

Sim-Diasca Installation Guide

Public Version

Sim~Diasca

Simulation of Discrete Systems of All Scales



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Dedication: For users installing the *Sim-Diasca* simulation engine.

Abstract: This document will guide the reader through step-by-step instructions in order to install the *Sim-Diasca* simulation engine from its sources, which is the recommended procedure.

Table of Contents

1	Objective & Context	3
2	Basic System-wide Network Settings	4
2.1	Recommended Rules	4
3	Software Prerequisites	5
3.1	Software Needed	6
3.2	Preparing the Sim-Diasca sources	10
4	Installing Erlang	12
5	Installing LogMX	16
5.1	Getting LogMX	17
5.2	Setting Up LogMX	18
6	Enabling the Python binding if needed: installing ErlPort	21
6.1	Python Configuration	21
6.2	ErlPort Installation	22
7	Checking Which Tools Sim-Diasca Will Use	23
8	Building Sim-Diasca	25
9	Enabling The Distributed Mode Of Operation	27
9.1	Basic Network Configuration	27
9.2	Password-less Authentication	28
9.3	Managing the Simulator Codebase	30
9.4	Miscellaneous	31
9.5	Cleaning Up	31
10	Testing Sim-Diasca	32
11	Installing Sim-Diasca	33
12	Credits	34
13	Please React!	35
14	Support	35
15	Ending Word	35

1 Objective & Context

The goal is to set up a fully functional Sim-Diasca installation, and to be able to test it and to develop with it, for example so that the implementation of new simulation cases and models can be directly experimented.

In the context of this public version, the installation will be performed:

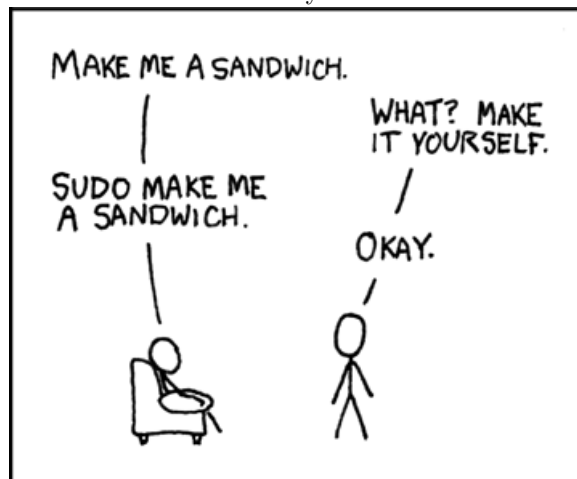
- either from an archive (ex: `Sim-Diasca-x.y.z.tar.bz2`), supposedly already transmitted (typically after a request made through the contact form available at [the official Sim-Diasca website](#) (pointing, at the time of this writing, to [this actual page](#)))
- or from its [official public repository](#)

The operating system is supposed here to be GNU/Linux³ (32 or, most probably, 64 bits):



(see the [credits](#) section about the comic strips)

Root access is not necessary, but recommended so that any lacking prerequisite can be installed directly and with little effort:



³This is the platform we use routinely, although other UNIX systems and possibly Windows platforms *could* be targeted. Sim-Diasca is also quite close to be able to run on Mac OS X, when a few perks will be ironed out (ex: `/proc/cpuinfo` replacement). Patches welcome!

Some space on disk will be needed. 300 megabytes should be enough for the full Sim-Diasca install by itself, but, depending on your use, generated data (ex: frames for simulation videos, plots of simulation results) could need *a lot* more additional space.

Finally, in all cases, i.e. even in the context of simulations to be run on a single machine (rather than in a distributed mode), the network configuration (on all hosts involved) must be adequate (notably so that any switch to a distributed mode of operation is as painless as possible).

2 Basic System-wide Network Settings

2.1 Recommended Rules

We observed in a few cases less-than-optimal network configurations (see also issues #3 and #4 in the *Most Common Issues* section of the *Sim-Diasca Technical Manual*); in short, if wanting to stay on the safer, UNIX-legit side (at least so that the Erlang VM can resolve consistently the local hostname), then ensure that (supposing this local hostname is meant to be **hurricane**):

- in `/etc/hosts`, for each name referring to the local host (hence in the 127/8 network, usually 127.0.0.1):
 - if using a specific domain (let's suppose it is **foobar.org**), first the FQDN (*Fully-Qualified Domain Name*) shall be specified (as the official name), then only the hostname (hence as an alias)
 - all names based on the `localhost` hostname shall come last, i.e. after all actual names that would be specified for the same local IP address
- in `/etc/resolv.conf`, if a domain is specified there (which seems the most suitable), then it *must* be the right one (i.e. **foobar.org** here)

More information:

- [The Wikipedia entry](#) for the `/etc/hosts` file
- [Is your /etc/hosts file healthy?](#)

Two typical examples of (IPv4) legit network configurations follow.

2.1.1 Example of a network configuration without a domain

We suppose here that no specified domain name applies.

Regarding `/etc/resolv.conf`:

```
domain localdomain
nameserver xx.xx.xx.xx
[...]
```

Regarding `/etc/hosts`:

```
127.0.0.1 localhost.localdomain localhost
::1      localhost
127.0.1.1 hurricane.localdomain hurricane
[...]
```

2.1.2 Example of a network configuration with a domain

Here a specific domain is to be specified.

Regarding `/etc/resolv.conf`:

```
domain foobar.org
nameserver xx.xx.xx.xx
[...]
```

Regarding `/etc/hosts`:

```
127.0.0.1 localhost.localdomain localhost
127.0.1.1 hurricane.foobar.org hurricane
[...]
```

2.1.3 Testing the current network configuration

To anticipate a bit (one may come back to this point later), one may try to check whether the current network settings have a fair chance of being correct.

Supposing the FQDN of the localhost is `hurricane.foobar.org` and that Erlang is already available, one may run:

```
$ erl -name my_test
```

It shall result in a prompt like:

```
Erlang/OTP 23 [erts-11.1.4] [source] [64-bit] [smp:8:8] [...]

Eshell V11.1.4 (abort with ^G)
(my_test@hurricane.foobar.org)1>
```

The key being that the Erlang node name is `my_test@hurricane.foobar.org` indeed; for example, neither `my_test@hurricane` nor `my_test@hurricane.acme.com`.

3 Software Prerequisites

This installation procedure is quite detailed and takes into account different cases. Applying it should not be too difficult or time-consuming, and anyway it just needs to be done once; upgrading the Sim-Diasca version will then be transparent afterwards.

Some best-effort support is generally available by email (see contact address at the top of this document), should an issue be encountered.

We preferred to list below the widest possible range of tools here. This includes:

- the **UNIX basics** (ex: `grep`, `awk`, `sed`, etc.); your distribution is expected to provide them out of the box
- the software of which **the simulation engine itself** is composed (ex: the Erlang runtime, the various intermediate layers)

- the **third-party tools** that most simulators may trigger for their own purpose (ex: `LogMX` to monitor and browse simulation traces, `gnuplot` to render plots - one should ensure that its PNG support is enabled, possibly thanks to `libgd` - or `graphviz` to render graphs)
- the **other tools** that, depending on the use cases, may be relied upon in order to post-process or make use of the simulation results (ex: `mplayer`, to display generated videos)
- finally, the **toolchain** that can be used to *build* the simulation engine and its dependencies (ex: to recreate the Sim-Diasca trace parser based on `LogMX`)

3.1 Software Needed

Software prerequisites for a given **host** (computer) depend on the role of this host.

One must indeed distinguish here between two kinds of **nodes** (in the sense of Erlang) involved in a Sim-Diasca simulation:

- the (single) **user node**, from which the simulation is launched and run, and to which results are retrieved and potentially displayed; there must be exactly one user node per simulation
- the (potentially numerous) **computing nodes**, which are in charge of the evaluation of all model instances and provide the resources needed by a parallel and distributed simulation; there must be at least one computing node per simulation (which is by default created on the same host as the user node)

These nodes are mapped to actual networked hosts (workstations, computers involved in a cluster, etc.). The current approach is to have exactly one computing node on each computing host (thus federating all local processors and cores thanks to Erlang), and have a user node that may or (rarely) may not be on the same host as one of the computing nodes.

So, typically, should just one computer be used, Sim-Diasca will then spawn (and run on) two (Erlang, local) nodes (the user node and one computing node).

Should a simulation be distributed over three hosts, by default the user host will run a user node and a computing node, whereas the two other hosts will each run one computing node.

