

The productive application of SystemRDL in 2013

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Executive Summary

On-chip registers define the critical software interface to the chip, and usually comprise the largest portion of the chip specification. With ever-increasing chip complexity documentation, implementation and maintenance is a growing challenge. Changing specs during the design cycle – for example bugs or marketing requests – demand repeated updates to the design and demands that all downstream teams are immediately working from updated views.

Yet many companies rely on SystemRDL 1.0, a lapsed ‘standard’, and Blueprint, a related but defunct commercial offering to manage their register mapping and the integrity of the HW/SW interface.

Correct by construction, Semifore provides a single-source specification for register and memory-map information from which design, verification, software and integration teams have their required views auto-generated so that they are perfectly synchronized at all times. Semifore’s approach improves inter-team communications, increases levels of flow automation and reduces development schedules. Today.

Background

SystemRDL has a relatively short, but surprisingly complicated history. Initially developed in 2000 by a leading networking company as an internal register specification language (with this author as an original team member) it was spun out to Denali Software, Inc. in August 2005 to become a commercial offering with the language renamed as SystemRDL and the associated software renamed as “Blueprint”.

SystemRDL was contributed to the then SPIRIT Consortium in 2007. With involvement of a few companies including Semifore the contribution was converted into a draft standard with the addition of some important enhancements. At that time the Semifore CSRCompiler was used to verify the draft standard along with the enhancements. CSRCompiler was also used to show translation of SystemRDL to the other SPIRIT Consortium standard, IP-XACT. During the draft validation Blueprint was not updated to include the language enhancements, and it remains to this day an incomplete and still incapable of generating valid IP-XACT.

With the successful validation of the draft standard by the Semifore CSRCompiler the SPIRIT Consortium was able to publish the SystemRDL 1.0 standard in March 2009. In April 2010 the SPIRIT Consortium was merged with the Accellera standards organization, which includes Semifore, among others.

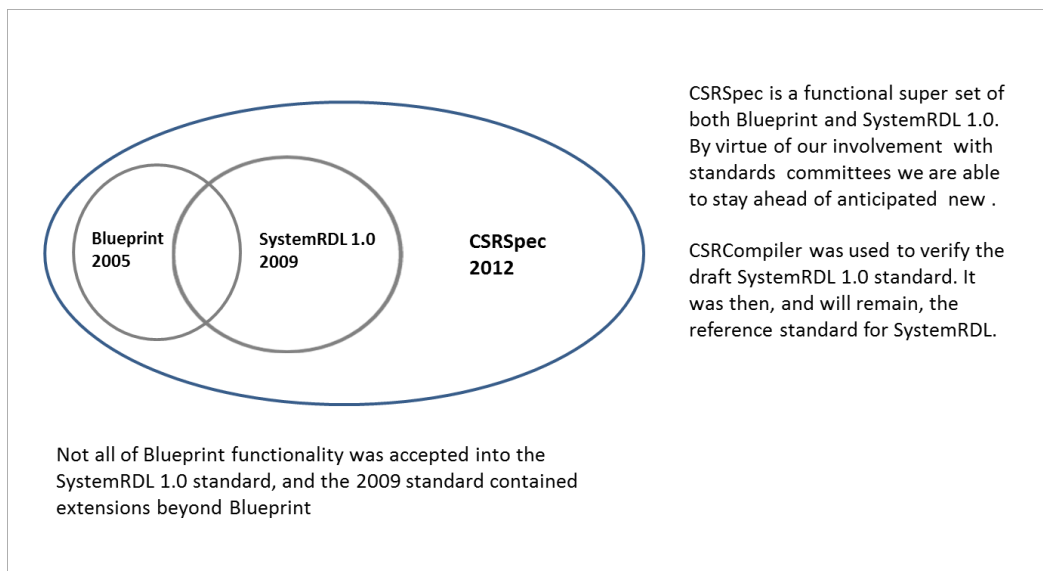
Denali marketed the technology as Blueprint until the company was bought by Cadence Design Systems in May 2010, and now Blueprint only exists as an unsupported product and has been unsupported since the end of 2008.

System RDL as a standard committee has not been reconvened since the release of version 1.0 in 2009, and the language is outdated and lagging other standards like IP-XACT and UVM.

Current situation

Today legacy Blueprint users have had to come to terms with its heritage. Never designed as coherent commercial product, Blueprint is actually a starting point for the internal development of a register tool. It is a framework, not a solution and requires considerable Perl scripting in front of, and after the Blueprint 'product'.

This requirement is both counter-productive and, at a time when most advanced companies are rejecting the limitations of home-grown scripting solutions, counter-intuitive. The tool has been out of development since 2008, and consequently was never updated to support the SPIRIT SystemRDL 1.0 standard published in 2009.



There is a current initiative, sponsored by Intel, to revive the SystemRDL steering committee. However, even if that is supported, real beneficial results are unlikely within 3 years.

Productivity limitations

In practical terms of productivity and efficiency legacy Blueprint has the following limitations:

- Speed – tool runtime is excessive - hours not seconds - limiting to only one or two runs a day
- Does not support import of header files from C or Verilog
- Does not have a provision for parameterized designs and instead relies on embedded Perl scripts
- Perl API tightly coupled to SystemRDL 1.0 parsing, and difficult to use
- Unlike modern standards, there is no memory object for design verification
- Does not support SystemRDL 1.0 overlapping bit fields
- Missing several field type definitions
- Does not support text macros and conditional compile
- No multi or one dimensional field arrays

The productive application of SystemRDL in 2013 and beyond

Our understanding of the original intent and limitations of Blueprint was at the heart of why Semifore was established. We wanted to create a pragmatic design environment to allow systems architects to get their job

done, and realize previously impossible productivity benefits. We did this by supporting those elements of standards that actually work, and by providing functionality that will be adopted by future standards.

The realities of the current market – ever increasing chip complexity, increasing engineering and substrate costs, huge impact of missed release dates - only make Blueprint's limitations more dangerous to its users.

Specific benefits of Semifore solution:

- CSRSpec support for software atomic access – neither Blueprint nor SysRDL support this
- CSRSpec support for HDL backdoor path – neither Blueprint nor SysRDL support this
- CSRSpec support for privacy level and privacy set – neither Blueprint nor SysRDL support this
- With CSRCompiler, even a 100,000 register design can be compiled in a few minutes, allowing the quick sharing of multiple design iterations.
- We are directly involved in the ongoing work related to industry standards in this area, and bring the benefits of our involvement regarding future directions of standards to all our customers.