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Mosel testing program

FICO®

Mosel testing system
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Mosel testing program

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Contents

1 Working with *moseltest*

The *moseltest* Mosel program is a general framework for testing Mosel using source Mosel files, C programs or Java programs. It can also be used for testing pre-compiled models, packages or applications (in the form of zip archives) and optionally collect coverage statistics during the execution of the tests. For its execution it only requires a valid Xpress installation and, if any tests are written in C or Java, the corresponding development tools:

- for Java: `java` and `javac`
- for C: `cc` and `make` (Unix); `cl` and `nmake` (Windows)

Public Git repository:

https://github.com/fico-xpress/mosel

1.1 Input files and directory structure

As input, the *moseltest* program expects either a directory containing the files to process or a single file

name. This input information is passed via the `SRCDIR` model parameter (default value: `alltests`). For instance to run the model `mytest.mos`:

```
mosel moseltest SRCDIR=mytest.mos
```

When using a directory as the source for test files, any directory structure is accepted (*i.e.* all subdirectories are traversed and files are processed in alphabetical order).

A test can be packaged either as a *single file* (.mos, .c, .java or .mcf), as an *archive* (.tar, .tar.gz, .tgz or .zip) or as a *subdirectory* (the name of such a directory must end with `.dir`). In the case of an archive (or directory tree), either it contains only one executable file (*i.e.* a single .c, .mos, .java or .mcf file) or the main file to run must be named `main.mos`, `main.c`, `main.java`, or `main.mcf`.

Source files (extension `mos`, `c` or `java`) are compiled then executed. Configuration files (extension `mcf`) are loaded and the file to execute must be defined by the *model* tag (see Section 2).

For instance, a test model `mytest.mos` requiring a data file `mydata.txt` may be stored:

- as an archive `mytest.zip|tar|tgz|tar.gz` containing the 2 files (*i.e.* `mytest.mos` and `mydata.txt`)
- in a directory named `mytest.dir` together with its data file

1.2 Working directory structure

The tests are run in a dedicated directory specified via the model parameter `WKDIR` (default value: `'workdir'`). Running *moseltest* will create and populate the working directory with the following contents (please note that unless model parameter `KEEPDIR` is set to 'true' the working directory will be deleted after each completed test run):

- the program to be tested both in source and compiled form (*e.g.* mos & bim file) or
- in the case of a model, a copy of the corresponding bim file, or
- in the case of an application, the expansion of the zip file and a copy of all files located under the directory 'model_resources', or
- the expansion of the specified archive/directory tree (if any)
- a valid makefile for the host operating system
- files `out.txt` and `err.txt` (output and error streams of the program).

The environment variables `CLASSPATH` and `MOSEL_DSO` are set as necessary, in particular modules and packages are searched for in the current directory as well as in a session specific modules directory (see tags *module* and *package* below). The location of this directory is recorded in the environment variable `DSODIR` (default value: `'dso'`). The environment variable `MOSEL_DSO` also includes the content of the parameter `LIBPATH`.

Thanks to the tag *save* a test may save a copy of a generated file that can be used later by another test defining the *restore* tag. Files handled by this mechanism are collected under the `DATADIR` directory (default value: `'data'`) which location is recorded in the `DATADIR` environment variable. Both directories `DSODIR` and `DATADIR` are deleted at the end of the testing procedure unless `KEEPDIR` is set to 'true'.

1.3 Other configuration settings

1.3.1 Coverage statistics collection

moseltest may be used to generate coverage statistics of packages, models or Insight apps. This mode is enabled by the definition of the parameter `COVLST` that consists in a list of packages/models (no file extension) or applications (extension '.zip') separated by spaces. The required bim files must be compiled with tracing information (option '-G') and be saved under one of the directories included in `LIBPATH`. To locate the corresponding source files *moseltest* will rely on the parameter `COVSRC` that is initialised by default with `LIBPATH`. In the case of applications it will check first the directory `'source'` of the zip archive before looking into `COVSRC` directories.