3.1.1 Tool List For the Computing Nodes

An host that is to run only a computing node needs only to have a recent-enough Erlang environment installed (according to the conventions detailed below).

If additional distributed services are enabled (typically probes, whose result generation is by default itself parallel and distributed), then of course their prerequisites shall be available also on the computing nodes (ex: `gnuplot` being then needed on them also).

As these needs form a subset of the needs of a user node, please refer to the next section.

3.1.2 Tool List For the User Node

On the targeted host the specific tools listed below and tagged **Mandatory** *must* be available: if not readily available, the corresponding packages⁴ ought to be installed.

Some hints about each tool are specified below the table. Afterwards, all installation procedures that are not trivial are described.

Tool Name	Corresponding Debian Packages	Tool Necessity	Purpose
Erlang	<code>erlang</code> (but not to be installed that way)	Mandatory	To generate and run Sim-Diasca. Installing Erlang from sources is strongly recommended (see below our script to automate that).
Myriad	(none)	Mandatory	Needed by Sim-Diasca. Myriad sources are already included in the Sim-Diasca ones, so nothing special is to be done for Myriad.
WOOPER	(none)	Mandatory	Needed by Sim-Diasca. WOOPER sources are already included in the Sim-Diasca ones, so nothing special is to be done for WOOPER.
Traces	(none)	Mandatory	Needed by Sim-Diasca. Traces sources are already included in the Sim-Diasca ones, so nothing special is to be done for Traces.
LogMX	(none)	Recommended	To monitor the simulation traces (this is the default trace supervision tool).
Gnuplot	<code>gnuplot</code> , <code>gnuplot-nox</code> and <code>gnuplot-x11</code>	Mandatory	To generate plots of numerical data.
Dot	<code>graphviz</code>	Strongly recommended	To generate graph renderings.
GNU make	<code>make</code>	Mandatory	To build and use Sim-Diasca.
ErlPort	N/A	Optional (dataflow only)	Necessary if enabling the Python dataflow binding.
Python 3	N/A	Optional (dataflow only)	Necessary if enabling the Python dataflow binding (obviously).

... continued on next page

⁴The package names are the ones used by Debian-based distributions, including Ubuntu. Other distributions might use (often slightly) different names.

Tool Name	Corresponding Debian Packages	Tool Necessity	Purpose
Java 8	N/A	Later (dataflow only)	Necessary if enabling any (future) Java dataflow binding (obviously).
Mplayer / Mencoder	<code>mplayer</code>	Optional	To encode and display generated videos.
Geeqie (was Gqview)	<code>geeqie</code> (formerly <code>gqview</code>)	Mandatory	To browse plots of time series and inspect generated frames.
Eye of Gnome	<code>eog</code>	Optional	To display generated images.
Emacs	<code>emacs</code>	Optional	To edit Sim-Diasca sources, preferably using the Erlang mode for that.
Nedit	<code>nedit</code>	Optional	To edit Sim-Diasca sources with a dedicated WOOPER-aware syntax highlighting
GIT	<code>git</code>	Optional	To be able to read and modify Sim-Diasca sources, depending on access options.
GCC	<code>gcc</code>	Recommended	Needed if building Erlang from sources (the general case).
Ant	<code>ant</code>	Optional	To build the Sim-Diasca Java Trace Parser for LogMX (if ever needed - probably not).
Java (Oracle version or Open-JDK)	<code>sun-java6-jdk</code> or <code>openjdk-7-jre</code>	Optional	To be able to compile and run a Sim-Diasca-enabled LogMX parser.
Docutils	<code>python-docutils</code>	Optional	To generate documentation files from RST (reStructuredText mark-up).
LaTeX and all	<code>texlive</code>	Optional	To generate PDF documentation.
Evince	<code>evince</code>	Optional	To display (possibly generated) PDF files.

3.1.3 Package Walk-Through

Erlang and Sim-Diasca (including its [Myriad](#), [WOOPER](#) and [Traces](#) layers) are of course needed and their installation is detailed in the next sections.

The use of a custom-built **Erlang** environment is *strongly* recommended, to be able to rely on an adequately-configured and up-to-date version⁵. Thus no need to install any distribution-specific prebuilt Erlang package⁶, however the GCC compiler (or any similar C compiler) must be available so that the build of

Erlang can be performed.

In the context of the evaluation of dataflow, some simulation actors, typically dataflow processing units, may be implemented in [Python](#) (precisely: Python3⁴), in which case the Python binding shall be enabled; for that, [ErlPort](#) is needed, as well as a recent enough version of Python.

The same binding effort has been initiated, yet not completed, for Java (no extra dependency would be needed then, except of course Java itself, in its 8.0 version or newer).

Note

Please note that such bindings are meant to apply *only in a dataflow context* (i.e. for the specific API borne by the processing unit): these are not general-purpose, actor-level bindings. Even if developing such generic bindings would certainly be feasible, no sufficient need arose yet to trigger their development. Contributions welcome!

An image viewer, a PDF viewer and a video player are generally useful to browse Sim-Diasca outputs. Defaults are, respectively: *Geeqie* ([geeqie](#), previously known as [gqview](#)), *Evince* ([evince](#)), and *Mplayer* ([mplayer](#)), but they can be replaced very easily, in Sim-Diasca code, by any counterparts that would be preferred⁷.

Depending on the version of the **Java Runtime Environment** (JRE) which is available on the user host, the prebuilt Sim-Diasca trace parser may be directly used (this is generally the case), otherwise it will have to be rebuilt from its sources. In this latter (unlikely) case only, **Ant** and a **Java SDK** will be needed.

Docutils, **LaTeX** and all are only useful if wanting to be able to generate the documentation of Sim-Diasca, or PDF-based trace reports.

GIT is needed only if using a repository (either EDF-internal or public) in order to retrieve the Sim-Diasca sources; otherwise of course sources could come from a released archive instead.

Note

If some actual development *on* Sim-Diasca, or *with* Sim-Diasca, was to be performed (beyond mere testing), then relying on a GIT clone rather than on a source archive should be preferred, so that Sim-Diasca can be updated accordingly (and in both directions) with little effort.

The choice in terms of text editor is a matter of taste, any should be suitable (including **Emacs** or IDEs like [Erlide](#), based on [Eclipse](#); the once-popular **Nedit** has an Erlang, WOOPER-enabled [syntax highlighting mode](#)).

⁵In the past, some distributions shipped stripped-down versions of Erlang that happened to be incorrectly built (ex: lacking some components). Nowadays some include versions of Erlang that are way too ancient to be conveniently used. The last stable version of Erlang is always the best bet, and the Sim-Diasca developments tend to stick to it (possibly using bleeding edge additions, thus often *requiring* recent-enough versions of Erlang).

⁶It is even safer not to have any *system-level* installation of Erlang, so that no version mismatch can ever happen, despite potential mistakes made in the user shell settings (note that a runtime checking of all the actual Erlang versions in use by each distributed host is performed). Thus one may only install first the dependencies of Erlang, i.e. the ones listed by the ["show dependencies"](#) action for your distribution of choice.

⁷For that refer to the *default tool section* in `myriad/src/utils/executable_utils.erl`.

Finally, users of Debian-based distributions (Jeesie, Wheezy) could just start with the following command to install the main prerequisite packages:

```
$ sudo apt-get install bzip2 coreutils build-essential g++ \
libncurses5-dev openssl libssl-dev libwxgtk3.0-dev \
libgl1-mesa-dev libglu1-mesa-dev libpng3 \
python-docutils eog evince gcc gnuplot gnuplot-x11 \
geeqie graphviz uuid-runtime make mplayer nedit subversion ant \
openjdk-8-jdk texlive python3
```

Note

On an headless server (with no GUI, like for some cluster hosts),
gnuplot-x11 may be replaced with gnuplot-nox.

3.2 Preparing the Sim-Diasca sources

The sources of Sim-Diasca can be obtained either from a GIT repository (recommended approach) or from an archive file. Both cases are detailed below.

3.2.1 Installation From the Sim-Diasca Internal GIT Repository

This is now the usual procedure.

3.2.1.1 Cloning The EDF-internal GIT repository is hosted by the PAM infrastructure, at the following location: <https://gitlab.pleiade.edf.fr/Sim-Diasca/sim-diasca>⁸.

