CS-Note* 79

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August 19, 2004

Filtering Verification Conditions using Slugs

1 Differ

The `differ` script takes a `.vcg` file and filters out the verification conditions(VCs) that can be simplified away by the simplifier. It does this by looking at the `.siv` file output of the simplifier and determining if a particular VC has all been proven or not. So the `.siv` file acts like a sieve enabling differ to filter out the proven VCs from the original.

However, within each VC that is not entirely proven there are a number of conclusions many of which will have been discharged by the simplifier. Because of the syntax of the `.siv` file and the changes made to the remaining conclusions it is very difficult to identify from it which of the original conclusions remain and which do not. So the `differ` script passes all the conclusions through no matter if they were discharged or not.

2 Extending to Slugs

As well as producing `.siv` files simplifier also produces a log of what it has done. These `.slg` files(which I like to call 'slug files'[1]) contain information about exactly which of the raw conclusions within a VC have been discharged. So by examining the `.slg` file as well as the `.siv` we can further filter the raw VCs to weed out specific conclusions that the simplifier has discharged.

The `.slg` file contains enough information in itself to make examining the `.siv` file redundant since it also records which VCs have been fully proven. But in extending the `differ` script I have not taken advantage of this and it still filters proven VCs by using the `.siv` file.

The script assumes that it will have access to the `.siv` and `.slg` files when doing the filtering. In the case of the `.siv` file this would seem to be reasonable since it is the primary output from the simplifier containing all the unproven VC conclusions so without prodiing it running the simplifier is a bit pointless.

However, the `.slg` file is another matter, it simply contains a log of what the simplifier has done. I don't know if this file will always be present after the simplifier has been run or if it's production can be suppressed. So the `.slg` file may not always be around to enable the script to filter out the individual conclusions within the raw VCs.

3 Difference

The new `differ` script uses three subscripts to perform the various operations. `indifferent` looks through the `.vcg` file and calls the other scripts to determine if parts of it can be thrown away. `indifference` takes a VC name and looks through the `.siv` file for it and reports if all the conclusions within it have been discharged. `indifficulties` takes a VC name and conclusion number and looks through the `.slg` file to determine if the simplifier managed to prove that specific one.

*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]Though maybe 'slog files' would be more appropriate.

