

Bayeux/trunk installation report on (X)Ubuntu 14.04 LTS (64bits)

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In this document we propose an installation procedure for the [Bayeux/trunk](#) library on top of [CadfaelBrew](#) on Xubuntu 14.04 LTS (Trusty Tahr) for a system (64-bits).

Notes:

- [CadfaelBrew](#) is only supported on 64-bits systems. This constrains [Bayeux](#) installation to such architectures.
- The (X)ubuntu 16.04 LTS (Xenial Xerus) will become the main supported Ubuntu flavor. This will imply a few changes in process of CadfaelBrew and Bayeux installation.
- Two build systems are supported : GNU/make and [Ninja](#), on top of which CMake is used to build [Bayeux](#).

Contents

The target system	2
Setup of CadfaelBrew	3
brew	3
Ninja	3
Qt5	4
Configuration and build of Bayeux/trunk	4
System dependencies	4
Working directory	4
Download Bayeux	4
Configure Bayeux	6
Build	6
Quick check after build	7
Test programs	7
Installation	8
Check installation	8
Suggestions for a Bash setup (see below)	9
Setup your environment for Bayeux	11
Update the source code from the Bayeux/trunk	12
Appendices	13
Alternative: build Bayeux with GNU make	13

The target system

- Architecture:

```
$ uname -a
Linux bayeux-laptop 3.13.0-74-generic #118-Ubuntu SMP ... x86_64 GNU/Linux
```

- Processors:

```
$ cat /proc/cpuinfo | grep "model name"
model name      : Intel(R) Core(TM) i7-3540M CPU @ 3.00GHz
model name      : Intel(R) Core(TM) i7-3540M CPU @ 3.00GHz
model name      : Intel(R) Core(TM) i7-3540M CPU @ 3.00GHz
model name      : Intel(R) Core(TM) i7-3540M CPU @ 3.00GHz
```

- Linux version:

```
$ cat /etc/lsb-release
DISTRIB_ID=Ubuntu
DISTRIB_RELEASE=14.04
DISTRIB_CODENAME=trusty
DISTRIB_DESCRIPTION="Ubuntu 14.04.3 LTS"
```

- Environment:

The system must have a relatively *bare* environment. It means that even if a lot of software has been installed on the system (`/usr/bin`) or in some alternative locations (`/usr/local`, `/opt...`), you should be able to run a shell with a lightweight `PATH`, typically something like:

```
$ echo $PATH
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games
```

In principle, you should not have the `LD_LIBRARY_PATH` environmental variable set:

```
$ echo aaa${LD_LIBRARY_PATH}ZZZ
aaaZZZ
```

- Dependencies:

It may be useful to install additional system packages to properly build Bayeux and activate some of its features. This is documented below.

Setup of CadfaelBrew

Links:

- [CadfaelBrew](#) repository (GitHub, public access)
- [Cadfael](#) (SuperNEMO Wiki, private access)

Please follow the instructions on the installation report at https://nemo.lpc-caen.in2p3.fr/browser/Bayeux/trunk/doc/InstallationReports/Cadfaelbrew/Xubuntu14.04-a/tagged/cadfaelbrew_xubuntu14.04-a_report-0.2.pdf

brew

Once you have installed [CadfaelBrew](#), you should be able to run a *brew* session:

```
$ brewsh
...
$ echo $PATH
/data3/sw/SuperNEMO-DBD/CadfaelBrew/bin:/usr/local/sbin:/usr/local/bin:
/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:
/data3/sw/SuperNEMO-DBD/CadfaelBrew/Library/Taps/supernemo-dbd/homebrew-cadfael/cmd:
/data3/sw/SuperNEMO-DBD/CadfaelBrew/Library/ENV/scm
```

Note that, in this example, the *brewsh* is an alias for:

```
$ /data3/sw/SuperNEMO-DBD/CadfaelBrew/bin/brew sh --cc=gcc-4.9
```

where the *brew* utility has been installed by [CadfaelBrew](#) on some arbitrary path on the system:

```
$ which brew
/data3/sw/SuperNEMO-DBD/CadfaelBrew/bin/brew
```

This opens a new shell with all environmental variables activated to setup all the software tools managed through [CadfaelBrew](#). Alternatively you can use a dedicated setup function, but you should favor the first method above:

```
$ do_cadfaelbrew_setup
NOTICE: CadfaelBrew is now setup !
```