1.3.2 Report generation settings

Unless Teamcity mode is enabled (see below) *moseltest* generates a report in the file specified via parameter `REPFILE` or if no specific name is set via this parameter using the base report name from parameter `BASEREP`, optionally generating a unique report file name by appending a timestamp to it (depending on setting of `REPDATED`, with optional formatting via `REPDATEFMT`), alternatively appending to or overwriting any existing file of the specified name (setting of `REPRESET`).

The report is formatted with the maximum line length specified via `LINELEN`. The parameter `SAVELOGS` indicates whether to keep logs of successful executions (otherwise only logs of those executions that have resulted in an unexpected error status are kept). If a directory for log files is specified via `LOGDIR` along with `SAVELOGS` set to 'true', then the logs will be copied as individual files per test into the location `LOGDIR` (similarly to the unique report file, the individual filenames can be configured via `REPDATED` and `REPDATEFMT` to include a timestamp), otherwise the contents of all files is collected in the `REPFILE`.

When generating coverage statistics (that is, if parameter `COVLST` is defined), a summary of the statistics is displayed at the end of execution of the testing procedure, and the parameter `COVREP` specifies which additional reports must be produced. If the bit 0 (value 1) is set, annotated Mosel source files will be produced. In this mode a copy of each source file with the extension '.cov' (*e.g.* `mymod.mos.cov`) is saved into the directory `COVDIR` (default value: `'coverage'`) – in these files each line is preceded by the number of times it has been executed. If the bit 1 (value 2) of `COVREP` is set, the file `moseltest.info` will be saved under `COVDIR`: this file can be used with the *genhtml* script from the *lcov* tool[1] to generate an HTML representation of the coverage statistics.

1.3.3 *xprmsrv* server startup

If any tests require an *xprmsrv* server and no such server is running before the start of *moseltest* then the parameter `PIDFILE` needs to define the name of an empty file to which write access is possible. If such a `PIDFILE` is specified then *moseltest* will startup an *xprmsrv* server and use this file to store the process ID of the server in order to be able to stop it when the execution of *moseltest* is about to terminate.

1.3.4 Execution time limit

The parameter `MAXWAIT` specifies the maximum time in seconds allowed for every individual execution of a test; the execution is interrupted by *moseltest* after this delay.

1.3.5 Mosel environment variables

If the parameter `KEEPENV` is 'true' then the `MOSEL_DSO` and `MOSEL_BIM` settings are inherited from the

[1] This tool is installed by default on most Unix and MacOS platforms; for Windows we suggest to use `genhtml.perl` from https://raw.githubusercontent.com/Farigh/lcov-for-windows/master/bin/genhtml

current environment, otherwise they are re-initialized by *moseltest*.

1.3.6 Teamcity mode

If Teamcity mode is enabled (by setting parameter `TC` to 'true') then no report file is generated, in its place output in Teamcity format is generated that is sent to the output stream. The length of the output sent to Teamcity is limited to the number of characters specified in `TCMAXLOG`, truncating from the end of the message string if required.

2 *moseltest* tags

By default, any specified test program is run and an exit status of 0 is interpreted as a success. This behaviour can be changed using tags embedded into the source program file. Tag lines are of the form:

```
!*! <tagname><sep><value>
```

Where *tagname* is the name of the tag, *sep* a separator (either a space, ':' or '=') and *value* the associated value. These tag lines can be directly incorporated into Mosel files (they are valid comments) but for C and Java files they have to be included in comments. For instance:

```
/*
!*! skip_host:winhost
!*! build tagada.bim
*/
```

The tags supported by *moseltest* fall under the following three categories:

- test selection (Section 2.1)
- build sequence and configuration (Section 2.2)
- test results (Section 2.3)

2.1 Conditional selection of tests

`skip:` boolean value indicating whether the test should be skipped. This can be used to disable a test unconditionally

`skip_host:` space-separated list of host names on which the test must not be run (*i.e.* it is skipped when the procedure is run on any of these hosts). Several *skip_host* can be specified: their values are concatenated.

