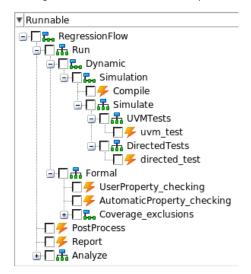# VRM APP LAYER USER MANUAL

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INTRODUCTION

This document intends to document the regression flow Run Manager DataBase (RMDB) template provided with Questa Verification Run Manager (VRM) to speed up Questa VRM integration in your regression environment.

The RMDB template encapsulate all generic tasks of a regression flow, such as simulation, formal, compilation, etc. … It is limited to verification but can be easily expanded on demand to either enhance the existing verification flow or add custom tasks part of your regression. Eventually it aims at serving projects with minimum customization/parameterization and maximum flexibility.

TEMPLATE FLOW DESCRIPTION

The regression flow described in the template RMDB is as depicted below:

4 top tasks are defined:

1. **Run**
   - Run regression tests with different tools
2. **PostProcess**
   - Placeholder for any tasks other than simulation such as adding trending metrics
3. **Report**
   - Generate regression run reports
4. **Analyze**
   - Optional step analyzing regression run performance

The top Run task is the main task and execute the following sub-tasks:

- ➢ **Dynamic**
  - • Run dynamic simulation
- ➢ **Formal**
  - • Run Static formal tools

Again each task or sub-task can be enhanced to meet your specific flow needs.

KNOWN LIMITATIONS

Current version has the following limitations:

- • **Doesn't take care of compile scripts**
  - • To be implemented by the end user using makefile or any other ways of his preference, he will just need to override the parameter "CompileCommand" so it is called accordingly by Compile task
- • **Only support Questa tool suite**
  - • Can be customized to support 3rd party simulator if needed
- • **Only support Linux**
  - • **Will be updated to support Windows later**

PREREQUISITES

There are no dependencies or prerequisites on the existing project structure and environment. To read the remaining of the document it is recommended that you get familiar with the basics of Questa VRM as we will use terms coming from the Questa VRM documentation and architecture.

You can find the appropriate documentation under the Questa install tree documentation directory.

QUICKSTART GUIDE

That quick start will guide you through the mandatory steps to quickly integrate the template regression flow and get your regression up and running with minimum customization and effort.

Refer to the additional sections of that user guide to customize further the regression environment and add additional features if required.

SETUP YOUR REGRESSION FLOW

During that step you will need to set parameters of the template RMDB:

> ➤ To set parameters via the GUI refer to chapter "Adding New Configurations to the Project File" and "Edit VRM Configurations" of Questa VRM documentation.
> ➤ To set the parameters via the command line refer to chapter "Override Parameter Values from Command Line "of Questa VRM documentation.
> > • Syntax is –G<parameter>=<value>

STEP 1 SETUP YOUR COMPILE FLOW

You can choose to compile your design and test bench with Questa VRM or leave it to your existing flow:

> ➤ Compilation outside of Questa VRM
> > • Make sure that you untick/exclude the Compile task when invoking vrun
> > • i.e. *vrun –exclude regression_flow/Dynamic/Simulation/Compile <other vrun options>*

> ➤ Compilation with Questa VRM
> > • Override "CompileCommand" parameter with your compile command or script
> > • i.e. *vrun -GCompileCommand="make compile" <other vrun options>*

STEP 2 SETUP YOUR REGRESSION TESTS LIST

The tests to be ran must be capture in either of these 2 format:

> ➤ csv space separated
> ➤ soffice or Excel spreadsheet

By default the entry format is a spreadsheet, it can be controlled via "testfileformat" parameter:

> ➤ i.e. *vrun –Gtestfileformat="csv" <other vrun options>*

CSV FORMAT

The csv format follow the syntax as defined below:

```
# File Syntax is

# <testname> type {<simulation options>} <repeat_count> <1st seed>...<nth seed>

# If not enough seeds then random is used to pad seeds.
```

Field	Testname	Type	Options	Repeat Count	Seed
Level	REQUIRED	REQUIRED	OPTIONAL	REQUIRED	OPTIONAL
Definition	test name	Type of test (uvm or directed)	Options passed at simulator invocation	# of iterations	Seeds (random by default)

As an example we have 2 test files shown below.