You can check the location and version of core software utilities:

```
$ which cmake
/data3/sw/SuperNEMO-DBD/CadfaelBrew/bin/cmake
$ cmake --version
cmake version 3.5.2

$ which g++
/data3/sw/SuperNEMO-DBD/CadfaelBrew/bin/g++
g++ (Homebrew gcc49 4.9.3) 4.9.3

$ which doxygen
/usr/bin/doxygen
$ doxygen --version
1.8.6
```

Ninja

[Ninja](#) is a build system which can be used in place of (GNU)make. Install [Ninja](#) through *brew* if it was not already done before (you must setup the *brew* environment for that):

```
$ brewsh
$ brew install ninja
...
```

Then you can check your Ninja version:

```
$ which ninja
/data3/sw/SuperNEMO-DBD/CadfaelBrew/bin/ninja
$ ninja --version
1.6.0
$ exit
```

Qt5

Qt5 is used for the Qt-based GUI components implemented in Bayeux (optional component). For now we use the system install of Qt5 (5.2.1 on Ubuntu 14.04):

```
$ sudo apt-get install \
    libqt5core5a \
    libqt5gui5 \
    libqt5svg5 \
    libqt5svg5-dev \
    libqt5svg5-private-dev \
    libqt5widgets5 \
    qtbase5-dev \
    qtbase5-dev-tools \
    libqt5svg-dev \
    qt5-default
```

Brew is able to install a recent Qt5 (Qt5.6.0) but this is still broken within Bayeux. Please do not use it as long as it is not fixed.

Configuration and build of Bayeux/trunk

Links:

- [Bayeux](#) (SuperNEMO Wiki, private access)

System dependencies

Install dependencies:

```
$ sudo apt-get install gnuplot gnuplot-doc gnuplot-mode
$ sudo apt-get install libreadline-dev readline-common
$ sudo apt-get install pandoc pandoc-data
$ sudo apt-get install python-docutils
```

See above for Qt5 components.

Working directory

Set the software base directory where there is enough storage capacity to host Bayeux (> 1 GB). Here we use a simple environment variable `SW_WORK_DIR` which points to a specific directory on the filesystem:

```
$ export SW_WORK_DIR=/data/sw
```

You should adapt this base directory to your own system, for example:

```
$ export SW_WORK_DIR=${HOME}/Software
```

Then create a few working directories:

```
$ mkdir -p ${SW_WORK_DIR}
$ mkdir ${SW_WORK_DIR}/Bayeux # base working directory for Bayeux
$ mkdir ${SW_WORK_DIR}/Bayeux/Source # hosts the source code
$ mkdir ${SW_WORK_DIR}/Bayeux/Binary # hosts the build/installation directories
```

Download Bayeux

Download Bayeux/trunk source files:

```
$ cd ${SW_WORK_DIR}/Bayeux/Source
$ svn co https://nemo.lpc-caen.in2p3.fr/svn/Bayeux/trunk Bayeux-trunk
$ cd Bayeux-trunk
$ LANG=C svn info
Path: .
Working Copy Root Path: /data/sw/Bayeux/Source/Bayeux-trunk
URL: https://nemo.lpc-caen.in2p3.fr/svn/Bayeux/trunk
Relative URL: ^/Bayeux/trunk
```

Repository Root: <https://nemo.lpc-caen.in2p3.fr/svn>
Repository UUID: 3e0f96b8-c9f3-44f3-abf0-77131c94f4b4
Revision: 17214
Node Kind: directory
Schedule: normal
Last Changed Author: mauger
Last Changed Rev: 17210
Last Changed Date: 2016-03-04 23:36:04 +0100 (Fri, 04 Mar 2016)

Configure Bayeux

1. Make sure CadfaelBrew is setup on your system. If you follow the CadfaelBrew installation report available from the Cadfael wiki page, you just have to invoke:

```
$ brewsh
```

or :

```
$ do_cadfaelbrew_setup
```

2. Create a build directory and cd in it:

```
$ BX_DEV_BIN_DIR="{SW_WORK_DIR}/Bayeux/Binary/Bayeux-trunk"
$ mkdir -p ${BX_DEV_BIN_DIR}/Build-gcc-cxx11-ninja-Linux-x86_64
$ cd ${BX_DEV_BIN_DIR}/Build-gcc-cxx11-ninja-Linux-x86_64
```

