dune-testtools: Modelling dynamic and static variations of system tests through ini files

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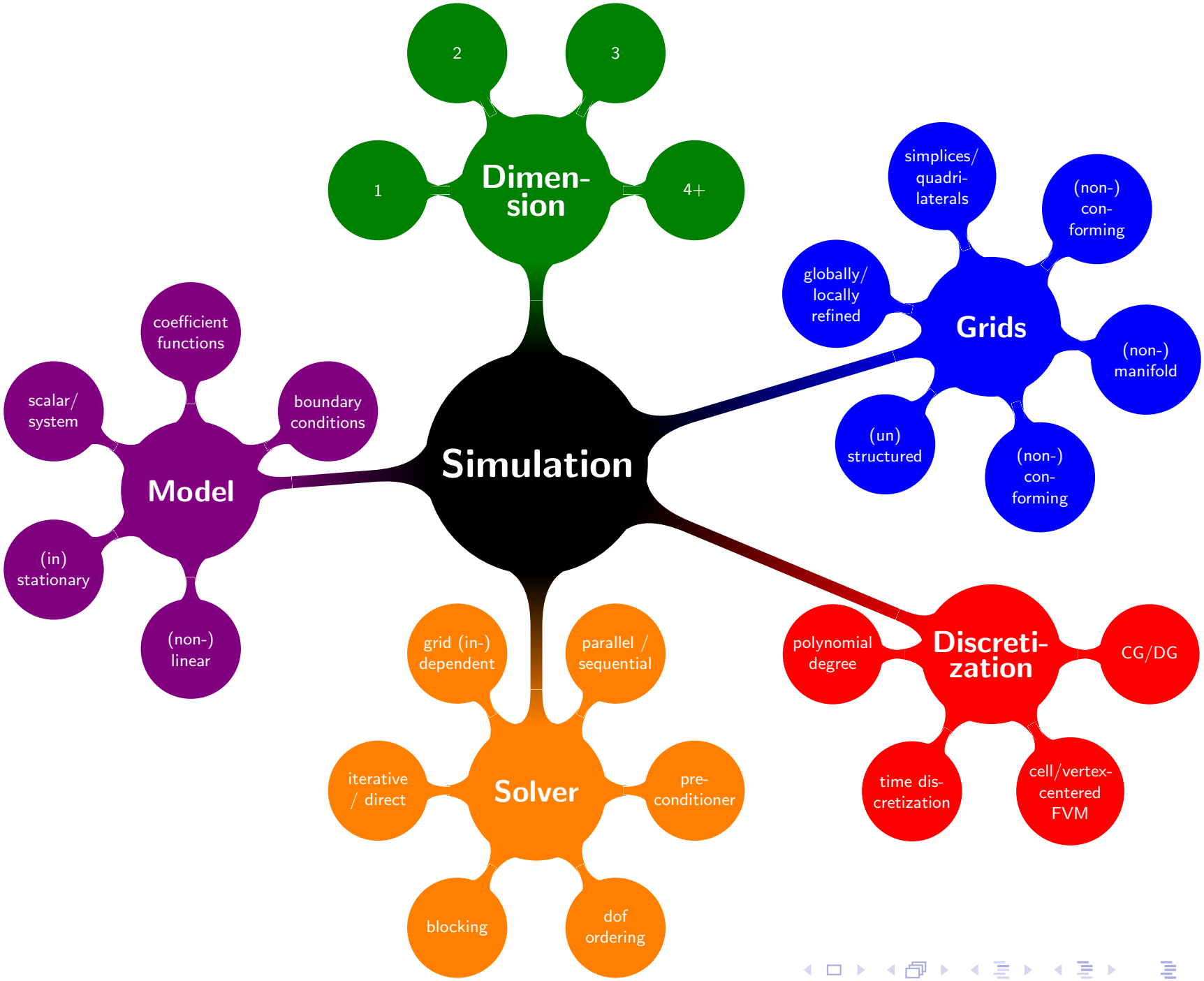
The Dune testing suite is not extensive enough and currently limited to unit testing.