The 1st example define a set of directed and random tests used to reach coverage. The seeds are left empty except for 1 test where it is set to 20. When not defined, seed is set as random and will be generated by the simulator. For the directed tests it is a don't care as there are no random objects.

```
# File Syntax is

# <testname> <type> {<simulation options>} <repeat_count> <1st seed>...<nth seed>

# If not enough seeds then random is used to pad seeds.

#directed tests

ace_rw_generic_test directed {} 1

ace_rw_generic_reordering_test directed {} 1

#random tests

ace_rw_txn_system_random_test uvm {+SCRAMBLING=off +UVM_VERBOSITY=UVM_DEBUG} 1 20

ace_rw_txn_nonshareable_random_test uvm {} 1

ace_rw_txn_innershareable_random_test uvm {} 1
```

You can see as well that for the fixed seed test we are passing additional options to the simulation so we can debug and turn off a part of the design for instance.

SPREADSHEET FORMAT

The spreadsheet format is pretty similar except it is captured in a spreadsheet. As for the csv file, you will capture testname, simulation options, count of repetition and optionally the seed.

An example is shown below:

	A	B	C	D	E
1	Testname	Type	Options	Repeat	Seeds
2	cpu68hc11_legal_ins_rand_test	uvm	-uvmcontrol=all -msgmode both -classdebug -assertdebug -coverage -assertcover -suppress 3829	4	
3	cpu68hc11_legal_ins_non_redundant_infact_test	directed	-uvmcontrol=all -msgmode both -classdebug -assertdebug -coverage -assertcover -suppress 3829 +inFact	4	

	A	B	C	D
1	Testname	Options	Repeat	Seeds
2	cpu68hc11_legal_ins_rand_test	-uvmcontrol=all -msgmode both -classdebug -assertdebug -coverage -assertcover -suppress 3829	1	
3	cpu68hc11_legal_ins_non_redundant_infact_test	-uvmcontrol=all -msgmode both -classdebug -assertdebug -coverage -assertcover -suppress 3829	1	
4				

STEP 3 SETUP YOUR REGRESSION RUN PARAMETERS

The last step is to set the minimal set of mandatory parameters. The following table show the list of required parameters.

For additional customization, Optional parameters are discussed in more details into section "Regression configuration parameters". With that minimum set of parameters you should be good to go with the regression run.

Description	Name	Example
if Compile task is ran, mandatory compile command to compile design and TB	**CompileCommand**	Make compile

If you want to link a test plan, set it to the value of your test plan file with full path (i.e. if not in excel format, set as well tplanoptions accordingly)	**tplanfile**	/home/project/testplan.xls
snapshot loaded in simulator	**SNAPSHOT**	top_dut_tb_opt
spreadsheet/csv file regression tests list	**testfile**	TestsList.xls
spreadsheet sheet/tab to extract the tests list	**testfile_tab**	SmokeTests

RUN YOUR REGRESSION

Now that you have setup the regression flow you are good to go and run your regression. You can refer to "Questa VRM user manual" to have all the possible options of vrun command, below is an example of invoking vrun:

vrun -Gtestfile=testslist.ods -Gtestfile_tab=SmokeTests -GSNAPSHOT=TOP.top_hdl_hvl_opt -GCompileCommand="cd (%VRUNDIR%);make all" -include regression_flow -exclude regression_flow/Run/Dynamic/RerunFailedTests -exclude regression_flow/Run/Formal -exclude regression_flow/Analyze -Gmergeoptions="-testassociated -du cpu68hc11\(rtl\) -recursive" -Gtplanfile=$PRJ_ROOT/run/reqtracer/CPUCORE_68HC11_TP.xml

That online command will run a regression with Questa VRM in batch mode with the following characteristics:

- grab regression tests to be ran in the spreadsheet testslist.ods at tab/sheet SmokeTests
- load the snapshot defined by parameter SNAPSHOT
- launch a compile command as defined per parameter CompileCommand
- only run the Dynamic simulation, PostProcess and Report tasks
- merge only the coverage for a specific design unit
- link the test plan define by parameter tplanfile to simulation coverage results

This is given as an example command and parameters overriding, much more parameterizations can be done and is documented in the section "Regression configuration parameters".

