annotation-Examiner**	**Annotation-Simplifier**	**Annotation-After**
47	**11**	**33**	**3**

2.3 db__convertdbsholtoshol.adb (2089)

NoAnnotation-Total	**NoAnnotation-Examiner**	**NoAnnotation-Simplifier**	**NoAnnotation-After**
245	**51**	**153**	**41**
Annotation-Total	**Annotation-Examiner**	**Annotation-Simplifier**	**Annotation-After**
263	**47**	**185**	**31**

2.4 histp.adb (computerollfilter + computepitchfilter (54+53))

NoAnnotation-Total	**NoAnnotation-Examiner**	**NoAnnotation-Simplifier**	**NoAnnotation-After**
13 + 13	**0 + 0**	**12 + 12**	**1 + 1**
Annotation-Total	**Annotation-Examiner**	**Annotation-Simplifier**	**Annotation-After**
13 + 13	**0 + 0**	**11 + 11**	**2 + 2**

*Notes in this series are for ϵ-baked ideas, for $1 \geq \epsilon \geq 0$. Only exceptionally should they be cited or distributed outwith the NuSPADE project (EPSRC GR/R24081).

[1] Ooops, Blast, etc.

[1] When counting subprograms.

2.5 sio5.adb (4590)

NoAnnotation-Total	NoAnnotation-Examiner	NoAnnotation-Simplifier	NoAnnotation-After
539	**141**	**369**	**29**
Annotation-Total	**Annotation-Examiner**	**Annotation-Simplifier**	**Annotation-After**
541	**141**	**381**	**19**

2.6 cursel.adb (424)

NoAnnotation-Total	NoAnnotation-Examiner	NoAnnotation-Simplifier	NoAnnotation-After
97	**12**	**80**	**5**
Annotation-Total	**Annotation-Examiner**	**Annotation-Simplifier**	**Annotation-After**
97	**12**	**82**	**3**

3 Compare within unproved VCs

Total proved (examiner):	1531
Total proved (simplifier):	6196
Total remaining:	844
Before annotation (proved):	$11 + 33 + 51 + 153 + 0 + 0 + 12 + 12 + 141 + 369 + 12 + 80 = 874$
Before annotation (remaining):	$3 + 41 + 1 + 1 + 29 + 5 = 80$
After annotation (proved):	$11 + 33 + 47 + 185 + 0 + 0 + 11 + 11 + 141 + 381 + 12 + 82 = 914$
After annotation (remaining):	$3 + 31 + 2 + 2 + 19 + 3 = 60$

NoAnnotation-Before	NoAnnotation-After	NoAnnotation-Proved (%)
$7727 + 874 = 8601$	$844 + 80 = 924$	89.25706313
Annotation-Before	**Annotation-After**	**Annotation-Proved (%)**
$7727 + 914 = 8641$	$844 + 60 = 904$	89.53824789

4 Comment

These results are fantastically unexciting. The negligible increase is a result of all the usual suspects: targeting a small (ish) proportion of the unproved VCs, a lot of automatically proved VCs and not yet employing our proof techniques. It is conceivable that some more annotating examples are lurking inside system S, but this is thought unlikely. Thus any real gains will have to come from the proof side.