`skip_sys:` list of system names or processor types on which the test must not be run (*i.e.* it is skipped when the procedure is run on any of these systems). Several *skip_sys* can be specified: their values are concatenated. Valid system names are: `aix darwin linux hp-ux sunos windows` The architecture may be appended to the system name. For instance `linux` will cause the test to be skipped on all Linux machines but `linux64` will keep the test on Linux 32bit.
The processor type prefixed by a `'-'` may also be appended to the system name (*e.g.* `linux-x86_64`).

`only_host:` is the opposite of *skip_host*: the test is run only on the specified hosts

`only_sys:` is the opposite of *skip_sys*: the test is run only on the specified systems (same predefined names as *skip_sys*.

`required:` minimum or maximum version number of a component that is required for running a test. Multiple conditions can be stated for the same or different components. The operators '>' and '<' mean '>=' and '<=' respectively. The extension needs to be specified if a component has both, a DSO and a BIM portion of the same name.
Format: `mosel|module[.dso]|package[.bim] <|>~MM[.mm[.rr]]`

2.2 Build sequence, build and run configurations

`build:` a list of objects to generate before running the test. This list may contain modules (.dso), packages (.bim) or executables (in this case the `make` command is used to build them). Several *build* can be specified: their values are concatenated.

`package:` name of a package. The "test" is in fact the source of a package. *moseltest* will compile this package, rename it according to this tag and save it into the session specific modules directory such that it becomes available for the following tests.

`module:` name of a module. The "test" is in fact the source of a module. *moseltest* will compile this module, rename it according to this tag and save it into the session specific modules directory such that it becomes available for the following tests.

`model:` name of a compiled model (no file extension) or an application (ends with '.zip'). This tag can only be used in a configuration file (extension .mcf), the "test" is the specified model or application that must be stored in one of the directories stated via `LIBPATH`.

`parms:` list of parameters passed to the test model. Several *parms* tags might be stated, the actual parameter string is built by concatenating the different tags.

`componly:` Boolean indicating whether execution of the test should be skipped. By default, each test is run after having being compiled. If this tag is set to 'true', the procedure is validated after a successful compilation.

`runbefore:` the name of a file (.mos, .c, .java) that must be run before the main test program. This program may be used to prepare the running environment for the test (*e.g.* grab some data from an external source) or to check whether the environment is suitable for the test. An exit status of '2' will make *moseltest* skip the current test and any other non-zero value will be interpreted as a failure.

`runafter:` the name of a file (.mos, .c, .java) that must be run after the main test. This program may be used to validate the execution (*e.g.* check the content of a result file). A non-zero exit value will be interpreted as a failure.

`restart:` Boolean indicating whether the Mosel instance must be restarted after this test. All tests are run on the same Mosel instance. When this tag is set to 'true', the current instance is terminated and a new one is started for the following tests.

`newinst:` Boolean indicating whether a new Mosel instance must be started for this particular test.

`setenv:` define an environment variable for the process running the Mosel instance. The syntax of this definition is:

```
[sysname.]varname=value
```

Note that 'value' may contain Unix variable references (*e.g.* `${XPRESS}`) that are expanded before definition. If a 'sysname' is used (see *skip_sys* for the list of system names) the variable will be defined only for the corresponding system. When environment variables are defined, the Mosel instance is systematically restarted and terminated at the end of the run (independently of the tags *restart* and *newinst*).

`save:` name of a file to be saved for future use. The operation is performed after execution of the model when it is successful. The file is copied to the directory identified by `DATADIR`. Several *save* tags may be stated

`restore:` name of a file to restore from a previous *save* operation. The file must have been saved by a previous test. The file copy is performed before execution of the test. The file is taken from the directory identified by `DATADIR`. Several *restore* tags may be used.