It can thus be obtained, on a GNU/Linux host connected to the RIN (EDF internal network), thanks to:

```
$ git clone https://gitlab.pleiade.edf.fr/Sim-Diasca/sim-diasca sim-diasca-clone
```

From now on, non-absolute paths (ex: `mock-simulators/soda-test/...`) must be understood as being relative to the root directory of (the current branch of) this clone.

Then a right branch or tag shall be selected, knowing that versions bear annotated tags now labelled as: `sim-diasca-x.y.z-version`.

The `master` branch is the main one, and contains the current reference version of Sim-Diasca (preparation of the next release, as a rolling release candidate).

For further details regarding the Sim-Diasca conventions in terms of version control, please refer to the **Sim-Diasca Developer Guide**.

3.2.1.2 Selecting One's Branch as a Developer When multiple *developers* have to collaborate on the codebase, they shall rely on different branches, per-developer (designated by: first name, dash, last name, all in lowercase; like in the `joe-dalton` branch) if not per-developer and per-feature (ex: a `joe-dalton-ui-rework` branch).

⁸Knowing that the location of the former internal GitLab project was [this one](#).

So typically a new developer would select the branch from which to derive (ex: `master`), and, if not already created, would derive his/her working branch from it:

```
$ git checkout my_start_branch
$ git checkout -branch joe-dalton
```

3.2.1.3 Selecting One's Branch as a User Most *users* will prefer sticking to the latest stable release, which can be obtained with:

```
$ git tag -l "sim-diasca-*-version" | sort | head -n 1
```

For example, at the time of this writing, this results in the `sim-diasca-2.3.10-version` tag.

Then, for example:

```
$ git checkout sim-diasca-2.3.10-version
```

3.2.1.4 Obtaining LogMX We rely internally on the professional version of LogMX.

You should thus have been given a LogMX licence file (ex: `license.properties`).

As for the LogMX archive (ex: `LogMX_vx.y.z_pro.zip`), it can be downloaded from [the repository dedicated to the Sim-Diasca prerequisites](#) (just pick the latest LogMX version available).

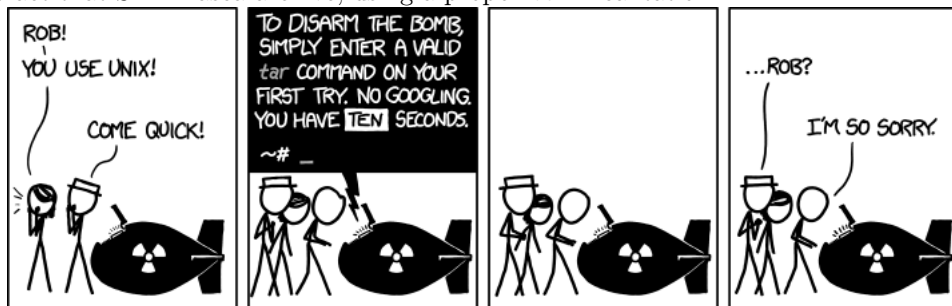
Note

Within EDF, both shall be used instead of the base ones that are mentioned later in this document.

3.2.2 Installation From a Sim-Diasca Archive

You should have been given a Sim-Diasca archive, probably corresponding to a stable version (ex: `Sim-Diasca-a.b.c.tar.xz`, like in `Sim-Diasca-2.2.11.tar.xz`) or a release candidate version, in the form of `Sim-Diasca-a.b.c-rcd.tar.xz` (like in `Sim-Diasca-2.2.11-rc3.tar.xz`). In 2015 we stopped using [Semantic Versioning](#) to switch back to the plain old versioning scheme.

In a directory on which you have read/write access and enough space left, extract that Sim-Diasca archive, using a proper `tar` incantation:



For example:

```
$ tar xvf Sim-Diasca-a.b.c.tar.xz
```

This should create a root directory named `Sim-Diasca-a.b.c` which contains all the relevant sources, including various top-level directories (`myriad`, `wooper`, `traces`, `sim-diasca`, etc.).

From now on, non-absolute paths (ex: `mock-simulators/soda-test/...`) must be understood as being relative to this root directory.

4 Installing Erlang

Sim-Diasca is essentially written in [Erlang](#), thus as soon as it will have to run on a given host, it will require a proper Erlang environment to be available on this host beforehand.

This means that **all the computing hosts that may be used in the context of a distributed simulation must have access to such an Erlang environment**, with compatible versions. There are various ways of ensuring it, including the cases where:

- an appropriate Erlang environment is already built-in on the host operating system
- the hosts have access to some shared infrastructure (ex: a distributed filesystem, like NFS) - it is generally the case with HPC clusters
- a dedicated installation is performed on each of them

Although older versions of Erlang were supported (initially starting from R12B-5, released on November 5, 2008), API and typing changes require now using Erlang versions that are considerably more recent. One may preferably rely on the latest stable version available, as it is both more robust and efficient, and this is the one that is used by the developers of the engine. This version was usually in the form `RxBY`, like `R16B`, and now is named typically as `OTP 23.2` at the time of this writing. As the engine relies on some features introduced in `OTP 23.0`, this version, or more recent, shall be used.

Erlang will then be preferably built from sources, rather than be installed thanks to the package manager of the distribution at hand, in order to benefit from an unmodified cutting-edge stable version that additionally will be built with the finely-tuned configuration deemed the most appropriate in a Sim-Diasca context⁹.

⁹We already saw very popular distributions attempting to split the Erlang environment into subpackages and ending up with a very non-functional software.

Note

The `libncurses` development files (ex: the `libncurses5-dev` package, for Debian-based distributions) are needed to build Erlang.

Similarly, the OpenSSL development files (i.e. the `openssl` and `libssl-dev` packages, for Debian-based distributions) are needed for the `crypto` Erlang module to be available, as we prefer to rely on better-quality random generation (in the future we may use *Tiny Mersenne Twister* - `TinyMT`, or a library dedicated to stochastic management).

Finally, newer Erlang graphical services rely on `WxWidgets`, whose packages (notably `libwxgtk2.8-dev` and their own prerequisites, `libgl1-mesa-dev`, `libglu1-mesa-dev`, `libpng3` and `g++`) are preferably to be installed (needed for the `wx` and `observer` modules for example).

Therefore all these packages should be installed beforehand. Build tools, notably `gcc` and GNU `make`, should be available as well.

So, to obtain a proper Erlang installation, users of Debian-based distributions may run the following command (in one line):

```
$ sudo apt-get install g++ make libncurses5-dev openssl \
libssl-dev libwxgtk3.0-dev libgl1-mesa-dev \
libglu1-mesa-dev libpng3
```

For such an installation from sources, in the `myriad/conf` directory of the Sim-Diasca codebase a script named `install-erlang.sh` is provided¹⁰.

If you have a direct connection to the Internet, it can automatically download the Erlang sources, and then build and install them appropriately; otherwise, typically if being behind a proxy, one may download first by oneself the relevant archives (namely OTP `x.y` Source File and OTP `x.y` HTML Documentation File) from [here](#).

You can then either run the installation script "as is" (with or without a prefix being specified as parameter) or, if preferred, modify its settings appropriately beforehand, or just get inspiration from it instead and then install Erlang directly from the shell.

`install-erlang.sh --help` will provide more usage information, notably on whether it should be run as root or not, installed in a prefixed directory or in the system tree, with a selection of options (ex: to prevent any attempt of downloading said archives), etc.

From a well-chosen, separate directory (ex: `~/Software/Erlang`, to avoid mixing the sources of Erlang with the ones of Sim-Diasca), one could run¹¹ for example:

```
$DIR/myriad/conf/install-erlang.sh
```

or, if a specific installation prefix is to be used:

```
$DIR/myriad/conf/install-erlang.sh /opt/my-tools-repository
```

¹⁰Also available at [install-erlang.sh](#).

¹¹Just ensure that any pre-downloaded archives are available from that directory.

Note

One should not execute this script directly from its containing directory (`myriad/conf`); instead the script shall be run **from outside any build tree related to Sim-Diasca** - a safe, recommended choice being `~/Software/Erlang`¹².

In all cases, you should end up with an installed version of the latest stable source of Erlang.

Sim-Diasca developers could prefer installing automatically this version, along with its associated documentation, in an **ad hoc software repository** (ex: `~/Software/Erlang/`), where successive versions of the tools would be installed over time (it is quite convenient to switch versions).