LOOK AT REGRESSION RESULTS

During and after the regression run, a number of outputs are generated and can be displayed and analyzed to steer the verification tasks to be done next (i.e. debugging failed test, cover coverage holes, eliminating noncontributing tests, etc. ….). The different outputs are defined in that section.

TESTS SIMULATION OUTPUTS

All simulation outputs are available under <regression dir>/regression_flow/Run/Dynamic/Simulation/Simulate directory. These directories can be reused as is outside of Questa VRM to replay a specific tests or ship a debug environment to another engineer, indeed the test directories are self-contained and can be reused outside of the VRMDATA directory structure.

This is a powerful and productive way of passing failing tests to debug for instance to a specific engineer.

FAILED TEST REPORT

All failed tests of the regression are captured in 2 files:

> a log file automatically generated by Questa VRM listing all the tasks that has failed including the merge, triage and simulation
> A csv file written during the PostProcess task capturing into the test list csv format only the failed tests.

Both lists are cumulative, meaning they capture failed tasks/tests from all previous regression run.

Using vrun option "-clean" or "-realclean" switch will remove them or it can be removed manually from Questa VRM data directory.

> **Commented [GA1]:** Upcoming release of the template RMDB shall support an automatic deletion via a RMDB parameter. (i.e. FAILED_TEST=cumulative or current)

MERGED COVERAGE OF CURRENT REGRESSION

At the end of the regression run, the merged coverage of the regression is available under <regression dir> and is saved as well under <regression dir>/logs with a timestamp suffix. The 1st merged coverage can be used to check the coverage of the specific regression, do analysis query (which test contributed to what, etc. …) while the latter is saved to make sure that one can go back and do these queries even after a regression clean that delete all data's under <regression dir> except for the logs directory contents.

MERGED COVERAGE OF ALL REGRESSIONS

At the end of regression, coverage result of the regression is merged with the previous regressions result in <regression dir>/logs. It enables to keep the merged coverage of all regressions run from the beginning of the project till present even after a "-clean".

TREND COVERAGE OF ALL REGRESSIONS

At the end of regression, trendable coverage result of the regression is merged with the trend coverage file to track the regression trend.

RANKING REPORT

At the end of regression, a ranking process is launched automatically and provide the following outputs which are all generated under the Questa VRM data directory:

- List of contributing tests   (.contrib file extension)
- List of noncontributing tests   (.noncontrib file extension)
- Log of ranking process containing the contributing,, non-contributing and missing tests (cf. tests linked to the test plan but not run)   (.rank.log file extension)
- Optimized tests list   (_optimized_tesfile suffix file)

The optimized test list is generated by processing the contributing tests list and the ucdb to recreate a test file in csv format so one can rerun automatically or on-demand an optimized regression for instance after a fix to a bug is done.

COVERAGE REPORT

At the end of regression, a coverage report in HTML format is generated and stored under <regression dir>/report/coverage. Refer to Questa user manual on "coverage report" for further details.

TREND REPORT

At the end of regression, a trending report in HTML format is generated and stored under <regression dir>/report/trend. Refer to Questa user manual on "trend report" for further details.

QUESTA VRM REPORT

At the end of regression, a regression run report in HTML format is generated and stored under <regression dir>/report/vrun. Refer to Questa user manual on "trend report" for further details.