A Raw VCs

A raw .vcg file may look something like this:

```
          *******************************************************
                        Semantic Analysis of SPARK Text
    SPARK95 Examiner with VC and RTC Generator Release 7.1d02XX / 06.04
                     Praxis Critical Systems, Bath, England
          *******************************************************


                         DATE : 22-JUL-2004 16:26:10.12

                       procedure SIO5.ClearLoopbackBuffer




For path(s) from start to run-time check associated with statement of line 2507:

procedure_clearloopbackbuffer_1.
H1:    true .
H2:    buffer >= slot5loopbackbufferi__first .
H3:    buffer <= slot5loopbackbufferi__last .
H4:    buflength >= charstotransmitpercalli__first .
H5:    buflength <= charstotransmitpercalli__last .
H6:     for_all (i___1: basictypes__integer32, ((i___1 >=
           siotypes__siorambufferi__first) and (i___1 <=
           siotypes__siorambufferi__last)) -> ((element(
           slot5siorambuffer, [i___1]) >= basictypes__wordt__first) and (element(
           slot5siorambuffer, [i___1]) <= basictypes__wordt__last))) .
        ->
C1:    buffer >= siotypes__siobufferpagei__first .
C2:    buffer <= siotypes__siobufferpagei__last .


For path(s) from start to run-time check associated with statement of line 2508:

procedure_clearloopbackbuffer_2.
H1:    true .
H2:    buffer >= slot5loopbackbufferi__first .
H3:    buffer <= slot5loopbackbufferi__last .
H4:    buflength >= charstotransmitpercalli__first .
H5:    buflength <= charstotransmitpercalli__last .
H6:     for_all (i___1: basictypes__integer32, ((i___1 >=
           siotypes__siorambufferi__first) and (i___1 <=
           siotypes__siorambufferi__last)) -> ((element(
           slot5siorambuffer, [i___1]) >= basictypes__wordt__first) and (element(
           slot5siorambuffer, [i___1]) <= basictypes__wordt__last))) .
H7:    buffer >= siotypes__siobufferpagei__first .
H8:    buffer <= siotypes__siobufferpagei__last .
H9:    fld_pagenumber(slot5sio1multipageregister__1) >=
           basictypes__threebitt__first .
H10:   fld_pagenumber(slot5sio1multipageregister__1) <=
           basictypes__threebitt__last .
H11:   fld_spare(slot5sio1multipageregister__1) >=
           basictypes__fivebitt__first .
H12:   fld_spare(slot5sio1multipageregister__1) <=
           basictypes__fivebitt__last .
H13:   fld_msbyte(slot5sio1multipageregister__1) >=
```

```
          basictypes__bytet__first .
H14:    fld_msbyte(slot5sio1multipageregister__1) <=
          basictypes__bytet__last .
        ->
C1:     buflength div 2 + (buflength - buflength div 2 * 2) >=
          siotypes__sionumberofwordsi__first .
C2:     buflength div 2 + (buflength - buflength div 2 * 2) <=
          siotypes__sionumberofwordsi__last .
C3:     buflength - buflength div 2 * 2 >=
          basictypes__integer32__base__first .
C4:     buflength - buflength div 2 * 2 <=
          basictypes__integer32__base__last .
C5:     2 <> 0 .
C6:     buflength div 2 >= basictypes__integer32__base__first .
C7:     buflength div 2 <= basictypes__integer32__base__last .
C8:     2 <> 0 .


For path(s) from start to run-time check associated with statement of line 2510:

procedure_clearloopbackbuffer_3.
H1:     true .
H2:     buffer >= slot5loopbackbufferi__first .
H3:     buffer <= slot5loopbackbufferi__last .
H4:     buflength >= charstotransmitpercalli__firidlecuriosity.org/links.htmlst .
H5:     buflength <= charstotransmitpercalli__last .
H6:      for_all (i___1: basictypes__integer32, ((i___1 >=
          siotypes__siorambufferi__first) and (i___1 <=
          siotypes__siorambufferi__last)) -> ((element(
          slot5siorambuffer, [i___1]) >= basictypes__wordt__first) and (element(
          slot5siorambuffer, [i___1]) <= basictypes__wordt__last))) .
H7:     buffer >= siotypes__siobufferpagei__first .
H8:     buffer <= siotypes__siobufferpagei__last .
H9:     fld_pagenumber(slot5sio1multipageregister__1) >=
          basictypes__threebitt__first .
H10:    fld_pagenumber(slot5sio1multipageregister__1) <=
          basictypes__threebitt__last .
H11:    fld_spare(slot5sio1multipageregister__1) >=
          basictypes__fivebitt__first .
H12:    fld_spare(slot5sio1multipageregister__1) <=
          basictypes__fivebitt__last .
H13:    fld_msbyte(slot5sio1multipageregister__1) >=
          basictypes__bytet__first .
H14:    fld_msbyte(slot5sio1multipageregister__1) <=
          basictypes__bytet__last .
H15:    buflength div 2 + (buflength - buflength div 2 * 2) >=
          siotypes__sionumberofwordsi__first .
H16:    buflength div 2 + (buflength - buflength div 2 * 2) <=
          siotypes__sionumberofwordsi__last .
H17:    buflength - buflength div 2 * 2 >=
          basictypes__integer32__base__first .
H18:    buflength - buflength div 2 * 2 <=
          basictypes__integer32__base__last .
H19:    2 <> 0 .
H20:    buflength div 2 >= basictypes__integer32__base__first .
H21:    buflength div 2 <= basictypes__integer32__base__last .
H22:    2 <> 0 .
H23:    buflength div 2 + (buflength - buflength div 2 * 2) >=
          siotypes__sionumberofwordsi__first .
```

```
H24:   buflength div 2 + (buflength - buflength div 2 * 2) <=
           siotypes__sionumberofwordsi__last .
        ->
C1:    (1 <= buflength div 2 + (buflength - buflength div 2 * 2)) -> ((
           buflength div 2 + (buflength - buflength div 2 * 2) >=
           siotypes__sionumberofwordsi__first) and (
           buflength div 2 + (buflength - buflength div 2 * 2) <=
           siotypes__sionumberofwordsi__last)) .
C2:    (1 <= buflength div 2 + (buflength - buflength div 2 * 2)) -> ((
           1 >= siotypes__sionumberofwordsi__first) and (1 <=
           siotypes__sionumberofwordsi__last)) .
C3:    buflength div 2 + (buflength - buflength div 2 * 2) >=
           basictypes__integer32__first .
C4:    buflength div 2 + (buflength - buflength div 2 * 2) <=
           basictypes__integer32__last .
C5:    1 >= basictypes__integer32__first .
C6:    1 <= basictypes__integer32__last .


For path(s) from start to default assertion of line 2510:

procedure_clearloopbackbuffer_4.
H1:    true .
H2:    buffer >= slot5loopbackbufferi__first .
H3:    buffer <= slot5loopbackbufferi__last .
H4:    buflength >= charstotransmitpercalli__first .
H5:    buflength <= charstotransmitpercalli__last .
H6:     for_all (i___1: basictypes__integer32, ((i___1 >=
           siotypes__siorambufferi__first) and (i___1 <=
           siotypes__siorambufferi__last)) -> ((element(
           slot5siorambuffer, [i___1]) >= basictypes__wordt__first) and (element(
           slot5siorambuffer, [i___1]) <= basictypes__wordt__last))) .
H7:    buffer >= siotypes__siobufferpagei__first .
H8:    buffer <= siotypes__siobufferpagei__last .
H9:    fld_pagenumber(slot5sio1multipageregister__1) >=
           basictypes__threebitt__first .
H10:   fld_pagenumber(slot5sio1multipageregister__1) <=
           basictypes__threebitt__last .
H11:   fld_spare(slot5sio1multipageregister__1) >=
           basictypes__fivebitt__first .
H12:   fld_spare(slot5sio1multipageregister__1) <=
           basictypes__fivebitt__last .
H13:   fld_msbyte(slot5sio1multipageregister__1) >=
           basictypes__bytet__first .
H14:   fld_msbyte(slot5sio1multipageregister__1) <=
           basictypes__bytet__last .
H15:   buflength div 2 + (buflength - buflength div 2 * 2) >=
           siotypes__sionumberofwordsi__first .
H16:   buflength div 2 + (buflength - buflength div 2 * 2) <=
           siotypes__sionumberofwordsi__last .
H17:   buflength - buflength div 2 * 2 >=
           basictypes__integer32__base__first .
H18:   buflength - buflength div 2 * 2 <=
           basictypes__integer32__base__last .
H19:   2 <> 0 .
H20:   buflength div 2 >= basictypes__integer32__base__first .
H21:   buflength div 2 <= basictypes__integer32__base__last .
H22:   2 <> 0 .
H23:   buflength div 2 + (buflength - buflength div 2 * 2) >=
```

```
          siotypes__sionumberofwordsi__first .
H24:    buflength div 2 + (buflength - buflength div 2 * 2) <=
          siotypes__sionumberofwordsi__last .
H25:    (1 <= buflength div 2 + (buflength - buflength div 2 * 2)) -> ((
          buflength div 2 + (buflength - buflength div 2 * 2) >=
          siotypes__sionumberofwordsi__first) and (
          buflength div 2 + (buflength - buflength div 2 * 2) <=
          siotypes__sionumberofwordsi__last)) .
H26:    (1 <= buflength div 2 + (buflength - buflength div 2 * 2)) -> ((
          1 >= siotypes__sionumberofwordsi__first) and (1 <=
          siotypes__sionumberofwordsi__last)) .
H27:    buflength div 2 + (buflength - buflength div 2 * 2) >=
          basictypes__integer32__first .
H28:    buflength div 2 + (buflength - buflength div 2 * 2) <=
          basictypes__integer32__last .
H29:    1 >= basictypes__integer32__first .
H30:    1 <= basictypes__integer32__last .
H31:    buflength div 2 + (buflength - buflength div 2 * 2) >=
          siotypes__sionumberofwordsi__first .
H32:    buflength div 2 + (buflength - buflength div 2 * 2) <=
          siotypes__sionumberofwordsi__last .
H33:    1 <= buflength div 2 + (buflength - buflength div 2 * 2) .
         ->
C1:     buffer >= slot5loopbackbufferi__first .
C2:     buffer <= slot5loopbackbufferi__last .
C3:     buflength >= charstotransmitpercalli__first .
C4:     buflength <= charstotransmitpercalli__last .
C5:      for_all (i___1: basictypes__integer32, ((i___1 >=
          siotypes__siorambufferi__first) and (i___1 <=
          siotypes__siorambufferi__last)) -> ((element(
          slot5siorambuffer, [i___1]) >= basictypes__wordt__first) and (element(
          slot5siorambuffer, [i___1]) <= basictypes__wordt__last))) .
C6:     1 >= siotypes__sionumberofwordsi__first .
C7:     1 <= siotypes__sionumberofwordsi__last .
C8:     1 <= buflength div 2 + (buflength - buflength div 2 * 2) .


For path(s) from default assertion of line 2510 to default assertion of line 2510:

procedure_clearloopbackbuffer_5.
H1:     buffer >= slot5loopbackbufferi__first .
H2:     buffer <= slot5loopbackbufferi__last .
H3:     buflength >= charstotransmitpercalli__first .
H4:     buflength <= charstotransmitpercalli__last .
H5:      for_all (i___1: basictypes__integer32, ((i___1 >=
          siotypes__siorambufferi__first) and (i___1 <=
          siotypes__siorambufferi__last)) -> ((element(
          slot5siorambuffer, [i___1]) >= basictypes__wordt__first) and (element(
          slot5siorambuffer, [i___1]) <= basictypes__wordt__last))) .
H6:     loop__1__i >= siotypes__sionumberofwordsi__first .
H7:     loop__1__i <= siotypes__sionumberofwordsi__last .
H8:     loop__1__i <= numberofwords__entry__loop__1 .
H9:     0 >= basictypes__wordt__first .
H10:    0 <= basictypes__wordt__last .
H11:    0 >= basictypes__wordt__first .
H12:    0 <= basictypes__wordt__last .
H13:    loop__1__i >= siotypes__siorambufferi__first .
H14:    loop__1__i <= siotypes__siorambufferi__last .
H15:    not (loop__1__i = numberofwords__entry__loop__1) .
```

```
       ->
C1:    buffer >= slot5loopbackbufferi__first .
C2:    buffer <= slot5loopbackbufferi__last .
C3:    buflength >= charstotransmitpercalli__first .
C4:    buflength <= charstotransmitpercalli__last .
C5:     for_all (i___1: basictypes__integer32, ((i___1 >=
           siotypes__siorambufferi__first) and (i___1 <=
           siotypes__siorambufferi__last)) -> ((element(update(
           slot5siorambuffer, [loop__1__i], 0), [i___1]) >=
           basictypes__wordt__first) and (element(update(
           slot5siorambuffer, [loop__1__i], 0), [i___1]) <=
           basictypes__wordt__last))) .
C6:    loop__1__i + 1 >= siotypes__sionumberofwordsi__first .
C7:    loop__1__i + 1 <= siotypes__sionumberofwordsi__last .
C8:    loop__1__i + 1 <= numberofwords__entry__loop__1 .


For path(s) from default assertion of line 2510 to run-time check associated with statement of line 251

procedure_clearloopbackbuffer_6.
H1:    buffer >= slot5loopbackbufferi__first .
H2:    buffer <= slot5loopbackbufferi__last .
H3:    buflength >= charstotransmitpercalli__first .
H4:    buflength <= charstotransmitpercalli__last .
H5:     for_all (i___1: basictypes__integer32, ((i___1 >=
           siotypes__siorambufferi__first) and (i___1 <=
           siotypes__siorambufferi__last)) -> ((element(
           slot5siorambuffer, [i___1]) >= basictypes__wordt__first) and (element(
           slot5siorambuffer, [i___1]) <= basictypes__wordt__last))) .
H6:    loop__1__i >= siotypes__sionumberofwordsi__first .
H7:    loop__1__i <= siotypes__sionumberofwordsi__last .
H8:    loop__1__i <= numberofwords__entry__loop__1 .
       ->
C1:    0 >= basictypes__wordt__first .
C2:    0 <= basictypes__wordt__last .
C3:    0 >= basictypes__wordt__first .
C4:    0 <= basictypes__wordt__last .
C5:    loop__1__i >= siotypes__siorambufferi__first .
C6:    loop__1__i <= siotypes__siorambufferi__last .


For path(s) from start to finish:

procedure_clearloopbackbuffer_7.
*** true .          /* trivially true VC removed by Examiner */


For path(s) from default assertion of line 2510 to finish:

procedure_clearloopbackbuffer_8.
*** true .          /* trivially true VC removed by Examiner */
```