The simplest and recommended approach is to run the installation script directly from such any software repository of choice (*not* located within the Sim-Diasca codebase), and to add the `--doc-install` option in order to obtain the documentation as well, like in:

```
$ mkdir -p ~/Software/Erlang
$ cd ~/Software/Erlang
$ $DIR/myriad/conf/install-erlang.sh --doc-install
```

Let's call `V` the Erlang version number selected by the script (ex: `V=23.2`). The actual installation directory will then be:

- if no prefix was specified (recommended case):
 - if the install script is run as root (*not* recommended), Erlang will be directly installed in `/usr/local`
 - otherwise (recommended): in `~/Software/Erlang/Erlang-$V`
- if a prefix `PREFIX` was specified, installation will be done in `PREFIX/Erlang/Erlang-$V`

To allow for any later recompilation (ex: should some options be changed), if no prefix was specified and if the installation script is not run as root, the **Erlang build tree** (`otp_src_x.y`) is *not* removed after the installation. Should the current directory (whence the user ran the installation script) be located within the build tree of any part of Sim-Diasca, the corresponding `otp_src_x.y` directory *must* be removed by the user, so that the Erlang BEAM files cannot be mixed up with the ones of that layer. In other cases, one may or may not prefer removing the OTP build tree or even the Erlang archives (typically `otp_*_x.y.tar.gz`).

¹²Otherwise, as the Erlang source archive is extracted in the current directory of the install script, the full build tree of Erlang (typically named `otp_src_x.y`) would end up in `myriad/conf`.

Then, at deployment time, when Sim-Diasca scans recursively the build trees of its prerequisite layers (namely, from bottom-up: [Myriad](#), [WOOPER](#) and [Traces](#); note that for convenience they are already integrated into the distributed Sim-Diasca codebase) in order to gather their BEAM files in its simulation package, it would select unnecessarily all the ones of Erlang itself as well (whereas they are expected to already be installed in each node) - leading for example to drastically longer deployment durations, very large simulation archives typically ending up with deployment time-outs.

A mechanism has been added in order to detect such cases.

If intending to make any actual development in the future (ex: writing a specialized simulator, adding models or operating on the Sim-Diasca code itself), one should add the `--generate-plt` option to the `install-erlang.sh` command-line. It will pre-process Erlang files to generate a *PLT file* that will be later reused by the [Dialyzer](#) tool for code analysis. Please refer to the *Using Type Specifications With Sim-Diasca* section of the *Sim-Diasca Developer Guide* for further information.

Running the installation script should create, in the target installation directory, two corresponding sub-directories, `Erlang-$V` and `Erlang-$V-documentation`, containing respectively the Erlang runtime and its corresponding documentation, if it was selected.

Additionally, in this installation directory two symbolic links (`Erlang-current-install` and `Erlang-current-documentation`) will also be automatically created or updated, to point to these newly installed directories, so that one can register in one's settings files (ex: `~/.bashrc`) appropriate paths referring to these **links**: further Erlang updates will then not require the user to update his settings, while prior installed versions will remain available through the use of their full path.

So one may end up with a directory layout like:

```
$ tree -L 1 -d ~/Software/Erlang/
/home/dalton/Software/Erlang/
|-- Erlang-R14B
|-- Erlang-R14B-documentation
|-- Erlang-R16B
|-- Erlang-R16B-documentation
|-- Erlang-23.2
|-- Erlang-23.2-documentation
|-- Erlang-current-documentation -> Erlang-23.2-documentation
'-- Erlang-current-install -> Erlang-23.2
```

In the general case (i.e. unless run as root with no prefix specified), the new Erlang environment will be installed in a prefix, thus probably it will not be readily available from the shell. As a consequence one should ensure that the Erlang compiler (`erlc`) and the corresponding interpreter (`erl`)¹³ can be found directly from the `PATH` (both are in the same directory).

For example, directly from a `bash` shell:

```
$ export PATH=~/Software/Erlang/Erlang-current-install/bin:$PATH
$ cd ~
$ type erl
erl is /home/dalton/Software/Erlang/Erlang-current-install/bin/erl
```

Setting also the relevant path, one time for all (rather than on a single short-lived terminal) in the shell configuration of the user (ex: `~/.bashrc`) is mandatory for further uses as well; as a consequence, please add the relevant export in the configuration file of your shell of choice.

¹³The Erlang compiler transforms Erlang code (in `*.erl`/`*.hrl` files) into BEAM bytecodes (`*.beam`) suitable for the *Erlang Virtual Machine*. They can then be executed by the Erlang interpreter.

Finally, two simple tests allow to ensure that Erlang can run flawlessly in this new environment. The first one allows to check that we are using the expected version and that it can indeed be run (you have to enter CTRL-C twice to close the Erlang shell afterwards):

```
$ cd
$ type erl
erl is /home/dalton/Software/Erlang/Erlang-current-install/bin/erl
$ erl
Erlang/OTP 23 [erts-11.1.4] [source] [64-bit] [smp:8:8] [ds:8:8:10] [async-threads:10]

Eshell v11.1.4 (abort with ^G)
```

Second test allows to check that your network configuration allows to run a *networked* Erlang virtual machine with long names (enter again CTRL-C twice to exit):

```
$ erl -name this_is_a_test
Erlang/OTP 23 [erts-11.1.4] [source] [64-bit] [smp:8:8] [ds:8:8:10] [async-threads:10]

Eshell V11.1.4 (abort with ^G)
(this_is_a_test@foo.bar.org )1>
```

Refer to the [Name Resolving](#) section should this test fail.

5 Installing LogMX

LogMX is the default tool used here to monitor the distributed simulation traces (refer to the [Ceylan-Traces website](#) for more information on that layer).

Using this proprietary tool is fully optional: adding the command-line option `CMD_LINE_OPT="--batch"` will disable its automatic launching by the engine. As, however, we believe that being able to easily inspect the simulation traces is essential in order to make the best use of the engine, we recommend to install this tool.

Although its purpose is only to allow to supervise the Sim-Diasca traces, its installation requires quite a lot of explanations, especially to deal with the case where the Sim-Diasca parser for LogMX has to be rebuilt from its sources (this is generally not needed, though).

A prerequisite to running LogMX is to have the **Java SE Runtime Environment** installed on the user host, preferably the (free software) OpenJDK version.

Note

LogMX can accommodate older versions of Java. However, if planning to use the Sim-Diasca Java Binding, then Java version 8.0 or newer must be used.

For example, Java 7 could suffice for LogMX:

```
$ java -version
java version "1.7.0_111"
OpenJDK Runtime Environment (IcedTea 2.6.7) (Arch Linux build 7.u111_2.6.7-1-x86_64)
OpenJDK 64-Bit Server VM (build 24.111-b01, mixed mode)
```


Otherwise the Sun (Oracle) version could be used, like in:

```
$ java -version
java version "1.6.0_10"
Java(TM) SE Runtime Environment (build 1.6.0_10-b33)
Java HotSpot(TM) Client VM (build 11.0-b15, mixed mode, sharing)
```

If not available, either the package manager of the distribution¹⁴ or this [link](#) for the Sun version should be used.

Note that if only the Java SE Runtime Environment (i.e. the JRE) is installed (instead of the Java SE Development Kit, i.e. the JDK), then Java code can be executed indeed, but not generated.

However both cases should work, since using a recent JRE should spare the rebuilding of the Sim-Diasca parser (and hence the use of the JDK).

Note

With some distributions (ex: Ubuntu), the default JRE is headless (which means that the JRE does not provide the dependencies used for the graphical components). Fixing this issue is as easy as installing the missing dependencies (`apt-get install openjdk-8-jre`).

5.1 Getting LogMX

LogMX is a proprietary software, thus it cannot be found in package repositories. If not supplied by your organisation, it should be directly downloaded from [that location](#), in its latest version, either the free Evaluation version or the Professional one (both of which can be used by Sim-Diasca).

Note

If you plan to make a commercial use of LogMX, then according to its licence you must purchase its quite inexpensive professional version. In this case all paths in the form of `LogMX_vx.y.z` should be translated into paths in the form of `LogMX_vx.y.z_pro`.

LogMX archive should be extracted, preferably in the same install directory as other tools.

For example:

```
$ mkdir -p ~/Software/LogMX
$ cd ~/Software/LogMX
$ cp ~/LogMX_vx.y.z.zip .
$ unzip LogMX_vx.y.z.zip
```

It must then be appropriately configured and linked to a proper Sim-Diasca parser, as shown below.