The `dune-pdelab` and `DuMux` teams are working on a joint project to add system testing tools. The module `dune-testtools` provides the "local" infrastructure for system testing.

Goals of `dune-testtools`:

- Provide tools to describe system tests.
- Integrate those tools into the Dune buildsystem.
- Develop testing tools specific to numerical software.
- Staying as close as possible to the user workflow.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What does a system test consist of?

A system test application consists of:

- One single `.cc` source file
- One `.ini` file
- Possibly some header files
- A single line of `CMake` code
- Maybe some reference data (see later)

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How is this done?

Workflow of the expansion process

Meta Ini File

under version control

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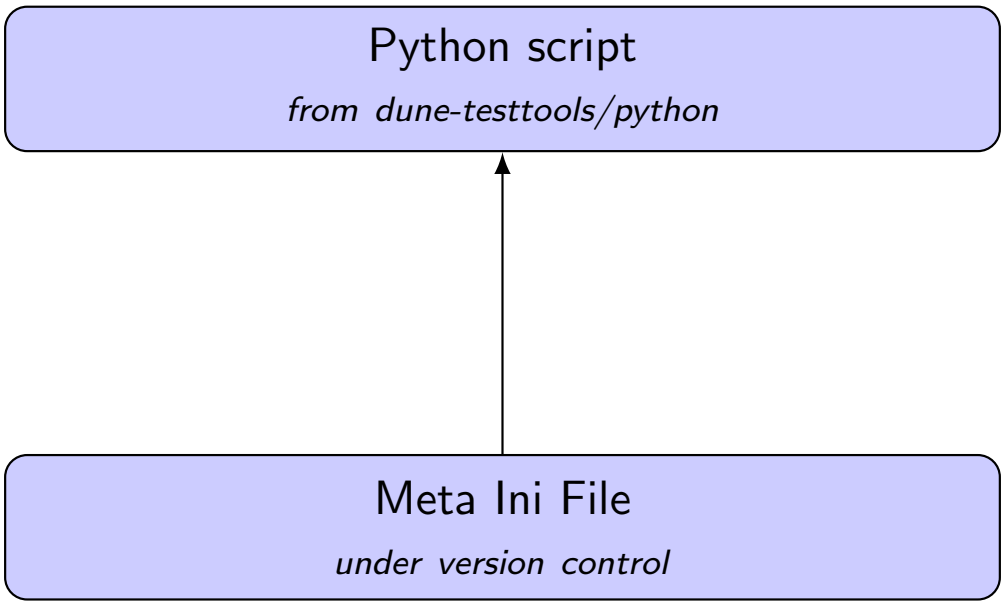

