

The OSVVM Simulator Script Library

The OSVVM Simulator Script Library provides a simple way to create and activate libraries, compile designs, and run simulations.

The intent of this scripting approach is to:

- Run the same scripts on any simulator
- Be as easy to read as a compile order list.
- Know the directory the script is in, so it does not have to be passed.
- Simplify integration of other libraries that use the same approach

This is an evolving approach. So it may change in the future. Input is welcome.

1 Clone the OSVVM-Libraries directory

Lets start by doing. The library [OSVVM-Libraries](#) contains all of the OSVVM libraries as submodules. Download the entire OSVVM model library using git clone with the --recursive flag:

```
$ git clone --recursive https://github.com/osvvm/OsvvmLibraries
```

2 The Script Files

- Startup.tcl
 - Detects the simulator running and calls the VendorScript_vendor-name.tcl. Also calls OsvvmProjectScripts.tcl and OsvvmScriptDefaults.tcl
- VendorScript_vendor-name.tcl
 - TCL procedures that do simulator specific actions.
 - <vendor-name> = one of (ActiveHDL, GHDL, Mentor, RivieraPro, VSimSA)
 - VSimSA is the one associated with ActiveHDL.
- OsvvmProjectScripts.tcl
 - TCL procedures that do common simulator and project build tasks.
- OsvvmScriptDefaults.tcl
 - Default settings for the OSVVM Script environment.

3 Create a Sim directory

Create a simulation directory. Generally I name this "sim" or "sim_vendor-name". Creating a simulation directory means that cleanup before running regressions is just a matter of deleting the sim directory and recreating a new one.

The following assumes you have created a directory named "sim" in the OsvvmLibraries directory.

Alternately, you can run simulations out of the Scripts, but cleanup is a mess as a simulator tends to create numerous temporaries.

4 Preparation

Edit StartUp.tcl and adjust LIB_BASE_DIR to be appropriate for your project. LIB_BASE_DIR determines where libraries are created – note that OSVVM uses a separate named library for different families of verification components. This directory can be your sim directory you created in the previous step, however, I prefer that it goes into a directory that is not backed up. Such as:

```
set LIB_BASE_DIR C:/tools/sim_temp
```

5 Initialization

5.1 Aldec RivieraPRO, Siemens QuestaSim and ModelSim

Initialize the OSVVM Script environment by doing:

```
source <path-to-OsvvmLibraries>/OsvvmLibraries/Scripts/StartUp.tcl
```

Want to avoid doing this every time? In Aldec RivieraPro, set the environment variable, ALDEC_STARTUPTCL to StartUp.tcl (including the path information). Similarly in Mentor QuestaSim/ModelSim, set the environment variable, MODELSIM_TCL to StartUp.tcl (including the path information).

5.2 Aldec ActiveHDL

Before doing this in ActiveHDL and VSimSA (ActiveHDL's command window) instead do:

```
scripterconf -tcl  
do -tcl <path-to-OsvvmLibraries>/OsvvmLibraries/Scripts/StartUp.tcl
```

Want to avoid doing this every time? For ActiveHDL, edit /script/startup.do and add above to it. Similarly for VSimSA, edit /BIN/startup.do and add the above to it. Note, with 2021.02, you no longer need to set the "Start In" directory to the OSVVM Scripts directory.

5.3 GHDL

I currently run GHDL using MSYS2 64 bit under windows. The scripts must run under tcl (tclsh). As a result, to start the OSVVM scripting environment, in a shell window do:

```
winpty rlwrap tclsh  
source <path-to-OsvvmLibraries>/OsvvmLibraries/Scripts/StartUp.tcl
```

To simplify this, I put the source `.../StartUp.tcl` in my `.tclshrc` file and as a result I do not have to do the source command. I have added a short cut that includes `C:\tools\msys64\mingw64.exe winpty rlwrap tclsh`. I added the short cut to my start menu. With these two, one click and you are running in the OSVVM tcl execution environment.

Alternately, if you are not running in windows, create the `.tclshrc` as above and then in your `.bashrc` create the alias `alias gsim='winpty rlwrap tclsh'` to simplify starting tclsh. From there, at the command line type `gsim` and you are running ghdl in the OSVVM environment.

5.4 Synopsys VCS

Synopsys scripts are beta level quality. VCS runs under Unix/Linux. The scripts must run under tcl (tclsh). As a result, to start the OSVVM scripting environment, in a shell window do:

```
rlwrap tclsh  
source <path-to-OsvvmLibraries>/OsvvmLibraries/Scripts/StartVCS.tcl
```

To simplify this, I put the source `.../StartVCS.tcl` in my `.tclshrc` file and as a result I do not have to do the source command.