¹⁴Example: for Debian-based distributions, `apt-get install openjdk-8-jdk` or `apt-get install sun-java8-jdk` can be used; or, for Arch Linux, `pacman -S jdk8-openjdk` may be used.

5.2 Setting Up LogMX

5.2.1 Configuration Files

Sim-Diasca provides, in the `traces/conf/logmx` directory, the following configuration files:

- `logmx.properties`
- `managers.properties`
- `parsers.properties`

They should be copied in the LogMX `config` directory. These files should overwrite the default LogMX ones. For example:

```
$ for f in logmx.properties managers.properties parsers.properties; do \
/bin/cp traces/conf/logmx/$f ~/Software/LogMX/LogMX_vx.y.z/config ; \
done
```

Note

If you purchased the LogMX professional version, copy the `license.properties` file that you obtained in the LogMX `config` directory instead of the supplied one (and of course keep the other properties-related files).

The LogMX script must then be set to executable:

```
$ chmod +x ~/Software/LogMX/LogMX_vx.y.z/logmx.sh
```

Identically to Erlang, the LogMX script must be found from the path. For example, with a `bash` shell:

```
$ export PATH=~/Software/LogMX/LogMX_vx.y.z:$PATH
$ cd ~
$ type logmx.sh
logmx.sh is /home/dalton/Software/LogMX/LogMX_vx.y.z/logmx.sh
```

Setting also the relevant path in the shell configuration (ex: `~/.bashrc`) is recommended for further uses.

A best practise for that is to install all custom software in a base directory (ex: `~/Software/`), with a sub-directory for each tool (ex: `~/Software/LogMX/`). Then all successive versions of that tool could be installed here (ex: `~/Software/LogMX/LogMX_v7.3.0/`).

Finally, a symbolic link pointing to the latest current version could be defined when installing a new version of that tool (ex: `cd ~/Software/LogMX/; ln -sf LogMX_v7.3.0 LogMX-current-install`).

That way, one just has to specify in one's shell configuration:

```
export PATH=~/Software/LogMX/LogMX-current-install:$PATH
```

This is thus done once for all, it will not have to be updated when upgrading LogMX.

LogMX should then be run "as is", to ensure that it has a chance to run later, when the Sim-Diasca parser will be plugged-in:

```
$ logmx.sh
```

After up to a few seconds, a LogMX window should successfully pop up. Then close that window.

Note

On some LogMX versions, running this `logmx.sh` script will output a line on the console complaining about a `startup.conf` file being not found, or printing `[: 86: 1: unexpected operator` and `[: 86: 0: unexpected operator`.

A simple solution is to edit `logmx.sh` and replace the `STARTUP_CONF_FILE="startup.conf"` line (around line 35) by `STARTUP_CONF_FILE=/dev/null`.

5.2.2 Setting Up the Sim-Diasca Trace Parser

Due to Java, this is probably the trickiest (optional, yet recommended) part of a Sim-Diasca install.

5.2.2.1 Using The Prebuilt Sim-Diasca Parser In the `traces/conf/logmx` directory, there is a prebuilt Java class, `CeylanTraceParser.class`, a generic parser we developed for Sim-Diasca and other tools.

If the Java environment installed on the host is recent enough (which is very likely), then that class file will be directly usable, without further need of recompiling it.

Best option is to try to use it directly, and to rebuild the parser only if this fails.

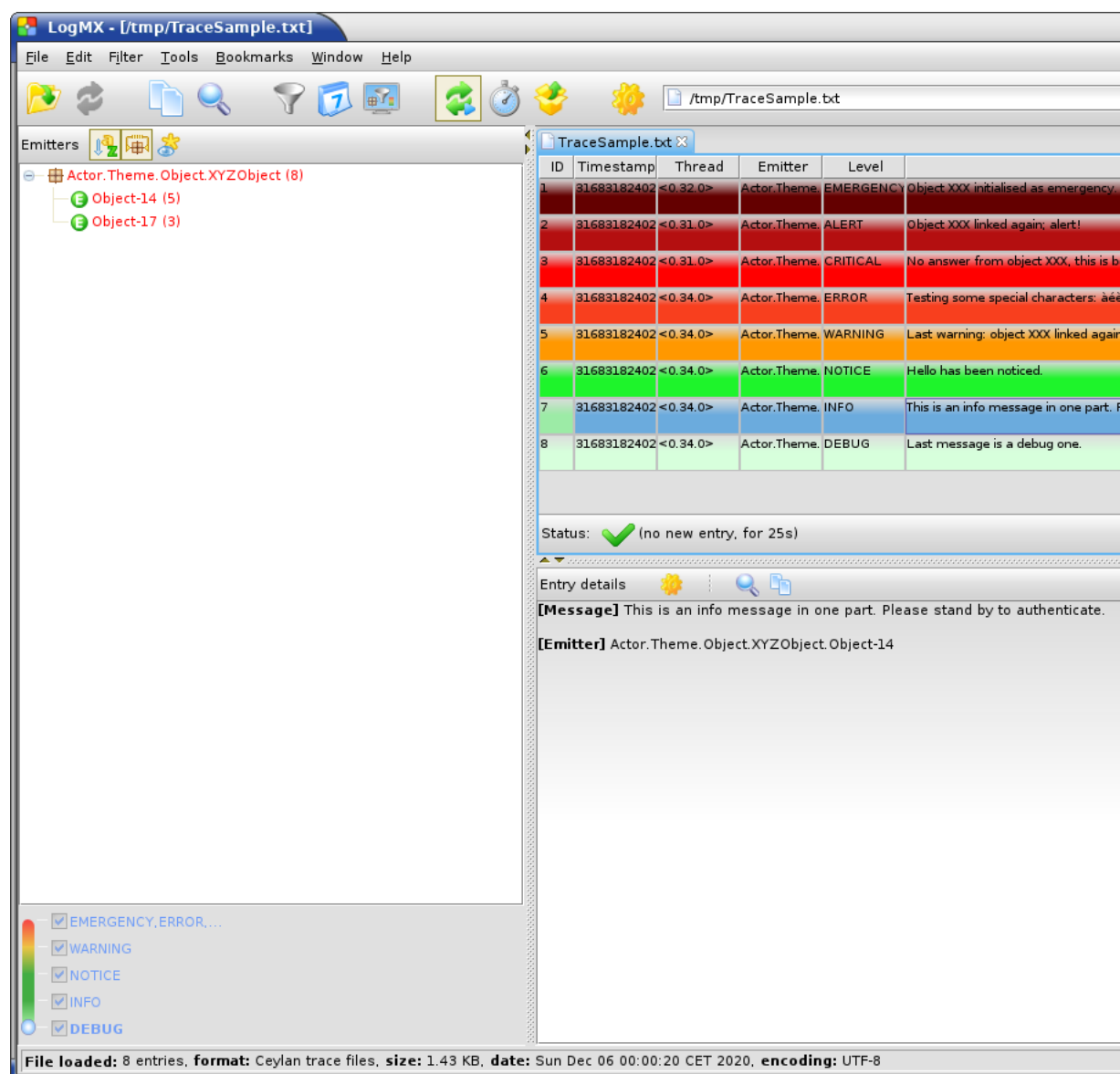
That file should just be copied to the right location:

```
$ CLASS_DIR=~/.Software/LogMX/LogMX_vx.y.z/parsers/classes/ceylan/parser
$ mkdir -p $CLASS_DIR
$ cp traces/conf/logmx/CeylanTraceParser.class $CLASS_DIR
```

5.2.2.2 Checking That The Sim-Diasca Parser Works Properly To do so, just test, from the root of the sources, whether LogMX and the Sim-Diasca parser are correctly integrated, with a sample of Sim-Diasca traces:

```
$ logmx.sh traces/conf/logmx/TraceSample.txt
```

You can skip next section if you see something like:



Otherwise, an error like `Error while instantiating parser` must have been reported: your Java environment is most probably not appropriate (too old?), and, if you are not able to upgrade the Java interpreter that you are using, then unfortunately the parser will have to be rebuilt with all the Java bells and whistles, as explained in the next section (usually this issue does not occur, and one can thus jump directly to the [Checking Which Tools Sim-Diasca Will Use](#) section).

5.2.2.3 Building The Sim-Diasca Trace Parser The Java SE Development Kit (i.e. the JDK) and Ant are needed here.

They can be installed either thanks to the distribution, for example:

```
$ sudo apt-get install openjdk-8-jdk ant
```

- or -

```
$ sudo apt-get install sun-java8-jdk ant
```

or they can be retrieved from their respective official sites ([1](#), [2](#)), if not directly built and installed from sources (for Ant).