B Sieve File

A `.siv` file is a simplified version of the `.vcg` file:

```
          *******************************************************
                       Semantic Analysis of SPARK Text
    SPARK95 Examiner with VC and RTC Generator Release 7.1d02XX / 06.04
```

```
                    Praxis Critical Systems, Bath, England
         *******************************************************

      CREATED 22-JUL-2004, 16:26:10  SIMPLIFIED 22-JUL-2004, 16:29:33
               (Simplified by SPADE Simplifier, Demo Version)

                      procedure SIO5.ClearLoopbackBuffer




For path(s) from start to run-time check associated with statement of line 2507:

procedure_clearloopbackbuffer_1.
*** true .          /* all conclusions proved */


For path(s) from start to run-time check associated with statement of line 2508:

procedure_clearloopbackbuffer_2.
*** true .          /* all conclusions proved */


For path(s) from start to run-time check associated with statement of line 2510:

procedure_clearloopbackbuffer_3.
*** true .          /* all conclusions proved */


For path(s) from start to default assertion of line 2510:

procedure_clearloopbackbuffer_4.
*** true .          /* all conclusions proved */


For path(s) from default assertion of line 2510 to default assertion of line
          2510:

procedure_clearloopbackbuffer_5.
H1:    buffer >= 2 .
H2:    buffer <= 3 .
H3:    buflength >= 0 .
H4:    buflength <= 2048 .
H5:    for_all(i___1 : basictypes__integer32, 1 <= i___1 and i___1 <= 1024 -> 0
          <= element(slot5siorambuffer, [i___1]) and element(slot5siorambuffer,
          [i___1]) <= 65535) .
H6:    loop__1__i <= 1024 .
H7:    loop__1__i < numberofwords__entry__loop__1 .
H8:    loop__1__i >= 1 .
       ->
C1:    loop__1__i <= 1023 .


For path(s) from default assertion of line 2510 to run-time check associated
          with statement of line 2518:

procedure_clearloopbackbuffer_6.
H1:    buffer >= 2 .
```

```
H2:    buffer <= 3 .
H3:    buflength >= 0 .
H4:    buflength <= 2048 .
H5:    for_all(i___1 : basictypes__integer32, 1 <= i___1 and i___1 <= 1024 -> 0
          <= element(slot5siorambuffer, [i___1]) and element(slot5siorambuffer,
          [i___1]) <= 65535) .
H6:    loop__1__i >= 0 .
H7:    loop__1__i <= 1024 .
H8:    loop__1__i <= numberofwords__entry__loop__1 .
       ->
C1:    loop__1__i >= 1 .


For path(s) from start to finish:

procedure_clearloopbackbuffer_7.
*** true .          /* all conclusions proved */



For path(s) from default assertion of line 2510 to finish:

procedure_clearloopbackbuffer_8.
*** true .          /* all conclusions proved */
```

