DEVELOPMENT OF A VHDL VALIDATION SUITE

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Abstract -- The need for a high quality validation suite has been an issue since the very first VHDL standardization meeting held in March 1986. While several attempts have been made, there is still not in existence a sufficient suite of tests that is complete enough for VHDL-1987, much less VHDL-1993. The last attempt at a validation suite was by VI with the development of a partial VHDL-1987 suite, produced under contract by The VHDL Technology Group. After the development of the suite, VIUF decided that the magnitude of the project was beyond the means of the organization. In November of 1994, in behalf of DoD the USAF Wright Laboratory signed a Memorandum of Agreement with VIUF to complete the development of a Validation Suite under joint sponsorship. This paper will discuss the status of the current suite and plans for the development of an extensible high quality validation suite for VHDL-1993.

I. Introduction
In 1992 VHDL International started a project to develop a VHDL-1987 compliant validation suite. The project had limited funding and the philosophy of the project was to start with contributed tests from the vendor group participating in the project, a previous test set developed by Virginia Polytechnic University, and other public domain tests. The project was to cover the integration of existing test suites rather than for the development of new tests. The final result was a test suite that yielded an aggregate language coverage of about 36% for the 1987 Language Reference Manual (LRM). While, the test coverage was not as much as desired, a great deal of effort went into establishing a reasonably good framework and infrastructure for developing new tests. The approach to developing the current test suite, its features and plans for the new project will be discussed below.

II. Current Test Suite
The first step in developing the current test suite establish test points in the VHDL Language Reference Manual. For the 1987 Standard there are some 756 testable sentences and 2096 testable phrases. Ideally, both successful and unsuccessful tests for each test point must be written. The current test suite has tests roughly at the sentence level of coverage. Thus for the 756 sentences there were 3164 tests. This yields 4.2 tests per sentence. If it is prognosticated that the 4.2 tests per test point holds in general then for complete coverage of the 1987 language features about 8800 tests needed to be generated. Since the intent of the current test suite concentrated on utilizing those tests that already existed, most of the effort went into developing the framework into which tests could be inserted and in examining the test suites donated to the cause for tests that fit the various test points. In the 3164 tests placed in the current test suite coverage percentage varied by LRM chapter. As stated earlier the total coverage is around 36%, but some chapters have coverage above 80%.

For convenience the test suite is organized along the same lines as the LRM. That is Chapters, Paragraphs, sentences and phrases. Each test point is referenced uniquely and before each test the exact text from the LRM is included for reference. By organizing the test suite in this manner, a shell script can be written to execute just which tests are desired as well as all tests. This feature is especially useful to developers who would like to invoke specific tests during the development of their VHDL simulator.

III. Planned Expansion
With 1076-1993 now the current standard and Published as the Federal Information Standard FIPS 172-1 to go into effect in May 1995, a validation suite for the 1993 version of the language is a necessity. The current suite must therefore be extended to include the 1993 feature set. While the current test suite utilized the 1992-B language draft as the format, there are some differences between the 1992-B draft and the final published 1993 standard. Thus at the beginning of the project, some reformatting must be accomplished. In addition, the current suite lacks even a semblance of a user's guide or manual. Thus the first order of business is to develop a good user's guide. This will serve the dual purpose of providing a document elucidating how to use the test suite as well as how to add new tests to it. The next step is to
define the additional test points to the 1993 LRM. It is estimated that in order to cover every language feature tests for an additional 1161 test points must be created. If the same ratio of 4.2 tests per test point holds, the total number of tests to cover the 93 LRM is 13,600. This means that some 10,000 new tests must be created to give complete language coverage.

As stated earlier, the current test suite has the capability for tailoring the tests. The approach is to allow the user to manually designate the tests explicitly and a shell script is created to access the tests. While it is helpful to utilize scripts to invoke various tests, with over 13,000 tests from which to choose, some better form of selection is necessary to avoid the tedious nature of user test selection over such a great number of choices. The exact form of this interface has not been defined as of yet, but a Graphical User Interface of some sort has been discussed. Some sort of Hypertext approach may also be viable. It however clear that with several thousand tests from which to choose, an unaided scripting interface is less than the preferred interface if the test suite is to be flexible enough to arbitrarily select any combination of tests on an individual test basis. While the primary intent of the validation suite is testing simulators and analyzers for conformance against the LRM, some attention will be given to ease of use.

After the users guide and new test points are defined, the preferred approach for development of tests will be to utilize multiple low cost sources of labor such as small businesses with low overhead or universities. Quality control of the test suite development will be administered by the National Institute of Standards and Technology (NIST).

IV. Suite Availability

If anyone wishes to have a copy of the current suite, inquire about participating in the test development, inquire on the status on the planned suite, please contact:

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After the test suite is developed, it is the intent to establish a certification program of some sort. It is not clear whether this will be administered by NIST.