COVERAGE EXCLUSIONS

> **Commented [GA2]:** TODO add formal exclusion definition

ADVANCED USAGE

That section complements the "Quickstart guide" section, it describe more advanced features useful for your regression analysis

RERUN OF REGRESSION FAILED TESTS

Questa VRM supports automatic rerun of failed tests, you can look at "Questa VRM user Manual" to learn more. 2 rerun options are supported and described below

AUTOMATIC RERUN

Automatic rerun leverage Questa VRM built-in feature "–rerun", it will do a 2nd pass of the regression with new parameters. For instance you can pass the following command:

vrun <my 1st pass options> -rerun "-select failed –GDEBUGMODE=1"

The command above will rerun your regression with the exact same parameters of the 1st run except that only failed tests will be selected and will be simulated in debug mode since DEBUGMODE parameter is set to 1. It is up to the user to add as many options override as desired

MANUAL RERUN

Manual rerun gives you the freedom to rerun failed tests on demand. The generated csv file containing all failed tests will be used as a parameter to tell Questa VRM to run only failed tests. You can choose for instance to rerun the failed tests in a different regression directory and ship that for debug to a group of engineers.

An example is shown below:

vrun <my 1st pass options>

vrun <my 1st pass options> -Gtestfileformat=csv –Gtestfile=reg_failed_tests.log.csv –GDEBUGMODE=1 –vrmdata VRMDATA_FAILED

RERUN OPTIMIZED REGRESSION

At the end of each regression a ranking of all tests is done and discriminate the contributing tests Vs non-contributing tests. From that ranking process a csv tests list of the contributing tests is generated automatically and stored under the regression directory in a filename called <reg_prefix>_optimized_testfile.

It enables you to rerun an optimized regression in terms of coverage for instance when a code modification is done and you want to verify that you still have your functionality preserved and working.

For instance the following command will rerun your optimized regression:

vrun <my 1st pass options> -Gtestfileformat=csv –Gtestfile=reg_optimized_testfile

RUN A REGRESSION FOR PROFILING ANALYSIS

To ensure your simulation performance stays efficient, it is a common practice to gather profiling information on your TB and DUT code execution for analysis to uncover particular areas hitting your

simulation performance and fix the code accordingly. For instance after a major code change in your TB and/or your DUT it makes sense to check that you have not inserted new code hitting your performance.

Queta RMDB template help you in thaet matter by allowing you to set a parameter and provide a list of tests meaningful for profiling For instance you can pass the following command:

vrun <my 1st pass options> **–Gtestfile_tab=ProfilingTests –GPROFILEMODE=1 –vrmdata VRMDATA_PROFILE**

The command above will rerun your regression with a limited set of tests you have listed in the sheet :ProfilingTests", but this time since parameter PROFILEMODE is set, each test will generate a profiling database which can be analyzed at the end of the run.

ADVANCED CUSTOMIZATION

REGRESSION CONFIGURATION PARAMETERS

Commented [GA3]: Would be productive if we could extract/update the table from the RMDB using tags/comment in the XML as this is a moving target

GLOBAL PARAMETERS

Description	Name	Default Value
Prefix used for filenames such as ucdb merge file, report, etc. ...	**regPrefix**	reg
Root directory of TB source, may be used for trending on TB code	**PRJ_TB_SRC_ROOT**	none
Root directory of DUT source, may be used for trending on DUT code	**PRJ_DUT_SRC_ROOT**	none
DUT Release #, may be used for trending on DUT code version	**PRJ_DUT_VERSION**	none
Modelsim ini variable to define Questa libraries mapping	**MODELSIMINI**	(%VRUNDIR%)/modelsim.ini

COMPILATION PARAMETERS

Description	Name	Default Value
if Compile task is ran, mandatory compile command to compile design and TB	**CompileCommand**	TBD

