Compliance Task Group Call – Minutes

Weds, July 25, 2019 8am Pacific →Daylight← Time

See slides 6,7 for summary

Charter

The Compliance Task Group will

- Develop a framework for RISC-V tests, taking into account approved specifications for:
  - Architectural versions (e.g. RV32I, RV32E, RV64I, RV128I)
  - Standard Extensions (M,A,F,D,Q,L,C,B,J,T,P,V,N)
  - All spec'ed implementation options
    - (incl. MHSU modes, optional CSRs, optional CSR bits)
- Develop a method for selecting and configuring appropriate tests for a RISC-V implementation, taking into account:
  - Platform profile and Execution Environment (EE)
  - Implemented architecture, extensions, and options
- Develop a method to apply the appropriate tests to an implementation and verify that it meets the standard
  - test result signature stored in memory will be compared to a golden model result signature

Adminstrative Pointers

- Chair – Allen Baum allen.baum@esperantotech.com
- Co-chair – Stuart Hoad stuart.hoad@microchip.com
- TG membership- Sue Leininger sue@riscv.org
  - Send email to her - you must have a lists.riscv.org login
- TG Email tech-compliance@lists.riscv.org
  - Notetakers: please send emails to allen.baum@esperantotech.com
- Meetings -Bi-monthly at 9am Pacific time on 2nd/4th Wednesdays
  - Location is https://zoom.us/j/6213886723
- Documents, calendar, roster, etc. in https://lists.riscv.org/tech-compliance/
  see /documents, /calendars subdirectories
- Git repositories
  - https://github.com/riscv/riscv-compliance/
  - https://github.com/rsnikhil/Experimental_RISCV_Feature_Model
  - https://github.com/rsnikhil/Forvis_RISCV-ISA-Spec
  - https://gitlab.com/incoresemi/riscof (Shakti framework)

Attendees

- Allen Baum (Esperanto)
- Greg Wright
- Lee Moore (Imperas)
- Simon Davidmann (Imperas)
- ?Cambridge
- Grant Martin (Cadence)
- Henrik Gustafsson (Qualcomm)
- Iilja Stepanov (Syntacore)
- Lavanya (IIT Madras)
- S Pawan Kumar (IIT Madras)
- Paul Donahue (Ventana)
- Stuart Hoad (Microchip)
- Jacob Chang (SiFive)

Meeting Agenda (in order of Priority)

1. Pull Request review (55) - postpone
   - changes to unaligned_jmp tests to support unaligned support
2. Email discussions
   - Email thread#1: Licensing: feedback favors BSD, board favors Apache (slide 9)
   - Email thread#2: TestFormat Spec Review – e.g. directory structure (slide 10)
   - Email thread#3: RFP for a compliance engineer (slide 11)
   - Email thread#4: Static vs Dynamic signatures
3. Email discussion (slide 10)
   - New test macros: RV_ [MSU]2[MSU],
     RV_[M/S/U]MODE_HANDLER(mode, sig_ptr, Code_ptr)
     RV_[M/S/U]CAUSE_HANDLER(cause_num, Code_ptr)
4. RISCOF status (slide 12)

Discussion

1. Pull Request review (55) - postpone
2. Email discussions
   - #1: Licensing: feedback favors BSD, board favors Apache (slide 9, 13)
   - #2: TestFormat Spec Review – e.g. directory structure (slide 10, 14)
   - #3: RFP for a compliance engineer (slide 11, 15)
     - Some email
   - #4: Static vs Dynamic signatures
     - Bulk of the discussion morphed from this to how to test compliance for non-conforming extensions
     - Only two possibilities are: 1) requiring formal model to trap on arbitrary opcodes or
       2) support loading of developer custom emulation environment
     - Formal model changes deemed difficult and out of scope, but TestSpecFormat doc states that we won't test emulation routines; consensus favors loading the emulation routines
     - Not needed for base tests except for unaligned Ld/St access support
3. Email discussion of new standard macros (slide 10)
   - not covered, but emulation support will require it
4. RISCOF status (slide 12)
   - Not covered, but progress is continuing
   - last week's status can be read in slide 12, there has been further progress since then

Conclusions & Action Items

Decisions

- 2.2 No strong disagreements with test suite directory structure
- 2.4 very strong agreement that dynamic signatures will be used
- We will concentrate on basic ISA (32i, im, imc) to start with; infrastructure support for unaligned emulation will enable more complex platform compliance.
- See slides 13-15 for paraphrased, edited email discussion results

Action Items

- 2.1 Allen will go back to companies and board to verify their positions

Backup for discussions

License Inconsistencies

Ken Dockser writes

In going through the files on git hub I have found inconsistencies in the licenses specified. Based on riscv-compliance/doc/README.adoc, the intent was to use BSD and Creative Commons.

- The top level license (riscv-compliance/COPYING.BSD) is a 3-clause BSD,
- The riscv-compliance/riscv-test-env/LICENSE specifies a slightly different 3-clause BSD license naming Regents as the copyright holder.
- In riscv-compliance/riscv-test-env/test_macros.h an Apache v2 license is employed. In fact, Apache-v2 shows up in 57 files.