C Slug File

The .slg file is a log of what the simplifier did to turn the .vcg file in the .siv file:

```
              *****************************************************
              LOG OF SIMPLIFICATIONS PERFORMED BY SPADE SIMPLIFIER
                          PVL SPADE TOOL DEMO VERSION
              *****************************************************

                       DATE : 22-JUL-2004 TIME : 16:29:32




@@@@@@@@@@  VC: procedure_clearloopbackbuffer_1.  @@@@@@@@@@
%%%  Simplified H6 on reading formula in, to give:
     %%%  H6:  for_all(i___1 : basictypes__integer32,
          siotypes__siorambufferi__first <= i___1 and i___1 <=
          siotypes__siorambufferi__last -> basictypes__wordt__first <= element(
          slot5siorambuffer, [i___1]) and element(slot5siorambuffer, [i___1])
          <= basictypes__wordt__last)
-S-  Applied substitution rule clearloopbac_rules(31).
     This was achieved by replacing all occurrences of
          siotypes__siobufferpagei__first by:
          0.
<S>  New C1:  buffer >= 0
-S-  Applied substitution rule clearloopbac_rules(32).
     This was achieved by replacing all occurrences of
          siotypes__siobufferpagei__last by:
          7.
<S>  New C2:  buffer <= 7
-S-  Applied substitution rule clearloopbac_rules(19).
     This was achieved by replacing all occurrences of basictypes__wordt__first
          by:
```

```
          0.
<S>   New H6:  for_all(i___1 : basictypes__integer32,
          siotypes__siorambufferi__first <= i___1 and i___1 <=
          siotypes__siorambufferi__last -> 0 <= element(slot5siorambuffer, [
          i___1]) and element(slot5siorambuffer, [i___1]) <=
          basictypes__wordt__last)
-S-   Applied substitution rule clearloopbac_rules(20).
      This was achieved by replacing all occurrences of basictypes__wordt__last
          by:
          65535.
<S>   New H6:  for_all(i___1 : basictypes__integer32,
          siotypes__siorambufferi__first <= i___1 and i___1 <=
          siotypes__siorambufferi__last -> 0 <= element(slot5siorambuffer, [
          i___1]) and element(slot5siorambuffer, [i___1]) <= 65535)
-S-   Applied substitution rule clearloopbac_rules(27).
      This was achieved by replacing all occurrences of
          siotypes__siorambufferi__first by:
          1.
<S>   New H6:  for_all(i___1 : basictypes__integer32, 1 <= i___1 and i___1 <=
          siotypes__siorambufferi__last -> 0 <= element(slot5siorambuffer, [
          i___1]) and element(slot5siorambuffer, [i___1]) <= 65535)
-S-   Applied substitution rule clearloopbac_rules(28).
      This was achieved by replacing all occurrences of
          siotypes__siorambufferi__last by:
          1024.
<S>   New H6:  for_all(i___1 : basictypes__integer32, 1 <= i___1 and i___1 <=
          1024 -> 0 <= element(slot5siorambuffer, [i___1]) and element(
          slot5siorambuffer, [i___1]) <= 65535)
-S-   Applied substitution rule clearloopbac_rules(35).
      This was achieved by replacing all occurrences of
          slot5loopbackbufferi__first by:
          2.
<S>   New H2:  buffer >= 2
-S-   Applied substitution rule clearloopbac_rules(36).
      This was achieved by replacing all occurrences of
          slot5loopbackbufferi__last by:
          3.
<S>   New H3:  buffer <= 3
-S-   Applied substitution rule clearloopbac_rules(39).
      This was achieved by replacing all occurrences of
          charstotransmitpercalli__first by:
          0.
<S>   New H4:  buflength >= 0
-S-   Applied substitution rule clearloopbac_rules(40).
      This was achieved by replacing all occurrences of
          charstotransmitpercalli__last by:
          2048.
<S>   New H5:  buflength <= 2048
***   Proved C1:  buffer >= 0
      using hypothesis H2.
***   Proved C2:  buffer <= 7
      using hypothesis H3.
***   PROVED VC.


@@@@@@@@@@  VC: procedure_clearloopbackbuffer_2.  @@@@@@@@@@
%%%   Simplified H6 on reading formula in, to give:
      %%%  H6:  for_all(i___1 : basictypes__integer32,
          siotypes__siorambufferi__first <= i___1 and i___1 <=
```

```
          siotypes__sirambufferi__last -> basictypes__wordt__first <= element(
          slot5siorambuffer, [i___1]) and element(slot5siorambuffer, [i___1])
          <= basictypes__wordt__last)
%%%  Simplified C5 on reading formula in, to give:
     %%%  C5:  true
%%%  Simplified C8 on reading formula in, to give:
     %%%  C8:  true
***  Proved C5:  true
***  Proved C8:  true
-S-  Applied substitution rule clearloopbac_rules(23).
     This was achieved by replacing all occurrences of
          siotypes__sionumberofwordsi__first by:
          0.
<S>  New C1:  buflength div 2 + (buflength - buflength div 2 * 2) >= 0
-S-  Applied substitution rule clearloopbac_rules(24).
     This was achieved by replacing all occurrences of
          siotypes__sionumberofwordsi__last by:
          1024.
<S>  New C2:  buflength div 2 + (buflength - buflength div 2 * 2) <= 1024
-S-  Applied substitution rule clearloopbac_rules(5).
     This was achieved by replacing all occurrences of
          basictypes__integer32__base__first by:
          -2147483648.
<S>  New C3:  buflength - buflength div 2 * 2 >= - 2147483648
<S>  New C6:  buflength div 2 >= - 2147483648
-S-  Applied substitution rule clearloopbac_rules(6).
     This was achieved by replacing all occurrences of
          basictypes__integer32__base__last by:
          2147483647.
<S>  New C4:  buflength - buflength div 2 * 2 <= 2147483647
<S>  New C7:  buflength div 2 <= 2147483647
-S-  Applied substitution rule clearloopbac_rules(7).
     This was achieved by replacing all occurrences of
          basictypes__threebitt__first by:
          0.
<S>  New H9:  fld_pagenumber(slot5sio1multipageregister__1) >= 0
-S-  Applied substitution rule clearloopbac_rules(8).
     This was achieved by replacing all occurrences of
          basictypes__threebitt__last by:
          7.
<S>  New H10:  fld_pagenumber(slot5sio1multipageregister__1) <= 7
-S-  Applied substitution rule clearloopbac_rules(11).
     This was achieved by replacing all occurrences of
          basictypes__fivebitt__first by:
          0.
<S>  New H11:  fld_spare(slot5sio1multipageregister__1) >= 0
-S-  Applied substitution rule clearloopbac_rules(12).
     This was achieved by replacing all occurrences of
          basictypes__fivebitt__last by:
          31.
<S>  New H12:  fld_spare(slot5sio1multipageregister__1) <= 31
-S-  Applied substitution rule clearloopbac_rules(15).
     This was achieved by replacing all occurrences of basictypes__bytet__first
          by:
          0.
<S>  New H13:  fld_msbyte(slot5sio1multipageregister__1) >= 0
-S-  Applied substitution rule clearloopbac_rules(16).
     This was achieved by replacing all occurrences of basictypes__bytet__last
          by:
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        255.
<S>   New H14:  fld_msbyte(slot5sio1multipageregister__1) <= 255
-S-   Applied substitution rule clearloopbac_rules(19).
      This was achieved by replacing all occurrences of basictypes__wordt__first
        by:
        0.
<S>   New H6:  for_all(i___1 : basictypes__integer32,
        siotypes__siorambufferi__first <= i___1 and i___1 <=
        siotypes__siorambufferi__last -> 0 <= element(slot5siorambuffer, [
        i___1]) and element(slot5siorambuffer, [i___1]) <=
        basictypes__wordt__last)
-S-   Applied substitution rule clearloopbac_rules(20).
      This was achieved by replacing all occurrences of basictypes__wordt__last
        by:
        65535.
<S>   New H6:  for_all(i___1 : basictypes__integer32,
        siotypes__siorambufferi__first <= i___1 and i___1 <=
        siotypes__siorambufferi__last -> 0 <= element(slot5siorambuffer, [
        i___1]) and element(slot5siorambuffer, [i___1]) <= 65535)
-S-   Applied substitution rule clearloopbac_rules(27).
      This was achieved by replacing all occurrences of
        siotypes__siorambufferi__first by:
        1.
<S>   New H6:  for_all(i___1 : basictypes__integer32, 1 <= i___1 and i___1 <=
        siotypes__siorambufferi__last -> 0 <= element(slot5siorambuffer, [
        i___1]) and element(slot5siorambuffer, [i___1]) <= 65535)
-S-   Applied substitution rule clearloopbac_rules(28).
      This was achieved by replacing all occurrences of
        siotypes__siorambufferi__last by:
        1024.
<S>   New H6:  for_all(i___1 : basictypes__integer32, 1 <= i___1 and i___1 <=
        1024 -> 0 <= element(slot5siorambuffer, [i___1]) and element(
        slot5siorambuffer, [i___1]) <= 65535)
-S-   Applied substitution rule clearloopbac_rules(31).
      This was achieved by replacing all occurrences of
        siotypes__siobufferpagei__first by:
        0.
<S>   New H7:  buffer >= 0
-S-   Applied substitution rule clearloopbac_rules(32).
      This was achieved by replacing all occurrences of
        siotypes__siobufferpagei__last by:
        7.
<S>   New H8:  buffer <= 7
-S-   Applied substitution rule clearloopbac_rules(35).
      This was achieved by replacing all occurrences of
        slot5loopbackbufferi__first by:
        2.
<S>   New H2:  buffer >= 2
-S-   Applied substitution rule clearloopbac_rules(36).
      This was achieved by replacing all occurrences of
        slot5loopbackbufferi__last by:
        3.
<S>   New H3:  buffer <= 3
-S-   Applied substitution rule clearloopbac_rules(39).
      This was achieved by replacing all occurrences of
        charstotransmitpercalli__first by:
        0.
<S>   New H4:  buflength >= 0
-S-   Applied substitution rule clearloopbac_rules(40).
```