COVERAGE PARAMETERS

Description	Name	Default Value
Questa VRM predefined parameter for regression merged ucdb	**mergefile**	(%regPrefix%)_merge.ucdb
Questa VRM predefined parameter for regression merge options	**mergeoptions**	-testassociated
Questa VRM predefined parameter for trending ucdb	**trendfile**	(%DATADIR%)/logs/(%regPrefix%)_trend.ucdb
Questa VRM predefined parameter for trending options	**trendoptions**	none
Questa VRM predefined parameter for test plan linking to ucdb	**tplanfile**	TBD
Questa VRM predefined parameter for test plan linking options	**tplanoptions**	-format Excel -verbose
Merge file preserved even after a –clean, deleted if -realclean	**mergefileAll**	(%DATADIR%)/logs/(%regPrefix%)_merge_all.ucdb

Description	Name	Default Value
Placeholder to prevent ucdb test status to be failed/warning by excluding error message patterns using questasim – ucdbteststatusmsgfilter options (refer to Questa VM documentation for usage)	**UCDBFILTER**	none
Optional code coverage exclude file applied on ucdb merge file	**CoverageManualExcludeFile**	TBD
Optional code coverage exclude file generated by Questa Covercheck and applied on ucdb merge file	**CoverageAutoExcludeFile**	(%DATADIR%)/covercheck_exclude.do

SIMULATION PARAMETERS

Description	Name	Default Value
snapshot loaded in simulator	**SNAPSHOT**	REQUIRED
Define test list format which can be either "csv" or "sheet"	**testfileformat**	sheet
spreadsheet/csv file with regression tests list	**testfile**	REQUIRED
spreadsheet sheet/tab to extract the tests list	**testfile_tab**	REQUIRED if testfileformat="sheet"
Options passed to simulator	**vsimoptions**	-modelsimini (%MODELSIMINI%) -do "run.do" -wlf (%INSTANCE%).wlf -l (%INSTANCE%).log -title (%INSTANCE%) -sv_seed (%seed%) (%UCDBFILTER%) -cvgprecollect (%mergefile%)
switch to batch or interactive simulation mode	**RUNMODE**	-c
contents of run.do file source at simulation time 0	**vsimRundo**	coverage save -cvg -codeAll -assert -onexit (%ucdbfile%);run -a;q -f
switch debug mode if set to 1 -> run.do file will source debug.do	**DEBUGMODE**	0
contents of debug.do file source in run.do if debug mode is on	**vsimDebugdo**	add log -r /* -depth 4
switch profile mode if set to 1 -> run.do file will source profile.do	**PROFILEMODE**	0
contents of profile.do file source in run.do if profile mode is on	**vsimProfiledo**	*profile on –assertions –classes –cvg –qdas –solver;profile save –onexit (%INSTANCE%).pdb*
placeholder to launch Unix commands prior starting all simulations	**SimulatePrecommand**	none
placeholder to launch Unix commands prior each test simulation	**testPrecommand**	none
placeholder to launch Unix commands after each test simulation	**testPostcommand**	none

REPORT PARAMETERS

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Description	Name	Default Value
Questa VRM predefined parameter for regression ranking output	**rankfile**	(%DATADIR%)/(%regPrefix%).rank
Questa VRM predefined parameter for regression ranking options	**rankoptions**	-fewest -log (%rankfile%).log
Questa VRM predefined parameter for result analysis database	**triagefile**	(%regPrefix%)_triage.tdb
Questa VRM predefined parameter for result analysis options	**triageoptions**	-severity IFE -teststatus FEW -verbose
Options for regression report output, by default HTML report is generated with full details	**reportoptions**	-html -details -source -code bcestxf -assert -cvg -htmldir (%DATADIR%)/report/coverage
Questa VRM predefined parameter for regression failed tests log file	**faillog**	(%regPrefix%)_failed_tests.log

FORMAL PARAMETERS

Description	Name	Default Value
	COMPILE_PARAMS	
	DUTMODULE	
	DUTLIB	
	DUTPREFIX	
	CLKNAME	clk
	CLKDUTY	0 50
	CLKPERIOD	100
	RSTNAME	rst_n
	RSTACTIVE	low
	DIRECTIVES	
	VERIFY_PARAMS	-effort low