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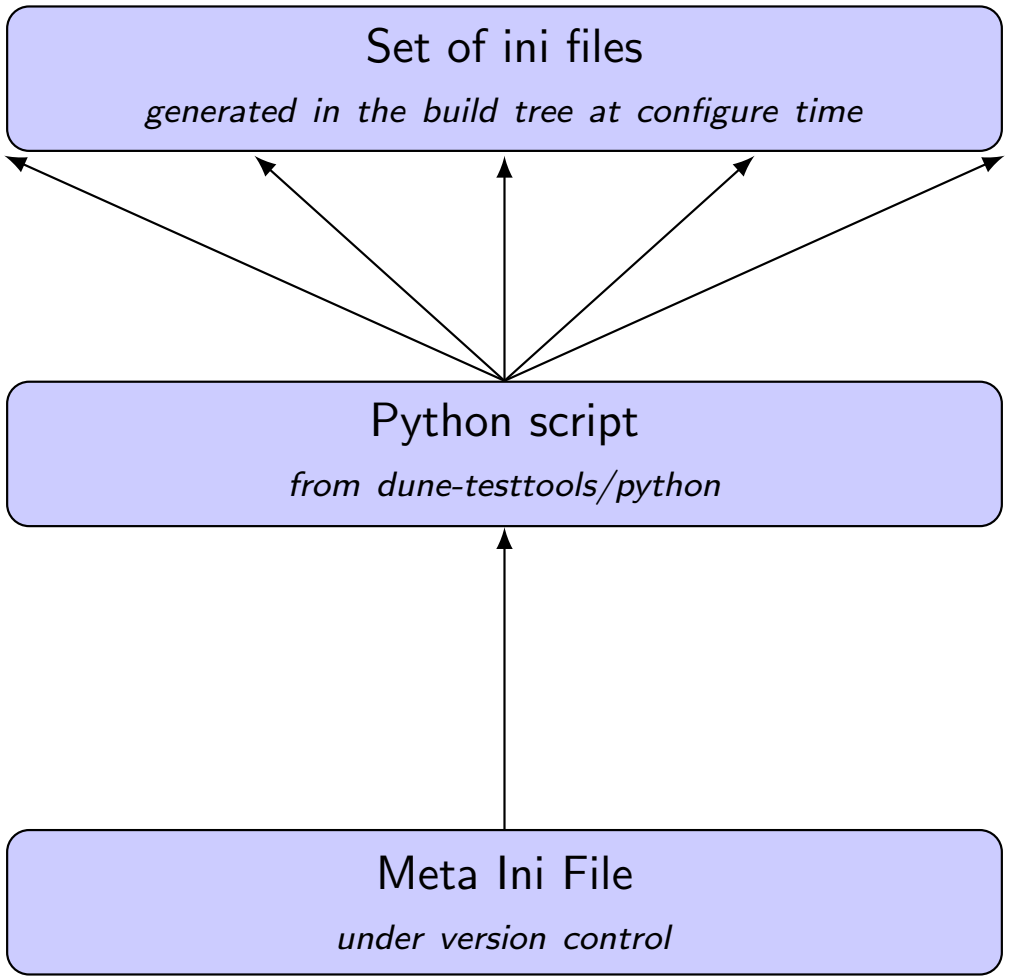

Introducing command syntax

$$< key > \equiv < value > \{ | < command > \{ < args > \}^* \}^*$$

The most important command is the `expand` command:

```
timestep = 0.5, 1 | expand
level = 1, 2, 3 | expand
```

Introducing command syntax

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The most important command is the `expand` command:

```
timestep = 0.5, 1 | expand
level = 1, 2, 3 | expand
```

It is also possible to connect expansion processes:

```
timestep = 0.5, 1 | expand refinement
level = 1, 2 | expand refinement
```

Key-dependent values

```
name = file1 , file2 | expand
file = {name}.ext
```

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```
name = file1 , file2 | expand
file = {name}.ext
```

```
lin = linear, nonlinear | expand
stat = stationary, instationary | expand

parameter = {{lin}_{stat}}

linear_stationary = 1.0
nonlinear_stationary = 2.0
linear_instationary = 3.0
nonlinear_instationary = 1.0
```

Other commands in meta ini files

There are some more commands:

- `unique` makes keys unique by appending consecutive numbering.
- `include` or `import` allow combining ini files.
- `tolower`, `toupper`, `eval` allow simple value modification
- Some testtools are controlled through specific commands

Additionally, there are some special keys that are recognized by the expansion process or testtools. All those start with two underscores.

- `__name` defines the filename. The `unique` command is automatically applied to this key.

Excluding some variants from the product set

Often, the set of possible configurations cannot be expressed as a simple product set, but some more sophisticated constraints are to be applied. This can be done in the same

```
grid = yasp, ug | expand
degree = 1, 2 | expand

{grid} == ug and {degree} == 2 | exclude
```

- The exclude command does not operate on a key/value pair!
- After resolving curly brackets, the value is interpreted as a boolean python expression
- All configurations, where it eavulates to `True` are discarded.

Build system integration / Static variations

The `__static` section in a meta ini file is a special section dedicated to static variations

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- A meta ini file generating static variations