Then the Sim-Diasca parser source file should be placed at the right location in the LogMX tree, and built:

```
$ PARSE_SRC_DIR=~/.Software/LogMX/LogMX_vx.y.z/parsers/src/ceylan/parser
$ mkdir -p $PARSE_SRC_DIR
$ cp traces/conf/logmx/CeylanTraceParser.java $PARSE_SRC_DIR
$ cd ~/.Software/LogMX/LogMX_vx.y.z/parsers
$ ant
Buildfile: build.xml
clean:
mkoutdir:
[mkdir] Created dir: ~/.Software/LogMX/LogMX_vx.y.z/parsers/classes
build-dev:
[javac] Compiling 1 source file to ~/.Software/LogMX/LogMX_vx.y.z/parsers/classes
BUILD SUCCESSFUL
Total time: 2 seconds
```

This should imply that `CeylanTraceParser.class` has been successfully built.

Test the result like explained before, in [Checking That The Sim-Diasca Parser Works Properly](#).

6 Enabling the Python binding if needed: installing ErlPort

In the context of the evaluation of a dataflow, some simulation actors may be implemented in [Python](#), in which case the (fully-optional) Python dataflow binding shall be enabled (see the `USE_PYTHON_BINDING` variable in `myriad/GNUMakevars.inc` for that). One should skip this section if not planning to use Python-based (dataflow) actors.

6.1 Python Configuration

Python 3 (3.5.2 or newer) is required here, and - as for the other runtime dependencies - must thus be available on the target system (i.e. on the user host and also on all additional computing hosts - if any).

Often, on a given host (typically a computing one), multiple generations of Python coexist (Python 2 or 3), as well as multiple versions thereof (ex: 3.5.2, 3.6.3, etc.).

We leave the choice of the actual Python version to be used by the engine up to the developer, who can select it by creating a symbolic link named `python-for-sim-diasca` that should point to the Python version of interest, and be found from the default user `PATH`.

For example one may create such a symbolic link in a `~/.Software/bin` that would be declared in the `PATH` environment variable, like in:

```
$ mkdir -p ~/Software/bin
$ cd ~/Software/bin

$ ln -s ~/Software/Python/Python-3.6.3-current-install/bin/python3.6
    python-for-sim-diasca
or
$ ln -s /usr/bin/python3 python-for-sim-diasca
```

Then `~/.bashrc` would be updated with:

```
export PATH=~/Software/bin:${PATH}
```

6.2 ErlPort Installation

As this binding relies on [ErlPort](#), this dependency must be installed beforehand. We currently rely on the original codebase (not on one of the forks thereof).

Our guidelines recommend that it is located in the `~/Software/ErlPort` directory, and that an `ErlPort-current-install` symbolic link points to it.

Knowing that the actual installation directory *must* be named `erlport`¹⁵, one should target a tree structure such as:

```
$ tree -L 1 ~/Software/ErlPort
/home/batman/Software/ErlPort
|-- erlport
'-- ErlPort-current-install -> erlport/
```

To do so, one can issue the following commands:

```
$ ERL_PORT_BASE=~/Software/ErlPort
$ mkdir -p ${ERL_PORT_BASE}
$ cd ${ERL_PORT_BASE}
# Circumvent any proxy here.
$ git clone https://github.com/hdima/erlport.git
$ ln -s erlport ErlPort-current-install
$ cd erlport
# The SHA1 we currently rely on:
$ git checkout 246b77
```

Another option is to download the [latest source version](#) of ErlPort directly, as it is usually appropriate.

Then, depending on your version of Python 3.x, typically if it is in the 3.5-3.7 range, it may need a minor code change, located, from the `erlport` directory, in `priv/python3/erlport/erlang.py`¹⁶.

Indeed the line near the top reading as:

```
from inspect import getargspec
```

¹⁵Otherwise the interpreter initialization on the computing nodes would fail (with the `{not_found,"erlport/priv"} error`).

¹⁶We have our own version of this file that *should* manage most, if not all, Python 3.x versions, to be found in the `sim-diasca/src/core/services/bindings/python/` (just replace, in `erlport/priv/python3/erlport`, the original `erlang.py` with this one then).

may have, for these very specific versions of Python, to be replaced with:

```
from inspect import getfullargspec
```

With the current versions of Erlang, another simple change is needed (in order to properly support stacktraces), in `src/erlport.erl`, according to following diff:

```
-      Type:Reason ->
-      Trace = erlang:get_stacktrace(),
-      {error, {erlang, Type, Reason, Trace}}
+      Type:Reason:StackTrace ->
+      {error, {erlang, Type, Reason, StackTrace}}
```

Then, still from the `erlport` root directory, one may run: `make` to enable the Python support.

Note

We supposed above that ErlPort was to be installed in `~/Software/ErlPort/erlport`.

Should another convention be preferred, then the `ERLPORT_BASE_DIR` environment variable shall be defined in order to point to the actual directory to use.

So, as an example, one may add in one's `~/.bashrc` the following line:
`export ERLPORT_BASE_DIR=/opt/ErlPort/erlport`.

To test the proper Python support, one should refer to the `Sim-Diasca Dataflow HOWTO` document.

7 Checking Which Tools Sim-Diasca Will Use

It is mandatory to have Sim-Diasca know where the tools it needs can be found. To check which main tools would be used, run from the `sim-diasca` directory:

```
$ make info-tools
ERLANG_INTERPRETER = ~/Software/Erlang/Erlang-current-install/bin/erl
ERLANG_COMPILER = ~/Software/Erlang/Erlang-current-install/bin/erlc
LOGMX = ~/Software/LogMX/LogMX-current-install/logmx.sh
```

Some tools will be only used by this `make` system, whereas others, the majority of them (ex: the Erlang interpreter and compiler) will be used by the simulator as well.

Therefore the path to the former ones could be set directly in the makefiles only. However it is generally more convenient that the latter ones are found directly from the shell environment, so that both the Make system *and* the simulator will find them with the same correct versions.

If a `make-only` tool is lacking, edit the `GNUmakevars.inc` file of the relevant package (ex: the one of `myriad`, `wooper`, `traces`, `sim-diasca`, etc.) accordingly.

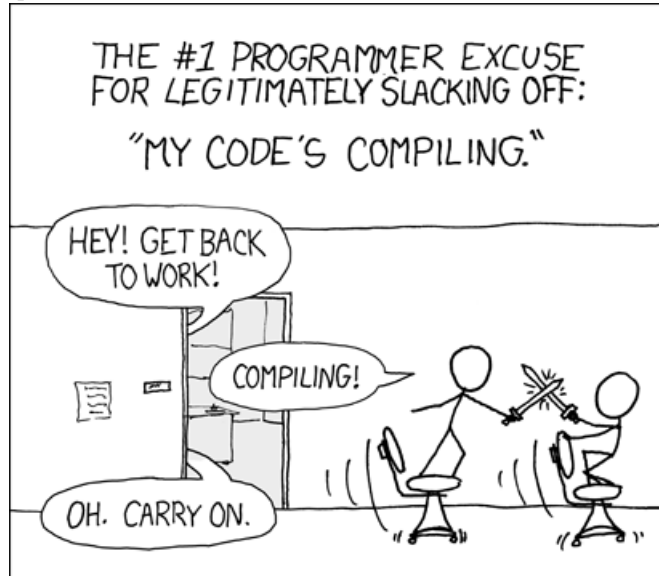
If another tool is lacking, then the shell environment should be updated. This involves updating - most preferably, once for all - the `PATH` environment variable.

This can be done by adding `PATH=/a/path/to/a/lacking/tool:$PATH` to the shell init file (ex: `~/bashrc`) and sourcing it again (`. ~/bashrc`).

Re-run `make info-tools` and apply changes until the `make` system selects the exact tool versions you want.

8 Building Sim-Diasca

The good news is that Sim-Diasca is written in Erlang, thus it requires to be compiled:



The bad news is that it will not take long, only up to a few minutes, as it is itself parallel on each package.

It is just a matter of running `make` from the Sim-Diasca source root, i.e. its base directory, which contains the `myriad`, `wooper`, `traces`, etc. directories.

If using a clone, go to this root typically by entering `cd sim-diasca-clone`. If using a file release, it will be: `cd Sim-Diasca-clone`.