3. Configure the Bayeux build with CMake and using Ninja and GCC :

```
$ BX11_DEV_INSTALL_DIR="{BX_DEV_BIN_DIR}/Install-gcc-cxx11-Linux-x86_64"
$ cmake \
  -DCMAKE_BUILD_TYPE:STRING="Release" \
  -DCMAKE_INSTALL_PREFIX:FILEPATH="{BX11_DEV_INSTALL_DIR}" \
  -DBAYEUX_CXX_STANDARD="11" \
  -DBAYEUX_WITH_IWYU_CHECK=ON \
  -DBAYEUX_WITH_DEVELOPER_TOOLS=ON \
  -DBAYEUX_WITH_LAHAGUE=ON \
  -DBAYEUX_WITH_GEANT4_MODULE=ON \
  -DBAYEUX_WITH_MCNP_MODULE=ON \
  -DBAYEUX_WITH_QT_GUI=ON \
  -DBAYEUX_ENABLE_TESTING=ON \
  -DBAYEUX_WITH_DOCS=ON \
  -DBAYEUX_WITH_DOCS_OCD=ON \
  -GNinja \
  ${SW_WORK_DIR}/Bayeux/Source/Bayeux-trunk
```

Build

Using 4 processors to go faster (depends on your machine):

```
$ time ninja -j4
...
real 12m6.886s
user 43m4.932s
sys 2m24.929s
```

Quick check after build

After the build step, Bayeux uses the following hierarchy on the file system:

```
$ LANG=C tree -L 1 BuildProducts/
BuildProducts/
|-- bin/
|-- include/
|-- lib/
`-- share/
```

Particularly, the shared libraries are:

```
$ LANG=C tree -F BuildProducts/lib/
BuildProducts/lib/
|-- cmake/
|   |-- Bayeux-3.0.0/
|       |-- BayeuxConfig.cmake
|       |-- BayeuxConfigVersion.cmake
|       |-- BayeuxDocs.cmake
|       |-- BayeuxTargets.cmake
|-- libBXCatch.a
|-- libBayeux.so*
|-- libBayeux_mctools_geant4.so*
`-- libBayeux_mctools_mcnp.so*
```

Executable are in:

```
$ LANG=C tree -L 1 -F BuildProducts/bin/
BuildProducts/bin/
|-- bxdpp_processing*
|-- bxg4_production*
|-- bxg4_seeds*
|-- bxgenbb_inspector*
|-- bxgenbb_mkskelcfg*
|-- bxgenvtx_mkskelcfg*
|-- bxgenvtx_production*
|-- bxgeomtools_inspector*
|-- bxgeomtools_mkskelcfg*
|-- bxmaterials_diagnose*
|-- bxmaterials_inspector*
|-- bxmctools_g4_mkskelcfg*
|-- bxocd_make_doc*
|-- bxocd_manual*
|-- bxocd_sort_classnames.py*
|-- bxquery*
|-- bxtests/
`-- bxvariant_inspector*
```

These directories and files will be copied in the installation directory.

Test programs

Before to do the final installation, we run the test programs:

```
$ ninja test
[1/1] Running tests...
Test project /data/sw/Bayeux/Binary/Bayeux-trunk/Build-gcc-cxx11-ninja-Linux-x86_64
   Start    1: datatools-test_reflection_0
  1/322 Test  #1: datatools-test_reflection_0 .....   Passed    0.39 sec
...
   Start  322: bxbayeux-test_bayeux
322/322 Test #322: bxbayeux-test_bayeux .....   Passed    0.15 sec

100% tests passed, 0 tests failed out of 322

Total Test time (real) = 68.27 sec
```