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     This was achieved by replacing all occurrences of
          charstotransmitpercalli__last by:
          2048.
<S>  New H5:  buflength <= 2048
---  Eliminated hypothesis H1 (true-hypothesis).
---  Eliminated hypothesis H7 (redundant, given H2).
---  Eliminated hypothesis H8 (redundant, given H3).
***  Proved C1:  buflength div 2 + (buflength - buflength div 2 * 2) >= 0
     via its standard form, which is:
     Std.Fm C1:  buflength - buflength div 2 > - 1
     using hypothesis H4.
***  Proved C2:  buflength div 2 + (buflength - buflength div 2 * 2) <= 1024
     via its standard form, which is:
     Std.Fm C2:  buflength - buflength div 2 <= 1024
     using hypothesis H5.
***  Proved C3:  buflength - buflength div 2 * 2 >= - 2147483648
     using hypothesis H4.
***  Proved C6:  buflength div 2 >= - 2147483648
     using hypothesis H4.
***  Proved C4:  buflength - buflength div 2 * 2 <= 2147483647
     using hypotheses H4 & H5.
***  Proved C7:  buflength div 2 <= 2147483647
     using hypothesis H5.
***  PROVED VC.


@@@@@@@@@@  VC: procedure_clearloopbackbuffer_3.  @@@@@@@@@@
%%%  Simplified H6 on reading formula in, to give:
     %%%  H6:  for_all(i___1 : basictypes__integer32,
          siotypes__siorambufferi__first <= i___1 and i___1 <=
          siotypes__siorambufferi__last -> basictypes__wordt__first <= element(
          slot5siorambuffer, [i___1]) and element(slot5siorambuffer, [i___1])
          <= basictypes__wordt__last)
%%%  Simplified H19 on reading formula in, to give:
     %%%  H19:  true
---  Hypothesis H22 has been replaced by "true".  (It is already present, as
          H19).
---  Hypothesis H23 has been replaced by "true".  (It is already present, as
          H15).
---  Hypothesis H24 has been replaced by "true".  (It is already present, as
          H16).
***  Proved C1:  1 <= buflength div 2 + (buflength - buflength div 2 * 2) ->
          buflength div 2 + (buflength - buflength div 2 * 2) >=
          siotypes__sionumberofwordsi__first and buflength div 2 + (buflength -
          buflength div 2 * 2) <= siotypes__sionumberofwordsi__last
     using hypotheses H15 & H16.
-S-  Applied substitution rule clearloopbac_rules(3).
     This was achieved by replacing all occurrences of
          basictypes__integer32__first by:
          -2147483648.
<S>  New C3:  buflength div 2 + (buflength - buflength div 2 * 2) >= -
          2147483648
<S>  New C5:  true
-S-  Applied substitution rule clearloopbac_rules(4).
     This was achieved by replacing all occurrences of
          basictypes__integer32__last by:
          2147483647.
<S>  New C4:  buflength div 2 + (buflength - buflength div 2 * 2) <= 2147483647
<S>  New C6:  true
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***  Proved C5:  true
***  Proved C6:  true
-S-  Applied substitution rule clearloopbac_rules(5).
     This was achieved by replacing all occurrences of
          basictypes__integer32__base__first by:
          -2147483648.
<S>  New H17:  buflength - buflength div 2 * 2 >= - 2147483648
<S>  New H20:  buflength div 2 >= - 2147483648
-S-  Applied substitution rule clearloopbac_rules(6).
     This was achieved by replacing all occurrences of
          basictypes__integer32__base__last by:
          2147483647.
<S>  New H18:  buflength - buflength div 2 * 2 <= 2147483647
<S>  New H21:  buflength div 2 <= 2147483647
-S-  Applied substitution rule clearloopbac_rules(7).
     This was achieved by replacing all occurrences of
          basictypes__threebitt__first by:
          0.
<S>  New H9:  fld_pagenumber(slot5sio1multipageregister__1) >= 0
-S-  Applied substitution rule clearloopbac_rules(8).
     This was achieved by replacing all occurrences of
          basictypes__threebitt__last by:
          7.
<S>  New H10:  fld_pagenumber(slot5sio1multipageregister__1) <= 7
-S-  Applied substitution rule clearloopbac_rules(11).
     This was achieved by replacing all occurrences of
          basictypes__fivebitt__first by:
          0.
<S>  New H11:  fld_spare(slot5sio1multipageregister__1) >= 0
-S-  Applied substitution rule clearloopbac_rules(12).
     This was achieved by replacing all occurrences of
          basictypes__fivebitt__last by:
          31.
<S>  New H12:  fld_spare(slot5sio1multipageregister__1) <= 31
-S-  Applied substitution rule clearloopbac_rules(15).
     This was achieved by replacing all occurrences of basictypes__bytet__first
          by:
          0.
<S>  New H13:  fld_msbyte(slot5sio1multipageregister__1) >= 0
-S-  Applied substitution rule clearloopbac_rules(16).
     This was achieved by replacing all occurrences of basictypes__bytet__last
          by:
          255.
<S>  New H14:  fld_msbyte(slot5sio1multipageregister__1) <= 255
-S-  Applied substitution rule clearloopbac_rules(19).
     This was achieved by replacing all occurrences of basictypes__wordt__first
          by:
          0.
<S>  New H6:  for_all(i___1 : basictypes__integer32,
          siotypes__sioramBufferi__first <= i___1 and i___1 <=
          siotypes__sioramBufferi__last -> 0 <= element(slot5sioramBuffer, [
          i___1]) and element(slot5sioramBuffer, [i___1]) <=
          basictypes__wordt__last)
-S-  Applied substitution rule clearloopbac_rules(20).
     This was achieved by replacing all occurrences of basictypes__wordt__last
          by:
          65535.
<S>  New H6:  for_all(i___1 : basictypes__integer32,
          siotypes__sioramBufferi__first <= i___1 and i___1 <=
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          siotypes__siorambufferi__last -> 0 <= element(slot5siorambuffer, [
          i___1]) and element(slot5siorambuffer, [i___1]) <= 65535)
-S-  Applied substitution rule clearloopbac_rules(23).
     This was achieved by replacing all occurrences of
          siotypes__sionumberofwordsi__first by:
          0.
<S>  New H15:  buflength div 2 + (buflength - buflength div 2 * 2) >= 0
<S>  New C2:  1 <= buflength div 2 + (buflength - buflength div 2 * 2) -> 1 <=
          siotypes__sionumberofwordsi__last
-S-  Applied substitution rule clearloopbac_rules(24).
     This was achieved by replacing all occurrences of
          siotypes__sionumberofwordsi__last by:
          1024.
<S>  New H16:  buflength div 2 + (buflength - buflength div 2 * 2) <= 1024
<S>  New C2:  true
-S-  Applied substitution rule clearloopbac_rules(27).
     This was achieved by replacing all occurrences of
          siotypes__siorambufferi__first by:
          1.
<S>  New H6:  for_all(i___1 : basictypes__integer32, 1 <= i___1 and i___1 <=
          siotypes__siorambufferi__last -> 0 <= element(slot5siorambuffer, [
          i___1]) and element(slot5siorambuffer, [i___1]) <= 65535)
-S-  Applied substitution rule clearloopbac_rules(28).
     This was achieved by replacing all occurrences of
          siotypes__siorambufferi__last by:
          1024.
<S>  New H6:  for_all(i___1 : basictypes__integer32, 1 <= i___1 and i___1 <=
          1024 -> 0 <= element(slot5siorambuffer, [i___1]) and element(
          slot5siorambuffer, [i___1]) <= 65535)
-S-  Applied substitution rule clearloopbac_rules(31).
     This was achieved by replacing all occurrences of
          siotypes__siobufferpagei__first by:
          0.
<S>  New H7:  buffer >= 0
-S-  Applied substitution rule clearloopbac_rules(32).
     This was achieved by replacing all occurrences of
          siotypes__siobufferpagei__last by:
          7.
<S>  New H8:  buffer <= 7
-S-  Applied substitution rule clearloopbac_rules(35).
     This was achieved by replacing all occurrences of
          slot5loopbackbufferi__first by:
          2.
<S>  New H2:  buffer >= 2
-S-  Applied substitution rule clearloopbac_rules(36).
     This was achieved by replacing all occurrences of
          slot5loopbackbufferi__last by:
          3.
<S>  New H3:  buffer <= 3
-S-  Applied substitution rule clearloopbac_rules(39).
     This was achieved by replacing all occurrences of
          charstotransmitpercalli__first by:
          0.
<S>  New H4:  buflength >= 0
-S-  Applied substitution rule clearloopbac_rules(40).
     This was achieved by replacing all occurrences of
          charstotransmitpercalli__last by:
          2048.
<S>  New H5:  buflength <= 2048
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***  Proved C3:  buflength div 2 + (buflength - buflength div 2 * 2) >= -
          2147483648
     using hypothesis H15.
***  Proved C4:  buflength div 2 + (buflength - buflength div 2 * 2) <=
          2147483647
     using hypothesis H16.
***  Proved C2:  true
***  PROVED VC.