5.5 Cadence Xcelium

Cadence Xcelium scripts are alpha level quality. Xcelium runs under Unix/Linux. The scripts must run under tcl (tclsh). As a result, to start the OSVVM scripting environment, in a shell window do:

```
rlwrap tclsh  
source <path-to-OsvvmLibraries>/OsvvmLibraries/Scripts/StartXcelium.tcl
```

To simplify this, I put the source `.../StartXcelium.tcl` in my `.tclshrc` file and as a result I do not have to do the source command.

5.6 Xilinx XSIM

Using OSVVM in Xilinx XSIM is under development. So far, Xilinx seems to be able to compile OSVVM utility library, however, we have not had any of our internal test cases pass.

To run OSVVM scripts in XSIM, start Vivado and then run the StartXSIM script shown below:

```
source <path-to-OsvvmLibraries>/OsvvmLibraries/Scripts/StartXSIM.tcl
```

If someone from XILINX is interested, the internal OSVVM utility library testbenches can be provided under an NDA.

6 Project Files

A project file is a script that allows the specification of basic tasks to run a simulation:

- library - Make this library the active library. Create it if it does not exist.
- analyze - Compile the design into the active library.
- Simulate - Simulate the design using the active library.
- RunTest - compile and simulate in one step
- include - include another project script
- build - include + start a new log file for this task
- TestSuite - identifies the TestSuite that is active
- TestCase - identify the TestCase that is active

The above tasks are TCL procedures. Hence, a project file is actually a TCL file, and when necessary, TCL can be used, however, the intent is to keep it simple. The naming of the project file is of the form <Name>.pro.

The following is an excerpt from OsvvmLibraries/AXI4/Axi4/Axi4.pro. It first activates the library osvvm_axi4. Next it compiles all of the files in the src directory.

```
library osvvm_axi4
analyze ./src/Axi4MasterComponentPkg.vhd
analyze ./src/Axi4ResponderComponentPkg.vhd
analyze ./src/Axi4MemoryComponentPkg.vhd
analyze ./src/Axi4MonitorComponentPkg.vhd
analyze ./src/Axi4Context.vhd
analyze ./src/Axi4Master.vhd
analyze ./src/Axi4Monitor_dummy.vhd
analyze ./src/Axi4Responder_Transactor.vhd
analyze ./src/Axi4Memory.vhd
```

The following is an excerpt from OsvvmLibraries/AXI4/Axi4/RunAllTests.pro. It sets the TestSuite name to Axi4Full and activates the library osvvm_TbAxi4. Next it does three includes. The first one is include ./testbench. Since testbench is a directory, this is a shorthand for include ./testbench/testbench.pro.

```
TestSuite Axi4Full
library osvvm_TbAxi4

include ./testbench
```

```
include ./TestCases
include ./testbench_MultipleMemory
```

The following is an excerpt from testbench_MultipleMemory.pro, which is run by the above include ./testbench_MultipleMemory. It activates its library. We use separate libraries for our testbenches as each has an entity named TestCtrl. It analyzes the testbench and then uses RunTest to analyze and simulate the testbench. With RunTest, if design unit you are simulating does not match the base name of the file, you need to specify it separately. This is shown with TbAxi4_Shared1 (but this is not needed here). OSVVM uses configurations to run our tests - this ensures that an exact test case runs when the configuration is called.

```
analyze TestCtrl_e.vhd
analyze TbAxi4_MultipleMemory.vhd

RunTest TbAxi4_Shared1.vhd TbAxi4_Shared1
RunTest TbAxi4_Separate1.vhd
```

7 Building and Running OSVVM Testbenches

To build all of the OSVVM Libraries, run the script, OsvvmLibraries.pro. In your simulator do the following. This will make you ready to run any of the testbenches.

```
cd <OsvvmLibraries directory>/sim
build ../OsvvmLibraries.pro
```

Now lets run the AXI4 testbench by doing the following in your simulator. You might note that the ".pro" extension was left off. When this is done and the last name is a directory, it looks for a file in that directory of the form <directory-name>.pro – hence here testbench.pro.

```
build ../AXI4/Axi4/RunAllTests.pro
```

This runs all of the tests. If you need to re-run one of the tests, such as TbAxi4_RandomreadWrite, you can do this with the following simulate:

```
simulate TbAxi4_RandomReadWrite
```