Installation

Run:

```
$ ninja install
...
```

Check installation

Browse the installation directory:

```
$ LANG=C tree -L 3 -F ${BX11_DEV_INSTALL_DIR}
/data/sw/Bayeux/Binary/Bayeux-trunk/Install-gcc-cxx11-Linux-x86_64
|-- bin/
|   |-- bxdpp_processing*
|   |-- bxg4_production*
|   |-- bxg4_seeds*
|   |-- bxgenbb_inspector*
|   |-- bxgenbb_mkskelcfg*
|   |-- bxgenvtx_mkskelcfg*
|   |-- bxgenvtx_production*
|   |-- bxgeomtools_inspector*
|   |-- bxgeomtools_mkskelcfg*
|   |-- bxmaterials_inspector*
|   |-- bxmctools_g4_mkskelcfg*
|   |-- bxocd_make_doc*
|   |-- bxocd_manual*
|   |-- bxocd_sort_classnames.py*
|   |-- bxquery*
|   '-- bxvariant_inspector*
|-- include/
|   '-- bayeux/
|       |-- bayeux.h
|       |-- bayeux_config.h
|       |-- brio/
|       |-- cuts/
|       |-- datatools/
|       |-- dpp/
|       |-- emfield/
|       |-- genbb_help/
|       |-- genvtx/
|       |-- geomtools/
|       |-- materials/
|       |-- mctools/
|       |-- mygsl/
|       |-- qt/
|       |-- reloc.h
|       '-- version.h
|-- lib/
|   |-- cmake/
|   |   '-- Bayeux-3.0.0/
|   |-- libBayeux.so
|   |-- libBayeux_mctools_geant4.so
|   '-- libBayeux_mctools_mcnp.so
'-- share/
    '-- Bayeux-3.0.0/
        |-- Documentation/
        |-- examples/
        '-- resources/
```


Suggestions for a Bash setup (see below)

1. Define convenient environmental variables:

```
$ export SW_WORK_DIR=/data/sw
$ export BX11_DEV_INSTALL_DIR=\
    "${SW_WORK_DIR}/Bayeux/Binary/Bayeux-trunk/Install-gcc-cxx11-Linux-x86_64"
```

2. The only configuration you need now is:

```
$ export PATH=${BX11_DEV_INSTALL_DIR}/bin:${PATH}
```

There is no need to update the LD_LIBRARY_PATH environment variable because Bayeux uses RPATH. So you **should NOT** use the following:

```
$ export LD_LIBRARY_PATH=${BX11_DEV_INSTALL_DIR}/lib:${LD_LIBRARY_PATH}
```

3. After setting PATH as shown above, you can check where some of the executable are installed:

```
$ which bxquery
/data/sw/Bayeux/Binary/Bayeux-trunk/Install-gcc-cxx11-Linux-x86_64/bin/bxquery
```

Check datatools' OCD tool:

```
$ which bxocd_manual
/data/sw/Bayeux/Binary/Bayeux-trunk/Install-gcc-cxx11-Linux-x86_64/bin/bxocd_manual
$ bxocd_manual --action list
List of registered class IDs :
cuts::accept_cut
cuts::and_cut
...
mygsl::histogram_pool
```

Check geometry tools; cd in the Bayeux/geomtools example #01:

```
$ cd /data/sw/Bayeux/Source/Bayeux-trunk/source/bxgeomtools/examples/ex01
$ export CONFIG_DIR=$(pwd)/config
$ bxgeomtools_inspector --manager-config config/manager.conf
```

```
GEOMTOOLS    INSPECTOR
Version 5.0.0
```

```
Copyright (C) 2009-2015
Francois Mauger, Xavier Garrido, Benoit Guillon,
Ben Morgan and Arnaud Chapon
```

```
immediate help: type "help"
quit:           type "quit"
support:        Gnuplot display
support:        Root display from GDML
```

```
geomtools> help
...
geomtools> display --help
...
geomtools> display
...
geomtools> list_of_logicals
...
geomtools> display optical_module.model.log
...
geomtools> list_of_gids --with-category optical_module.gc
List of available GIDs :
[2020:0.0] as 'optical_module.gc'      [2020:0.1] as 'optical_module.gc'
[2020:1.0] as 'optical_module.gc'      [2020:1.1] as 'optical_module.gc'
```

```
geomtools> display [2020:0.1]
```

Press [Enter] to continue...

```
geomtools> export_gdml bxgeomtools_test.gdml
```

GDML file 'bxgeomtools_test.gdml' has been generated !

```
geomtools> quit
```

Conclusion:

- No problem for compiling, running tests and examples.