@@@@@@@@@@  VC: procedure_clearloopbackbuffer_4.  @@@@@@@@@@
%%%  Simplified H6 on reading formula in, to give:
     %%%  H6:  for_all(i___1 : basictypes__integer32,
          siotypes__siorambufferi__first <= i___1 and i___1 <=
          siotypes__siorambufferi__last -> basictypes__wordt__first <= element(
          slot5siorambuffer, [i___1]) and element(slot5siorambuffer, [i___1])
          <= basictypes__wordt__last)
%%%  Simplified H19 on reading formula in, to give:
     %%%  H19:  true
---  Hypothesis H22 has been replaced by "true".  (It is already present, as
          H19).
---  Hypothesis H23 has been replaced by "true".  (It is already present, as
          H15).
---  Hypothesis H24 has been replaced by "true".  (It is already present, as
          H16).
---  Hypothesis H31 has been replaced by "true".  (It is already present, as
          H15).
---  Hypothesis H32 has been replaced by "true".  (It is already present, as
          H16).
%%%  Simplified C5 on reading formula in, to give:
     %%%  C5:  for_all(i___1 : basictypes__integer32,
          siotypes__siorambufferi__first <= i___1 and i___1 <=
          siotypes__siorambufferi__last -> basictypes__wordt__first <= element(
          slot5siorambuffer, [i___1]) and element(slot5siorambuffer, [i___1])
          <= basictypes__wordt__last)
***  Proved C1:  buffer >= slot5loopbackbufferi__first
     using hypothesis H2.
***  Proved C2:  buffer <= slot5loopbackbufferi__last
     using hypothesis H3.
***  Proved C3:  buflength >= charstotransmitpercalli__first
     using hypothesis H4.
***  Proved C4:  buflength <= charstotransmitpercalli__last
     using hypothesis H5.
***  Proved C5:  for_all(i___1 : basictypes__integer32,
          siotypes__siorambufferi__first <= i___1 and i___1 <=
          siotypes__siorambufferi__last -> basictypes__wordt__first <= element(
          slot5siorambuffer, [i___1]) and element(slot5siorambuffer, [i___1])
          <= basictypes__wordt__last)
     using hypothesis H6.
***  Proved C7:  1 <= siotypes__sionumberofwordsi__last
     using hypotheses H16 & H33.
***  Proved C8:  1 <= buflength div 2 + (buflength - buflength div 2 * 2)
     using hypothesis H33.
-S-  Applied substitution rule clearloopbac_rules(23).
     This was achieved by replacing all occurrences of
          siotypes__sionumberofwordsi__first by:
          0.
<S>  New H15:  buflength div 2 + (buflength - buflength div 2 * 2) >= 0
<S>  New H25:  1 <= buflength div 2 + (buflength - buflength div 2 * 2) ->
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          buflength div 2 + (buflength - buflength div 2 * 2) >= 0 and
          buflength div 2 + (buflength - buflength div 2 * 2) <=
          siotypes__sionumberofwordsi__last
<S>  New H26:  1 <= buflength div 2 + (buflength - buflength div 2 * 2) -> 1 <=
          siotypes__sionumberofwordsi__last
<S>  New C6:  true
***  Proved C6:  true
***  PROVED VC.


