

Xenomai 3 installation notes



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Xenomai 3

- Xenomai 3 has a new architecture
- Can run:
 - Cobalt: Seamlessly side-by-side with Linux as a co-kernel system
 - Best performance, but
 - Implies patching and compiling the kernel
 - Mercury: Natively over mainline Linux kernels.
 - The mainline kernel may be patched with the PREEMPT-RT patch to improve timeliness
 - Poorer performance
 - Smaller installation burden/complexity
 - Good for taking a “taste” of Xenomai or for applications with large periods and jitter tolerance ...

Installation

- Xenomai follows a split source model, decoupling the kernel space support from the user-space libraries.
 - Kernel components available under the kernel/ sub-tree
 - User-space components under lib/ sub-tree.
 - Other top-level directories, such as scripts/, testsuite/ and utils/, provide additional scripts and programs to be used on either the build host, or the runtime target.
- The kernel/ sub-tree which implements the in-kernel support code is seen as a built-in extension of the Linux kernel. Therefore, the standard Linux kernel configuration process should be used to define the various settings for the Xenomai kernel components.
- The lib/ sub-tree contains the various user-space libraries exported by the Xenomai framework to the applications.
 - This tree is built separately from the kernel support.
 - Libraries are built in order to support the selected core, either Cobalt or Mercury.

Installation - Mercury

- Does not require compiling a kernel
- Kernel should provide high resolution timers support (CONFIG_HIGH_RES_TIMERS)
 - Check with:
 - `$cat /boot/config-$(uname -r) | grep CONFIG_HIGH_RES_TIMERS`
- PREEMPT_RT patch may be used for shorter latency/jitter

Installation - Mercury

- Download the tarball to a folder of your choice.
 - Link to the latest stable tarball is available at: <https://xenomai.org/downloads/xenomai/stable/>
 - You should use a private folder, under your /home folder, not a system folder.
 - **Avoid long paths with complex names (spaces, signs, ...). Keep the path simple. E.g. /home/USER_NAME/xenomai/**
- Open a terminal, move to the folder where you have downloaded the tarball and extract it with:
 - `$tar xvjf xenomai-3.1.tar.bz2`
- Move to the source tree and run the bootstrap script to generate the configure script and the Makefiles
 - `$cd xenomai-3.1`
 - `./scripts/bootstrap`
 - You need a set of tools. Installing dh-autoreconf (and dependencies)should install all its needed
- Create a build folder, configure and install (Mercury libraries natively for a x86_64/SMP system, enabling shared multi-processing support)
 - E.g. `$cd ..` then `$mkdir xenomaibuild` and `$cd xenomaibuild/`
 - `../xenomai-3.1/configure --with-core=mercury --enable-smp --enable-pshared`
 - `sudo make install`

Installation - Mercure

- After this step the installation root should be populated with the libraries, programs and header files needed to build Xenomai-based real-time applications.
 - The default directory path is `/usr/xenomai`.
- Time to test the installation
 - `$cd /usr/xenomai/demo`
 - `$. /altency` or
 - `$sudo ./cyclictest`
- If the test programs work properly everything is set
- Those programs provide good indications about the RT performance of the platform.

Xenomai application development

- PATH and LD_LIBRARY_PATH must be set properly.
- If the applications fail to compile/execute do:
 - `$export PATH=$PATH:/usr/xenomai/bin/`
 - `$export LD_LIBRARY_PATH=$LD_LIBRARY_PATH:/usr/xenomai/lib/`
- For a permanent solution configure the “.profile” or “.bash_profile” (individual users) or “/etc/environment” (system-wide) files accordingly.
- I have provided a file called “setXenoEnv.cmd” with those commands. Just issue “source ./setXenoEnv.cmd” on the command line to set the environment variables on a terminal.
- To make it easier, open a terminal on the exec folder and:
 - `$sudo su`
 - `#source source ./setXenoEnv.cmd`
 - `./app_exec` (where app_exec is e.g. periodicTask)

Notes:

- The procedure herein reported was tested with Ubuntu 20.04 LTS and Xenomai 3.1
- Also works in Ubuntu 22.04, but has some issues
 - Do not enable “--enable-pshared” in “../xenomai-3.1/configure ...”
 - Gcc catches an error in “latency.c”. Go to line 415 and replace “fclose(ifp);” with “pclose(ifp);” (it is indeed an error in the source code)

Installation requirements

- Make sure to have the following dependencies:
 - autoconf (≥ 2.62), automake and libtool
 - E.g. in Ubuntu 22.04 simply install dh-autoreconf and everything needed gets installed
 - Pkg-config: install the package with this name

Info Sources

- Overview and Architecture
 - https://gitlab.denx.de/Xenomai/xenomai/-/wikis/Introducing_Xenomai_3
 - <https://elinux.org/images/7/76/Kiszka.pdf>
- Installation
 - <https://xenomai.org/documentation/xenomai-3/html/README.INSTALL/>
- Application development
 - <https://xenomai.org/documentation/xenomai-3/html/xeno3prm/index.html>
 - https://gitlab.denx.de/Xenomai/xenomai/-/wikis/Building_Applications_For_Xenomai_3
 - <https://www.ashwinnarayan.com/post/xenomai-realtime-programming/>
 - <https://www.ashwinnarayan.com/post/xenomai-realtime-programming-part-2/>
- Other
 - <https://www.diva-portal.org/smash/get/diva2:1251188/FULLTEXT01.pdf>