```
yasp = Dune::YaspGrid<2>
foam = Dune::FoamGrid<2,3>
[__static]
GRIDTYPE = {yasp}, {foam} | expand
```

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- The C++ code

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typedef GRIDTYPE Grid;
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- How does the CMakeLists.txt look like?

Build system integration / The CMake macros

- One macro to rule them all: static & dynamic variations

```
add_dune_system_test(SOURCE src1
                     BASENAME base
                     INIFILE ini
                     TARGETS output
                     [SCRIPT script])
```

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Meta Ini File
+ Source File

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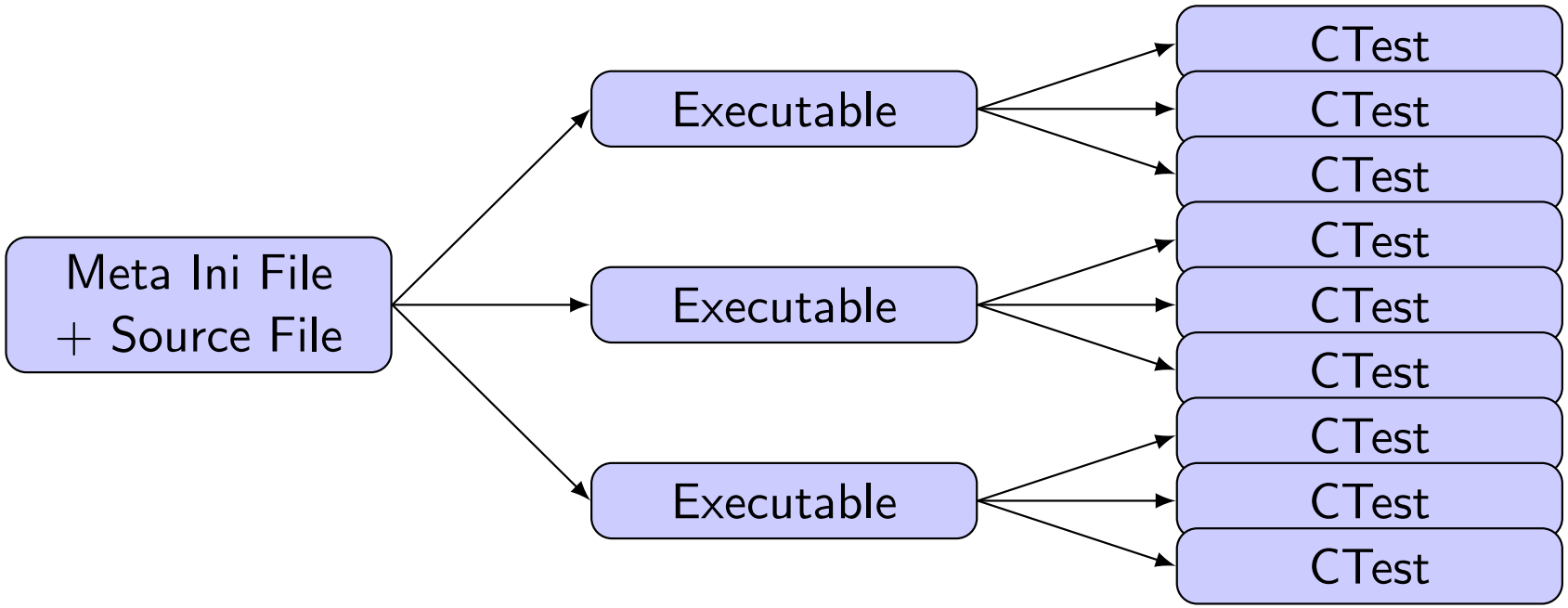

`dune-testtools` is available on:

`http://conan2.iwr.uni-heidelberg.de/git/quality/dune-testtools` It depends on the build system extension module `dune-python` available from

`http://conan2.iwr.uni-heidelberg.de/git/quality/dune-python`
Documentation is also available!

If you have any questions, just contact:

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