2.3 Status values and test output

`compstat:` expected compilation status (integer). By default *moseltest* expects the compilation of a model source to succeed. This tag will be used to test the compiler when a compilation failure is expected.

`runstat:` expected execution status (integer). By default a test is successful after the model execution returns the execution status value 0. This tag specifies an alternative execution status.

`exitcode:` expected exit code (integer). By default a test is successful after the model execution returns the execution exit code 0. This tag specifies an alternative exit code.

`noerrmsg:` Boolean indicating that any message sent to the error stream will cause a test failure (by default the error stream is ignored if execution succeeded).

`outexpect:` an extended regular expression that will be searched in the output stream of the test program after its execution. Several *outexpect* tags may be specified: they are searched in the order of their declaration (*i.e.* after the first expression has been found, the following one is searched in the remaining part of the document, *etc.*). The test will be successful only if all regular expressions have been found.

`errexpect:` similar as *outexpect* but expressions are searched in the error stream.

2.4 Usage examples

Here are some examples of how to use the *moseltest* tags:

- A test must be run exclusively under Windows 32bit and Aix 64bit: the model file must include the following tag:

```
!*! only_sys windows32 aix64
```

- A test does not work on HPUX:

```
!*! skip_sys hp-ux
```

- A test performs 3 consecutive optimisations. The first optimisation should result in the output "Solution: 123", the second one in "Solution: 456" and the last one "Solution: 789". The following tags make it possible to identify a valid execution:

```
!*! outexpect Solution: 123
!*! outexpect Solution: 456
!*! outexpect Solution: 789
```

- A collection of tests require the package 'toolbox': instead of including the package source in each test, the source file can be put in the test directory named such that it will be processed before the other files (*e.g.* `aaa_mypackage.mos`). This source file must include the following tag:

```
!*! package toolbox
```

  Because of this tag, after compilation the package is copied into the directory `DSODIR` as `toolbox.bim` and it becomes available for the following tests

- A test is expected to fail (Mosel status 11 — for runtime error) and the error stream must report error "invalid parameter". This can be achieved with the following tags:

```
!*! runstat 11
!*! errexpect invalid parameter
```

- A test requires a data file stored on a remote host — the model `getit.mos` performs the retrieval; it also depends on module `useful.dso` and package `plusplus.bim`, both sources are included in the test archive. Moreover, evaluation of a successful execution is done by analysing a resulting output file. This verification is operated by model `verif.mos`. The main model of this test must define the following tags (the other files are not tagged):

```
!*! build useful.dso plusplus.bim
!*! runbefore getit.mos
!*! runafter verif.mos
```

- Contents of an .mcf file to run model `mymodel.bim` (located on the `LIBPATH`) setting 2 runtime parameters and checking the produced output (the model displays the parameter values).:

```
!*! model:mymodel
!*! parms:Q=3,G='hello'
!*! outexpect G=hello
!*! outexpect 3
```

- Contents of an .mcf file to run the compiled .bim contained in the specified Insight app archive, the output file `usrinputdump.txt` produced by this run is stored for later use by other tests:

```
!*! model:explapp.zip
!*! save usrinputdump.txt
```

  A second .mcf file for the same Insight app may specify a different parameter configuration by which the app reads in the previously saved file that gets copied into the test working directory via *restore*:

```
!*! model:explapp.zip
!*! restore usrinputdump.txt
!*! parms:MODE=USRRUN
```

- Run a test with Mosel versions 5.2-5.6 only, if *mmxprs* version is at least 3:

```
!*! required:mosel > 5.2, mosel < 5.6
!*! required:mmxprs > 3
```

3 Return value

moseltest returns an exit code of 0 when all tests have been passed. Otherwise, a non-zero value is returned and by default a report is generated including the output and error streams of all tests that have failed.