All OSVVM verification components include a testbench. You can learn much about how to use a model in a test by reading the testbenches. Run the other OSVVM verification components by doing the following.

```
build ../AXI4/Axi4/RunAllTests.pro
build ../AXI4/Axi4Lite/RunAllTests.pro
build ../AXI4/AxiStream/RunAllTests.pro
build ../UART/RunAllTests.pro
```

8 Commands

Command	Description
library <library>	Make the library the active library. If the library does not exist, create it and create a mapping to it. Libraries are created in the path specified by LIB_BASE_DIR in Scripts/StartUp.tcl.
analyze <file>	Compile the file. A path name specified is relative to the location of the current <file>.pro directory location. Library is the one specified in the previous library command.
simulate <design-unit>	Start a simulation on the design unit. Library is the one specified in the previous library command.
RunTest <file>	RunTest combines TestCase, analyze, and simulate. RunTest optionally takes two parameters. With two parameters, the first is the file name to analyze, the second is the design unit name to use for simulation and TestCase. With one parameter, the first parameter is the file name. The second parameter is the base name of the file name - any path and file extension are removed.
RunTest <file> <name>	
include <name>	Include accepts an argument "name" that is either a file or a directory. If it is a file and its extension is .pro, .tcl, or .do, it will be sourced. If "name" is a directory, then files whose name is "name" and whose extension is .pro, .tcl, or .do, it will be sourced. Both <name> and <path>/<name> are relative to the current directory from which the script is running. Extensions of the form ".files" or ".dirs" is handled in a manner described in "Deprecated Descriptor Files".
include <path>/<name>	
build <directory>	
build <path>/<file>	
SetVHDLVersion	Set VHDL analyze version. Valid values = (2008, 2019, 1993, 2002). OSVVM libraries require 2008 or newer
GetVHDLVersion	Return the current VHDL Version
SetSimulatorResolution	Set Simulator Resolution. Any value supported by the simulator is ok.
GetSimulatorResolution	Return the current Simulator Resolution
TestCase <name>	Set the test case name.
TestSuite <name>	Set the test suite name.
map <library> [<path>]	Create a mapping to a library
RemoveAllLibraries	Delete all of the working libraries.
LinkLibrary	Link libraries that are in the LibraryDirectory LibraryDirectory

	is the directory that contains an OSVVM created VHDL_LIBS directory
Undocumented Procedures	Any undocumented procedure is in development and may change in a future revision

9 Extra Scripts Run during Simulation

When "simulate" is called, it will call the following scripts, in order, if they exist:

- OsvvmLibraries/Scripts/<ToolVendor>.tcl
- OsvvmLibraries/Scripts/<simulator>.tcl
- <sim-run-dir>/<ToolVendor>.tcl
- <sim-run-dir>/<simulator>.tcl
- <sim-run-dir>/<LibraryUnit>.tcl
- <sim-run-dir>/<LibraryUnit>_<simulator>.tcl
- <sim-run-dir>/wave.do

ToolVendor is either {Aldec, Siemens}. Simulator is one of {QuestaSim, ModelSim, RivieraPRO, ActiveHDL}. LibraryUnit is the name of the design being simulated. Sim run dir is the directory from which you run the simulator.

Currently GHDL does not run any extra scripts since it is a batch simulator.

10 Deprecated Descriptor Files

Include with a file extension of ".dirs" or ".files" is deprecated and is only supported for backward compatibility.

<Name>.dirs is a directory descriptor file that contains a list of directories. Each directory is handled by calling "include <directory>".

<Name>.files is a file descriptor that contains a list of names. Each name is handled by calling "analyze <name>". If the extension of the name is ".vhd" or ".vhdl" the file will be compiled as VHDL source. If the extension of the name is ".v" the file will be compiled as verilog source. If the extension of the name is ".lib", it is handled by calling "library <name>".

11 Release History

For the release history see, [CHANGELOG.md](#)

12 Participating and Project Organization

The OSVVM project welcomes your participation with either issue reports or pull requests. For details on [how to participate](#) see

You can find the project [Authors here](#) and [Contributors here](#).

13 More Information on OSVVM

OSVVM Forums and Blog: <http://www.osvvm.org/>

SynthWorks OSVVM Blog: <http://www.synthworks.com/blog/osvvm/>

Gitter: <https://gitter.im/OSVVM/Lobby>

Documentation: [Documentation for the OSVVM libraries can be found here](#)

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