Then:

```
$ make all
Building all, sequentially, in [..]/Sim-Diasca-clone
Building all, in parallel over 8 cores, from [..]/myriad
Building all in [..]/Sim-Diasca-clone/myriad/contrib
Building all in [..]/Sim-Diasca-clone/myriad/src
    Compiling module hashtable.erl
    Compiling module hashtable_test.erl
    Compiling module hashtables_comparison_test.erl
[...]
Building all, in parallel over 8 cores, from [..]/wooper
[...]
Building all, in parallel over 8 cores, from [..]/traces
[...]
Building all, in parallel over 8 cores, from [..]/sim-diasca
[...]
Building all, in parallel over 8 cores, from [..]/mock-simulators
[...]
```

Then you should have a version of Sim-Diasca properly built, and fully able to run, locally or not.

However, should multiple computing hosts be used, a few system-level checks shall be performed first, to ensure that the distributed mode of operation is correctly enabled - as discussed in the next section.

Just before, a note about what we believe is a rather common network misconfiguration of too many Linux computers, which may impact even local, single-host simulations¹⁷: one should ensure that, if FQDN hostnames are associated to IPs for the local host in `/etc/hosts` (ex: `127.0.1.1 hurricane.foobar.org hurricane`), their domain matches the one (if any) specified in `/etc/resolv.conf`.

Often one can see there `domain localdomain` (instead of, say, `domain foobar.org`), which may lead to resolve the local FQDN as `hurricane.localdomain` instead of `hurricane.foobar.org` (which may be a problem at least for the Erlang VM).

¹⁷The network configuration still plays a role even in a non-distributed mode of operation, as the user node is to launch, on that same given host, a computing node, and this spawned one is to connect back to the user node by designating it with either just a node name (ex: `my_user_node`) or with a node name *and* a (local, here) hostname (ex: `my_user_node@LOCAL_HOSTNAME`). A problem with the aforementioned discrepancy is that, if we just specify `my_user_node`, it will be expanded by the VM in `my_user_node@hurricane.localdomain` instead of `my_user_node@hurricane.foobar.org`, and that computing node will never be seen by the user node.

9 Enabling The Distributed Mode Of Operation

A key point of scalability lies in the possibility of harnessing distributed resources.

Note

Should Sim-Diasca be run only locally (i.e. on the current computer), this section can be safely skipped.

In a distributed context, Sim-Diasca must be able to make use of the computing resources available in other networked hosts.

To do so, the Sim-Diasca agents must be already running - and thus be already installed - on each of the targeted hosts before a simulation relying on them is run.

Of course, the user could log on each of these hosts, and install then launch manually the agents needed, however this process would be quite cumbersome and could not scale up. Sim-Diasca can fully perform this deployment task on the user's behalf instead (installation and execution), if proper settings are used. Then it is sufficient either to list the candidate hosts that can be used, or to run the higher-level cluster scripts that we provide (for which the amount of processing resources required has just to be specified).

One has mainly to ensure that the network is correctly configured and that, with one's account, a SSH password-less login can be performed from the current computer to all targeted remote hosts, which are expected to already have an Erlang environment directly available.

From now on, the *user node* will designate the Erlang node from which the user will run the simulation (ex: the one created when issuing a command like `make my_simulation_run` from the user shell). That Erlang node will never take part directly to the computing. However, depending on the simulation settings, the *host* this node runs on may or may not be used as a computing resource, thanks to the automatic creation of another (local, simulation-dedicated) computing node.

One can also refer to the *distributed cheat sheet* of the *Sim-Diasca Technical Manual* for further guidance.

9.1 Basic Network Configuration

Note

Sim-Diasca will check automatically all the points discussed in this section, whose purpose is only to inform the reader and to provide some guidelines, should a check determine that the network is not properly configured.

9.1.1 Interconnectivity

All hosts able to take part to a (distributed) simulation should be able to reach all other hosts thanks to the network.

To check that at least a basic interconnectivity is available, Sim-Diasca will ping all eligible hosts from the user host, and retain only the alive ones (i.e. hosts that cannot be ping'ed are deemed not available for the simulation)¹⁸.

Once this *host* interconnectivity is established, *node* interconnectivity is automatically checked further.

9.1.2 Name Resolving

Each computing host should, in terms of network, be correctly configured.

Notably, for an host whose fully qualified DNS name is expected to be `hurricane.foobar.org`, one should have indeed:

```
$ hostname
hurricane

$ hostname -f
hurricane.foobar.org
```

In the latter case, returned values such as `localhost.localdomain` or `localhost` mean that the host will not be able to take part to a networked simulation.

Usually this configuration can be fixed if having root permissions. The `/etc/hosts` file should indeed have a line similar to:

```
127.0.0.1 hurricane.foobar.org hurricane localhost.localdomain localhost
```

Note the order: the fully qualified DNS name (`hurricane.foobar.org`) should be the first entry listed after the `127.0.0.1` IP, otherwise the networked mode of operation of Erlang may not be activated.

9.1.3 Security

All nodes created by Sim-Diasca will be given the unique cookie forged (based in a custom-generated UUID) by the user node. So no two simulations can collide, even if the same case is run by the same user on the same set of computers.

9.2 Password-less Authentication

This can be done with SSH quite simply, without requiring specific permissions¹⁹, but thanks to a proper configuration.

Let's suppose a user `foobar` on host `host_a.foobar.org` wants to set-up password-less connections to `host_b.foobar.org` (supposedly with the same username).

`foobar` just has to generate, when logged on `host_a.foobar.org`, a key pair with:

¹⁸Note however that we could imagine that the user host pings successfully `h1` and `h2`, while `h1` is still not able to communicate with `h2`. However such awkward network configuration issues seldom occur, and any non fully-meshed connectivity would be detected later, at simulation-time.

¹⁹Provided that the SSH server running on the target host allows it (see the `PubkeyAuthentication yes` entry in the `/etc/ssh/sshd_config` file); it is generally the case.

```

foobar@host_a.foobar.org$ ssh-keygen -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key (/home/foobar/.ssh/id_rsa):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/foobar/.ssh/id_rsa.
Your public key has been saved in /home/foobar/.ssh/id_rsa.pub.
The key fingerprint is: XX:XX:XX... foobar@host_a.foobar.org

```

It generates a private key (`~/.ssh/id_rsa`, which shall be kept as is) and a public one (`~/.ssh/id_rsa.pub`, which can be freely shared).

The user then just has to register that public key to `host_b.foobar.org`.
On GNU/Linux this can be done simply thanks to:

```

foobar@host_a.foobar.org$ ssh-copy-id -i \
    ~/.ssh/id_rsa.pub host_b.foobar.org

```

If the above command fails or is not available, then the following procedure should be used.

First the public key must be transferred to the remote host:

```

foobar@host_a.foobar.org$ scp ~/.ssh/id_rsa.pub \
    foobar@host_b.foobar.org:/home/foobar/.ssh/id_rsa-from-host_a.pub

```

Then it just has to be declared as authorised on that remote host, with the proper permissions:

```

foobar@host_b.foobar.org$ cat /home/foobar/.ssh/id_rsa-from-host_a.pub \
    >> /home/foobar/.ssh/authorized_keys
foobar@host_b.foobar.org$ chmod 600 /home/foobar/.ssh/authorized_keys
foobar@host_b.foobar.org$ chmod 700 /home/foobar/.ssh

```

Once either of the two approaches succeeded, with a basic proper configuration of the SSH server, the login to the remote host should be performed without needing a password:

```

foobar@host_a.foobar.org$ ssh host_b.foobar.org
last login: XXX
foobar@host_b.foobar.org$

```

Hint

Each time a computing host that has never been used previously is added, one should preferably attempt first to perform from the command line a connection from the user host to this new host, in order to ensure that no interactive acknowledgement is needed.

For example, following message could be prompted once (some measures have been taken to avoid it, though):

The authenticity of host 'Server (XXXXX)' can't be established. RSA key fingerprint is YYYYYY. Are you sure you want to continue connecting (yes/no)?.

Just answer yes (once for all).

Note finally that when using multiple computing nodes, all nodes should be able to connect to all nodes. More precisely, the first constraint is actually that the host on which the deployment manager will be run (i.e. the user node) should be able to connect by SSH to all other hosts (to spawn the remote computing nodes).

Then, once the deployment phase is over, the load balancer may spawn a model instance on any of the computing nodes, and two model instances may interact (between them and with the various simulation services) regardless of their respective actual locations. Therefore a fully-meshed network connectivity (everyone to everyone) is needed.