Setup your environment for Bayeux

Here we explicitly *load/setup* the Bayeux environment from a Bash shell with a dedicated function defined in my `~/ .bashrc` startup file:

```
# The base directory of all the software (convenient path variable):
export SW_WORK_DIR=/data/sw
export BX_DEV_BIN_DIR="${SW_WORK_DIR}/Bayeux/Binary/Bayeux-trunk"

# The Bayeux/trunk setup function:
function do_bayeux_trunk_setup()
{
    do_cadfaelbrew_setup # Automatically load the Cadfaelbrew dependency
    if [ -n "${BX11_DEV_INSTALL_DIR}" ]; then
        echo "ERROR: Bayeux/trunk is already setup !" >&2
        return 1
    fi
    export BX11_DEV_INSTALL_DIR=${BX_DEV_BIN_DIR}/Install-gcc-cxx11-Linux-x86_64
    export PATH=${BX11_DEV_INSTALL_DIR}/bin:${PATH}
    echo "NOTICE: Bayeux/trunk is now setup !" >&2
    return;
}
export -f do_bayeux_trunk_setup

# Special alias:
alias do_bayeux_dev_setup="do_bayeux_trunk_setup"
```

When one wants to use pieces of software from Bayeux, one runs:

```
$ do_bayeux_dev_setup
```

Then all executable are usable from the Bayeux installation directory:

```
$ which bxocd_manual
...
$ which bxgeomtools_inspector
...
$ which bxg4_production
...
```

Update the source code from the Bayeux/trunk

1. Activate the CadfaelBrew environment:

```
$ brewsh
```

2. Cd in the Bayeux/trunk source directory:

```
$ cd ${SW_WORK_DIR}/Bayeux/Source/Bayeux-trunk
```

3. Update the source code:

```
$ svn up
```

4. Cd in the Bayeux/trunk build directory:

```
$ BX_DEV_BIN_DIR="${SW_WORK_DIR}/Bayeux/Binary/Bayeux-trunk"  
$ cd ${BX_DEV_BIN_DIR}/Build-gcc-cxx11-ninja-Linux-x86_64
```

5. You may need to clean the build directory:

```
$ ninja -clean
```

and even to completely delete it to rebuild from scratch:

```
$ cd ${BX_DEV_BIN_DIR}  
$ rm -fr Build-gcc-cxx11-ninja-Linux-x86_64  
$ mkdir Build-gcc-cxx11-ninja-Linux-x86_64  
$ cd Build-gcc-cxx11-ninja-Linux-x86_64
```

then reconfigure (see above).

6. You may need to delete the install tree:

```
$ rm -fr ${BX_DEV_BIN_DIR}/Install-gcc-cxx11-Linux-x86_64
```

7. Rebuild, test and install:

```
$ ninja -j4  
$ ninja test  
$ ninja install
```

Appendices

Alternative: build Bayeux with GNU make

a. Build dir:

```
$ BX_DEV_BIN_DIR="${SW_WORK_DIR}/Bayeux/Binary/Bayeux-trunk"
$ mkdir -p ${BX_DEV_BIN_DIR}/Build-gcc-cxx11-gnumake-Linux-x86_64
$ cd ${BX_DEV_BIN_DIR}/Build-gcc-cxx11-gnumake-Linux-x86_64
```

b. Configure Bayeux with CMake and GNU make (default build system):

```
$ brewsh
$ BX11_DEV_INSTALL_DIR="${BX_DEV_BIN_DIR}/Install-gcc-cxx11-Linux-x86_64"
$ cmake \
  -DCMAKE_BUILD_TYPE:STRING="Release" \
  -DCMAKE_INSTALL_PREFIX:FILEPATH="${BX11_DEV_INSTALL_DIR}" \
  -DBAYEUX_WITH_IWYU_CHECK=ON \
  -DBAYEUX_WITH_DEVELOPER_TOOLS=ON \
  -DBAYEUX_WITH_LAHAGUE=ON \
  -DBAYEUX_WITH_GEANT4_MODULE=ON \
  -DBAYEUX_WITH_MCNP_MODULE=ON \
  -DBAYEUX_WITH_QT_GUI=ON \
  -DBAYEUX_ENABLE_TESTING=ON \
  -DBAYEUX_WITH_DOCS=ON \
  -DBAYEUX_WITH_DOCS_OCD=ON \
  ${SW_WORK_DIR}/Bayeux/Source/Bayeux-trunk
```

c. Build, test and install:

```
$ time make -j4
...
$ make test
$ make install
```