@@@@@@@@@@  VC: procedure_clearloopbackbuffer_5.  @@@@@@@@@@
%%%  Simplified H5 on reading formula in, to give:
     %%%  H5:  for_all(i___1 : basictypes__integer32,
          siotypes__siorambufferi__first <= i___1 and i___1 <=
          siotypes__siorambufferi__last -> basictypes__wordt__first <= element(
          slot5siorambuffer, [i___1]) and element(slot5siorambuffer, [i___1])
          <= basictypes__wordt__last)
---  Hypothesis H11 has been replaced by "true".  (It is already present, as H9)
          .
---  Hypothesis H12 has been replaced by "true".  (It is already present, as
          H10).
%%%  Simplified C5 on reading formula in, to give:
     %%%  C5:  for_all(i___1 : basictypes__integer32,
          siotypes__siorambufferi__first <= i___1 and i___1 <=
          siotypes__siorambufferi__last -> basictypes__wordt__first <= element(
          update(slot5siorambuffer, [loop__1__i], 0), [i___1]) and element(
          update(slot5siorambuffer, [loop__1__i], 0), [i___1]) <=
          basictypes__wordt__last)
***  Proved C1:  buffer >= slot5loopbackbufferi__first
     using hypothesis H1.
***  Proved C2:  buffer <= slot5loopbackbufferi__last
     using hypothesis H2.
***  Proved C3:  buflength >= charstotransmitpercalli__first
     using hypothesis H3.
***  Proved C4:  buflength <= charstotransmitpercalli__last
     using hypothesis H4.
***  Proved C5:  for_all(i___1 : basictypes__integer32,
          siotypes__siorambufferi__first <= i___1 and i___1 <=
          siotypes__siorambufferi__last -> basictypes__wordt__first <= element(
          update(slot5siorambuffer, [loop__1__i], 0), [i___1]) and element(
          update(slot5siorambuffer, [loop__1__i], 0), [i___1]) <=
          basictypes__wordt__last)
     using hypotheses H5, H9, H10, H13 & H14.
***  Proved C6:  loop__1__i + 1 >= siotypes__sionumberofwordsi__first
     using hypothesis H6.
-S-  Applied substitution rule clearloopbac_rules(24).
     This was achieved by replacing all occurrences of
          siotypes__sionumberofwordsi__last by:
          1024.
<S>  New H7:  loop__1__i <= 1024
<S>  New C7:  loop__1__i <= 1023
>>>  Restructured hypothesis H15 into:
     >>>  H15:  loop__1__i <> numberofwords__entry__loop__1
-S-  Applied substitution rule clearloopbac_rules(19).
     This was achieved by replacing all occurrences of basictypes__wordt__first
          by:
          0.
<S>  New H5:  for_all(i___1 : basictypes__integer32,
          siotypes__siorambufferi__first <= i___1 and i___1 <=
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          siotypes__siorambufferi__last -> 0 <= element(slot5siorambuffer, [
          i___1]) and element(slot5siorambuffer, [i___1]) <=
          basictypes__wordt__last)
<S>  New H9:  true
-S-  Applied substitution rule clearloopbac_rules(20).
     This was achieved by replacing all occurrences of basictypes__wordt__last
          by:
          65535.
<S>  New H10:  true
<S>  New H5:  for_all(i___1 : basictypes__integer32,
          siotypes__siorambufferi__first <= i___1 and i___1 <=
          siotypes__siorambufferi__last -> 0 <= element(slot5siorambuffer, [
          i___1]) and element(slot5siorambuffer, [i___1]) <= 65535)
-S-  Applied substitution rule clearloopbac_rules(23).
     This was achieved by replacing all occurrences of
          siotypes__sionumberofwordsi__first by:
          0.
<S>  New H6:  loop__1__i >= 0
-S-  Applied substitution rule clearloopbac_rules(27).
     This was achieved by replacing all occurrences of
          siotypes__siorambufferi__first by:
          1.
<S>  New H13:  loop__1__i >= 1
<S>  New H5:  for_all(i___1 : basictypes__integer32, 1 <= i___1 and i___1 <=
          siotypes__siorambufferi__last -> 0 <= element(slot5siorambuffer, [
          i___1]) and element(slot5siorambuffer, [i___1]) <= 65535)
-S-  Applied substitution rule clearloopbac_rules(28).
     This was achieved by replacing all occurrences of
          siotypes__siorambufferi__last by:
          1024.
<S>  New H14:  loop__1__i <= 1024
<S>  New H5:  for_all(i___1 : basictypes__integer32, 1 <= i___1 and i___1 <=
          1024 -> 0 <= element(slot5siorambuffer, [i___1]) and element(
          slot5siorambuffer, [i___1]) <= 65535)
-S-  Applied substitution rule clearloopbac_rules(35).
     This was achieved by replacing all occurrences of
          slot5loopbackbufferi__first by:
          2.
<S>  New H1:  buffer >= 2
-S-  Applied substitution rule clearloopbac_rules(36).
     This was achieved by replacing all occurrences of
          slot5loopbackbufferi__last by:
          3.
<S>  New H2:  buffer <= 3
-S-  Applied substitution rule clearloopbac_rules(39).
     This was achieved by replacing all occurrences of
          charstotransmitpercalli__first by:
          0.
<S>  New H3:  buflength >= 0
-S-  Applied substitution rule clearloopbac_rules(40).
     This was achieved by replacing all occurrences of
          charstotransmitpercalli__last by:
          2048.
<S>  New H4:  buflength <= 2048
%%%  Hypotheses H8 & H15 together imply that
          loop__1__i < numberofwords__entry__loop__1.
     H8 & H15 have therefore been deleted and a new H8 added to this effect.
***  Proved C8:  loop__1__i + 1 <= numberofwords__entry__loop__1
     via its standard form, which is:
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     Std.Fm C8:  - loop__1__i + numberofwords__entry__loop__1 > 0
     using hypothesis H8.
---  Eliminated hypothesis H11 (true-hypothesis).
---  Eliminated hypothesis H12 (true-hypothesis).
---  Eliminated hypothesis H9 (true-hypothesis).
---  Eliminated hypothesis H10 (true-hypothesis).
---  Eliminated hypothesis H14 (duplicate of H7).
---  Eliminated hypothesis H6 (redundant, given H13).