Desire is to use Apache? (BSD regents may eventually be replaced. RISCOF uses BSD 3-clause

Test Spec

- Proposed Structure is 2-level: <arch>_<modes>/<feature(s)>
  - <arch> are rv64i, rv32i, rv32e
  - <modes> are M, MS, MU, MSU: modes that the test will run in
    - Always starts in M at least, so always present ←still disagreements
  - <feature(s)> are
    - lettered extension [A | B | C | M ...] or subextension [Zam | ...]
    - more general names when tests cross extensions (e.g. Priv, Interrupt, VM, Integer).
    - Exact syntax/names for cross-extension subdirectories has not been ennumerated.
    - Tests that can /should be run in multiple modes replicate the subdirectory
- New Standard Macros
  - RVTEST_CASE(CaseName,CondStr, [DocTmp, DocString])
    - Test ases must be inside `#ifdef TEST_CASE_<CaseName>,#endif` pairs
  - RVTEST_SIGBASE(BaseReg,Val)
  - RVTEST_SIGUPD(BaseReg, Reg, Value)
  - RVTEST_M2S, M2U, S2U, U2M, U2S, S2M (?) -- TBD

Foundation Expectations

- Objective: publish compliance test 1.0 and finish the public review **before** the RISC-V summit in Dec. Shorter term is pre-1.0 by EO Q3
- Scope: publish tests and expected results run from the executable RISC-V formal specs -- make sure that all formal specs agree with each other
  - (Note: this approach will not work for priv spec)
- Minimal acceptance criteria is RV32Imc and RV64Imc
- Allen will focus on driving the task group to make this happen
- Nikhil will be tasked to ask all formal spec groups to commit their executable model support in the riscv-compliance repository
- Silviu and Yunsup will make the {compliance manager} CFP happen. They just need to understand what help is needed.

RISCOF status

- RISCOF can now be installed as a pip package (pip install riscof)
- Current suite supported: Integer and MulDiv extension.
- New directory structure adopted : https://gitlab.com/incoresemi/riscof/tree/master/riscof/suite
- YAML-Validator now a separate package - RIFLE (RISC-V Legalizer) usable w/RISCOF or standalone.
- HTML report generation done. *(needs WG feedback)*
- reduced command line options: RISCOF now takes inputs from a config.ini file. Example
- Updated YAML schemas with supervisor nodes as well.
- Modified macros into new RVTEST_ and RVMODEL_ prefixed macros. Doc: https://riscof.readthedocs.io/en/1.7.3/macros.html
- Added support for separate environment files for model and standard macros.
- Created user plugins for most repository targets: https://gitlab.com/incoresemi/riscof-plugins
  - riscvOVPsim grift Eclass sail_ocamlSim
  - CodasipSim Spike sail_cSim ***sifive-formal - Doesn't work*!!**
- Currently working on parallelizing test runs (e.g. make -jN to parallelize runs). ETA 2 weeks
- For more granular changes/updates: https://gitlab.com/incoresemi/riscof/blob/master/CHANGELOG.md

Paraphrased Licensing Discussion

- There seem to be concerns these days with BSD and how it does/doesn't address software patents. https://en.wikipedia.org/wiki/MIT_License#Relation_to_Patents
- The Foundation geared towards BSD3 for code & CC Attribution for docs, which they were used originally.
- We would prefer BSD as well.
- My view is the it all should be Apache 2.0
- The Board's primary concern was that it must be permissive. I don't think there are any patent issues here BSD would be simpler. UCB in particular can't to Apache on their tests (this might change)
- My understanding is UCB claims copyright on riscv-compliance/riscv-test-env/LICENSE text, not code it's applied to. Given the top level license specified in riscv-compliance/COPYING.BSD, I see no reason for this file & will delete if there are no objections

  riscv-compliance/riscv-test-env/test_macros.h is Imperas owned w/Apache v2, & only they can re-license it

I suggest to fix this including the correct SPDX metadata in each file. (see riscv-compliance/doc/README.adoc:

```
////
SPDX-License-Identifier: CC-BY-4.0
...
////
```

For the code we should add:

```
/* SPDX-License-Identifier: BSD-3-Clause */
```

At the same time, we can ensure the canonical text is in the top level COPYING.xxx files.
If the group as a whole is happy with this, I'm happy to go through and insert SPDX license identifiers.

Paraphrased TestFormatSpec Discussion

- Identical tests executed in different modes should be copied, not link to
- RE: not testing emulated ops, just trap handling – this was the original scheme, but requires extensive reference model support for nonconforming extensions (e.g. MUL w/o DIV).
  - Proposing that we implement and ABI/macros that will enable DUT developers to provide
- Several discussions of the framework, but are not specifically test format related
  - parallel test execution
  - legal Configuration validator
- Much discussion about or related to test selection vs. executing all tests
  - This works only if reference model can be configured identically to DUT
  - Or if mismatches can be automatically be filtered out
  - Both approaches seem equivalent – needs further discussion
- Target independence of tests , tests not depending on tool specific feaure
  - this is description issue. Some parts of the framework (in macro libraries only) must be target dependent
- Framework as a master engine vs a collection of components
  - This needs to be made clearer, they should not be conflicting
- Test-pool subdirectory naming convention
  - Needs to be clearer that this indicates the modes that tests will be executing in, not the modes that are implemented
- Binary test – should they be part of test suite?
  - The original doc has a rationale and I thought the original test suite had tests for it, though I don't know which tests those were or how they work
- Multiple code/data segment:
  - should be able to declare them inside RV_COMPLIANCE_CODE_START/END macros

Paraphrased RFP for Compliance Engineer

Only discussion was with Shakti Team

Prerequisites: We have a documented

- test spec format
- coverage metrics

The compliance engineer will

- restructure the repository to meet the structure documented in the test spec format
  RISCOF has done this. Please check here
- convert tests to use the macros documented in the test spec format
  This too is available here
- modify any other collateral to match the new structure if necessary
  We have gotten rid of the un-necessary preambles from riscv_test.h.
  We have already ported spikeriscvovpsim and one shakti-core within RISCOF.
  Migrating the current RISC-V targets on github to RISCOF will happen
- Provide docs and an example of how to download the respository and run the framework
  We have made an attempt to document as much as possible. Please find it here Feedback is appreciated.
- add (to) tests to meet coverage metrics

Trap Handler Data Structure