Note also that, notably for the sake of homogeneity, if the host from which the user launched the simulation has been listed among the eligible computing hosts, then another node will be created on the same host (an additional computing node), rather than reusing that launching (user) node as a computing one. No SSH connection between these two local nodes will be attempted, they will be directly interconnected.

Finally, for an host named `foo.bar.org`, a simple test allows to check both the SSH configuration and the availability of an Erlang environment. One should just run for each of the computing host:

```
$ ssh -q foo.bar.org erl -eval \
    'io:format( \"This host would use Erlang version ~s.~n\", \
    [erlang:system_info(otp_release)]), erlang:halt().'
```

```
Eshell V7.3 (abort with ^G)
This host would use Erlang version 18.
```

In that case, this host should be able to take part to the simulation, provided the firewall policy does not prevent it²⁰.

Note also that the Sim-Diasca host configuration file allows to specify which UNIX user should be used on which host (as one may use different logins on different hosts).

9.3 Managing the Simulator Codebase

In a distributed context, the proper code (software) must of course be available on each of the computing hosts, so that this host is able to run a part of the simulation.

However installing manually everything on each host would be soon strenuous, error-prone, and could happen many times (ex: when fine-tuning some models).

With Sim-Diasca, the only prerequisite that must be available on a host before this host is able to take part to a simulation are:

- having a proper configuration of the computing host, as already described (notably regarding network and SSH)

²⁰Note that Sim-Diasca provides a way of specifying a non-standard EPMD port and a range of allowed TCP ports (see `FIREWALL_OPT` in `myriad/GNUmakevars.inc` or, preferably, the `firewall_restrictions` field of the `deployment_settings` record). However the usual practice, and by far safest, is to avoid the use of specific firewall policies between internal hosts: there are already plenty of reasons for a distributed application to experience runtime issues, no need to add more potential problems.

- and having a proper Erlang environment available on that host (i.e. `erl` must be directly found on the shell after a non-interactive login), preferably installed once for all with the `myriad/conf/install-erlang.sh` script we provide, or installed globally on the mount point of a distributed filesystem (typically NFS)

Then Sim-Diasca is able to launch automatically the proper agents on each of the selected computing hosts, and to transfer and set up on that host not only the simulation models to be used (both their code and data), but also its own code and prerequisites as well (i.e. the `myriad`, `wooper`, `traces` and `sim-diasca` packages).

So Sim-Diasca provides an automatic deployment system for the full simulator.

Such a deployment is based on a deployment archive (a `.sda` file, for *Sim-Diasca archive* - a compressed, binary file automatically sent over the network), which can be either prebuilt once and then just specified to each Sim-Diasca run, or that can be automatically built on the fly by Sim-Diasca, from the build tree it is run from on the user node (this latter case is the default one).

9.4 Miscellaneous

One should ensure that the `/tmp` directory is writable by the user on each computing node, and that sufficient free space is available.

9.5 Cleaning Up

Under some circumstances (ex: a model-level failure encountered during a simulation), some pending nodes, created by the deployment manager, may linger on a computing host; this should not be an issue, as the next launching of Sim-Diasca will wipe them out.

To remove them manually, the *Erlang Port Mapper Daemon* can be used, just run on that host:

```
$ epmd -kill
```

Note that launched nodes are, except on some error cases, automatically cleaned up and shut down by Sim-Diasca on simulation termination.

Should a simulation crash prevent this removal, all pending nodes will stop by themselves after a time-out.

Additionally, each time a simulation is run, by default it will start by attempting to remove any still lingering node it would detect.

Finally, should a new simulation be started whereas such pending nodes are still alive (despite the counter-measures taken), the simulation will detect this abnormal situation (based on the run-specific UUID that is generated first), and will exclude the corresponding hosts from that run.

10 Testing Sim-Diasca

Several test cases that can be run to experiment with Sim-Diasca: when a class `X` is defined (in `class_X.erl`), it is recommended to add a corresponding unitary test case (in `class_X_test.erl`).

To run such a test, once Sim-Diasca has been successfully built, one just has to go to the directory where that test is defined, and to run `make class_X_run`: the Sim-Diasca Make system will take care of compiling this test if needed and run it with an appropriately-configured Erlang interpreter.

For example, if wanting to run a Sim-Diasca built-in soda-vending test:

```
$ cd mock-simulators/soda-test/src
$ make
$ make demo-batch
```

Your console should be filled by much text similar to:

```
$ make demo-batch

make[1]: Entering directory 'A_ROOT_DIR/mock-simulators/soda-test/src'
Running unitary test soda_stochastic_integration_run (third form)
from soda_stochastic_integration_test
Launching the Erlang VM in non-distributed mode.
Erlang/OTP 19 [erts-8.1] [source] [64-bit] [smp:8:8] [async-threads:128]
[hipe] [kernel-poll:true]

Eshell V8.1 (abort with ^G)

1>
Simulation instance identifier is '46672710'.
Simulation trace file is
'Soda_Stochastic_Integration_Test-by-dalton-46672710.traces';
no interactive supervision requested.

The single specified computing host is available, using corresponding
node: 'Sim-Diasca-Soda_Stochastic_Integration_Test-dalton-46672710-computing-node@fo

Use cookie '315bf70c-b6f1-4ff2-be23-f85832c08c31' to connect to the
nodes (user or computing ones).

[...]

[Trace Aggregator] Aggregator deleted.
End of case soda_stochastic_integration_test
(case finished, interpreter halted)
make[1]: Leaving directory 'A_ROOT_DIR/mock-simulators/soda-test/src'
```

Congratulations, a full simulation case just ran successfully!

One may then go one step further and test also a non-batch, more graphical mode of operation by running:

```
$ make demo
```


Three windows should pop up²¹:

- a first **Geeqie/Gqview** window, displaying the two simulation results (two time series) as graphs (plots), representing the number over time of cans available in each of the two soda vending machines
- a second **Geeqie/Gqview** window, displaying the measures aggregated by the performance tracker (resource consumption, number of instance per node, etc.), if this service is enabled (true by default)
- a **LogMX** console, for the supervision of the distributed simulation traces (if traces are enabled, which is true by default)

When not useful any more, all windows can be safely closed. The end of the simulation session occurs when the trace supervision window is closed.

Should a problem arise, please have a look at the *Sim-Diasca Troubleshooting* section of the *Sim-Diasca Technical Manual*.

To further discover how Sim-Diasca works and can be used, the next steps could be to peer in the source code of tests and of classes, before playing around and adding some toy models.

11 Installing Sim-Diasca

This completely optional action (that is generally not needed) allows to install all Sim-Diasca related packages (i.e. the **Myriad**, **WOOPER**, etc. packages), and Sim-Diasca itself, out of the build tree.

To do so, one just has to execute, from the top source directory (the one that contains the top-level directories like **sim-diasca**, **wooper**, etc.):

```
$ make install
```

In this case everything will be installed in the default **~/Software** directory, which will be created if not existing already.

The user can specify any other installation directory instead, by defining the **INSTALLATION_PREFIX** variable, like in:

```
$ make install INSTALLATION_PREFIX=/opt/my-simulator
```

In all cases, under the installation directory, all Sim-Diasca related packages will be properly installed, mostly according to the Erlang recommended practices (i.e. with a hierarchy based on standard nested directories like **ebin**, **examples**, **include**, **src**, **test**, etc.).

²¹When running a test from the command line, simulation results are displayed, whereas when the same test is run as part of a test suite, its outputs are generated but not displayed, since it must be run in batch (i.e. silently). Note that how tests are run regarding their outputs is unrelated to the operation mode of the time manager (batch or interactive mode).

12 Credits

Special thanks to **Randall Munroe** who is the author of all the comic strips that enliven this documentation, and who kindly allowed their use in this material.

See his [XKCD](#) website for all information, including for all his delightful other strips.

13 Please React!

If you have information more detailed or more recent than those presented in this document, if you noticed errors, neglects or points insufficiently discussed, drop us a line! (for that, follow the [Support](#) guidelines).

14 Support

Bugs, questions, remarks, patches, requests for enhancements, etc. regarding the installation procedure are to be reported to the [project interface](#) (typically [issues](#)) or directly at the email address mentioned at the beginning of this document.

15 Ending Word

We hope that the installation went smooth!

Now is maybe a good time to run some examples found in the `mock-simulators` tree (located at the root of the Sim-Diasca clone) - typically a `soda-test`?