@@@@@@@@@@  VC: procedure_clearloopbackbuffer_6.  @@@@@@@@@@
%%%  Simplified H5 on reading formula in, to give:
     %%%  H5:  for_all(i___1 : basictypes__integer32,
          siotypes__siorambufferi__first <= i___1 and i___1 <=
          siotypes__siorambufferi__last -> basictypes__wordt__first <= element(
          slot5siorambuffer, [i___1]) and element(slot5siorambuffer, [i___1])
          <= basictypes__wordt__last)
-S-  Applied substitution rule clearloopbac_rules(19).
     This was achieved by replacing all occurrences of basictypes__wordt__first
          by:
          0.
<S>  New H5:  for_all(i___1 : basictypes__integer32,
          siotypes__siorambufferi__first <= i___1 and i___1 <=
          siotypes__siorambufferi__last -> 0 <= element(slot5siorambuffer, [
          i___1]) and element(slot5siorambuffer, [i___1]) <=
          basictypes__wordt__last)
<S>  New C1:  true
<S>  New C3:  true
-S-  Applied substitution rule clearloopbac_rules(20).
     This was achieved by replacing all occurrences of basictypes__wordt__last
          by:
          65535.
<S>  New H5:  for_all(i___1 : basictypes__integer32,
          siotypes__siorambufferi__first <= i___1 and i___1 <=
          siotypes__siorambufferi__last -> 0 <= element(slot5siorambuffer, [
          i___1]) and element(slot5siorambuffer, [i___1]) <= 65535)
<S>  New C2:  true
<S>  New C4:  true
-S-  Applied substitution rule clearloopbac_rules(27).
     This was achieved by replacing all occurrences of
          siotypes__siorambufferi__first by:
          1.
<S>  New H5:  for_all(i___1 : basictypes__integer32, 1 <= i___1 and i___1 <=
          siotypes__siorambufferi__last -> 0 <= element(slot5siorambuffer, [
          i___1]) and element(slot5siorambuffer, [i___1]) <= 65535)
<S>  New C5:  loop__1__i >= 1
-S-  Applied substitution rule clearloopbac_rules(28).
     This was achieved by replacing all occurrences of
          siotypes__siorambufferi__last by:
          1024.
<S>  New H5:  for_all(i___1 : basictypes__integer32, 1 <= i___1 and i___1 <=
          1024 -> 0 <= element(slot5siorambuffer, [i___1]) and element(
          slot5siorambuffer, [i___1]) <= 65535)
<S>  New C6:  loop__1__i <= 1024
***  Proved C1:  true
***  Proved C3:  true
***  Proved C2:  true
***  Proved C4:  true
-S-  Applied substitution rule clearloopbac_rules(23).
```

```
     This was achieved by replacing all occurrences of
          siotypes__sionumberofwordsi__first by:
          0.
<S>  New H6:  loop__1__i >= 0
-S-  Applied substitution rule clearloopbac_rules(24).
     This was achieved by replacing all occurrences of
          siotypes__sionumberofwordsi__last by:
          1024.
<S>  New H7:  loop__1__i <= 1024
-S-  Applied substitution rule clearloopbac_rules(35).
     This was achieved by replacing all occurrences of
          slot5loopbackbufferi__first by:
          2.
<S>  New H1:  buffer >= 2
-S-  Applied substitution rule clearloopbac_rules(36).
     This was achieved by replacing all occurrences of
          slot5loopbackbufferi__last by:
          3.
<S>  New H2:  buffer <= 3
-S-  Applied substitution rule clearloopbac_rules(39).
     This was achieved by replacing all occurrences of
          charstotransmitpercalli__first by:
          0.
<S>  New H3:  buflength >= 0
-S-  Applied substitution rule clearloopbac_rules(40).
     This was achieved by replacing all occurrences of
          charstotransmitpercalli__last by:
          2048.
<S>  New H4:  buflength <= 2048
***  Proved C6:  loop__1__i <= 1024
     using hypothesis H7.


@@@@@@@@@@  VC: procedure_clearloopbackbuffer_7.  @@@@@@@@@@
***  Proved C1:  true
***  PROVED VC.


@@@@@@@@@@  VC: procedure_clearloopbackbuffer_8.  @@@@@@@@@@
***  Proved C1:  true
***  PROVED VC.
```

D Filtered Raw VCs

The result of running the `differ` script over the `.vcg` file using both `.siv` and `.slg` files to filter is shown below:

```
          *******************************************************
                       Semantic Analysis of SPARK Text
    SPARK95 Examiner with VC and RTC Generator Release 7.1d02XX / 06.04
                    Praxis Critical Systems, Bath, England
          *******************************************************


                        DATE : 22-JUL-2004 16:26:10.12
```

```
For path(s) from start to run-time check associated with statement of line 2507:

procedure_clearloopbackbuffer_1.
*** true .  /* all conclusions can be simplified */


For path(s) from start to run-time check associated with statement of line 2508:

procedure_clearloopbackbuffer_2.
*** true .  /* all conclusions can be simplified */


For path(s) from start to run-time check associated with statement of line 2510:

procedure_clearloopbackbuffer_3.
*** true .  /* all conclusions can be simplified */


For path(s) from start to default assertion of line 2510:

procedure_clearloopbackbuffer_4.
*** true .  /* all conclusions can be simplified */


For path(s) from default assertion of line 2510 to default assertion of line 2510:

procedure_clearloopbackbuffer_5.
H1:    buffer >= slot5loopbackbufferi__first .
H2:    buffer <= slot5loopbackbufferi__last .
H3:    buflength >= charstotransmitpercalli__first .
H4:    buflength <= charstotransmitpercalli__last .
H5:     for_all (i___1: basictypes__integer32, ((i___1 >=
           siotypes__siorambufferi__first) and (i___1 <=
           siotypes__siorambufferi__last)) -> ((element(
           slot5siorambuffer, [i___1]) >= basictypes__wordt__first) and (element(
           slot5siorambuffer, [i___1]) <= basictypes__wordt__last))) .
H6:    loop__1__i >= siotypes__sionumberofwordsi__first .
H7:    loop__1__i <= siotypes__sionumberofwordsi__last .
H8:    loop__1__i <= numberofwords__entry__loop__1 .
H9:    0 >= basictypes__wordt__first .
H10:   0 <= basictypes__wordt__last .
H11:   0 >= basictypes__wordt__first .
H12:   0 <= basictypes__wordt__last .
H13:   loop__1__i >= siotypes__siorambufferi__first .
H14:   loop__1__i <= siotypes__siorambufferi__last .
H15:   not (loop__1__i = numberofwords__entry__loop__1) .
        ->
C7:    loop__1__i + 1 <= siotypes__sionumberofwordsi__last .


For path(s) from default assertion of line 2510 to run-time check associated with statement of line 251

procedure_clearloopbackbuffer_6.
H1:    buffer >= slot5loopbackbufferi__first .
H2:    buffer <= slot5loopbackbufferi__last .
H3:    buflength >= charstotransmitpercalli__first .
H4:    buflength <= charstotransmitpercalli__last .
H5:     for_all (i___1: basictypes__integer32, ((i___1 >=
           siotypes__siorambufferi__first) and (i___1 <=
```

```
           siotypes__siorambufferi__last)) -> ((element(
           slot5siorambuffer, [i___1]) >= basictypes__wordt__first) and (element(
           slot5siorambuffer, [i___1]) <= basictypes__wordt__last))) .
H6:    loop__1__i >= siotypes__sionumberofwordsi__first .
H7:    loop__1__i <= siotypes__sionumberofwordsi__last .
H8:    loop__1__i <= numberofwords__entry__loop__1 .
        ->
C5:    loop__1__i >= siotypes__siorambufferi__first .


For path(s) from start to finish:

procedure_clearloopbackbuffer_7.
*** true .  /* all conclusions can be simplified */


For path(s) from default assertion of line 2510 to finish:

procedure_clearloopbackbuffer_8.
*** true .  /* all conclusions can be simplified */
```