Evolving the Xenomai Project in a Global Community

Jan Kiszka | Xenomai Workshop, Beijing, China, November 26, 2024

Agenda

~~What is Xenomai?~~ How Did it Evolve?

Current Community State

Developer & Contributor Support

About New Kids on the Block

Summary

Xenomai History, Part I

Xenomai 1.0

- Started in 2001 as RTOS application portability framework by Philippe
- Became part of RTAI

Xenomai 2.0

- Stand-alone again since 2005 (different design goals)
- I-pipe patch to hook into the kernel
- Ported to 6 architectures

Xenomai 3.0

- Released in 2015 (>5 years of work)
- Rework of in-kernel core (“cobalt”)
- Support for native Linux (“mercury”)

Key Contributors of the Last 5 Years

Slide from 2018

- **Philippe Gerum** → **customer-funded** + **personal budget**
- **Gilles Chanteperdrix** → **spare-time**, partly **employer-funded**
- **Jan Kiszka** → **employer-funded**
- **Jorge Ramirez-Ortiz** → employer-funded, partly spare-time
- **Henning Schild** → employer-funded
- **Dmitriy Cherkasov** → customer-funded, now spare-time

- **No longer sustainable** (“elephant in the room” email thread)
- **Siemens increased invest, assigned more engineers**
- **But a new maintainer was needed as well...**

Xenomai History, Part II

Xenomai 3 Series

Xenomai 3.0.8

- 2019: First release by me as new maintainer
- Philippe focuses on new core

Xenomai 3.1

- 2020: ++arm64, --blackfin, --powerpc64
- Announcement of Common Xenomai Platform between version 3 and 4 (EVL)

Xenomai 3.2

- 2022: Uses dovetail patch (kernel 5.10+)

Xenomai 3.3

- 2024: Dovetail-only, --powerpc (32-bit), Y2038-ready

Xenomai 4 Series

v5.0-evl1 / libevl r0

- 2019: First releases of new EVL core and library
- Based on dovetail kernel patch

v5.4-evl1-rebase to v5.4.102-evl1-rebase

- 2019..2021: First EVL stable kernel releases
- libevl evolved from r8 to r25 meanwhile

revl v0.2.0

- 2022: First release of EVL Rust crate

v6.6.58-evl1-rebase / libevl r50 / revl v0.5.0

- 2024: Latest stable releases, now with RT networking
- Announcement of POSIX API effort(s)

Xenomai 3, EVL Project, Xenomai 4 – The Community Remains One

Co-kernel RT Linux remains a niche

- Majority of users are fine with PREEMPT RT
- RT patches now part of mainline (since 6.12)
- Focus of hardware enabling and testing efforts

Xenomai gathers co-kernels users and developers

- Well known “brand”
- Recognized for long-term availability

Common ground between Xenomai 3 and EVL

- Baseline kernel patch dovetail
- Co-kernel principles: design and debugging experience, even across different cores
- Testing concepts and infrastructures

[Key] Contributors, 2024 Edition

Xenomai 3 (>10 patches in last 5 years)

- Jan Kiszka, Siemens (308)
- Florian Bezdeka, Siemens (179)
- Philippe Gerum (144)
- Richard Weinberger, sigma star (42)
- Hongzhan Chen, Intel (30)
- Song Chen (29)
- Aaron Marcher, sigma start (12)
- Clara Kowalsky, Siemens (11)

Xenomai 4 (derived from v6.6.y-evl-rebase)

- Philippe Gerum (674)
- Liu Hailong(?) (2)
- Jorge Ramirez-Ortiz (2)
- Zhang Kun (1)

Dovetail patches (v6.6.y-dovetail-rebase)

- Philippe Gerum (151)
- Florian Bezdeka (7)
- Jan Kiszka (3)
- leo(?) (2)
- Clara Kowalsky (1)
- Hongzhan Chen (1)

Current Roles in the Xenomai Project

Xenomai 3

- Jan Kiszka: maintenance head + stable trees (3.0, 3.1, 3.2, 3.3), maintenance of xenomai-image (example and test images)

Xenomai 4

- Philippe Gerum: maintenance EVL kernels, libevl, revl
- Jan Kiszka: maitenance of xenomai-images support

Dovetail patches

- Philippe Gerum: porting of latest kernel, maintenance of 2 stable kernels (-rebase branches, currently 6.1 + 6.6 → 6.1-cip + 6.12)
- Jan Kiszka: maintenance of 5.10 and 5.15, forward-merging branches for 6.1 and 6.6 → 6.1-cip + 6.12
- Florian Bezdeka: porting of latest kernel in tik-tok with Philippe (first time for 6.13)

I-pipe patches

- Jan Kiszka: maintenance of 4.4 (arm + x86), 4.19 and 5.4 (both only x86)

Developer Support & Tools

Primary channel

- xenomai@lists.linux.dev, archived at https://lore.kernel.org/xenomai

Further channels

- Biweekly Zoom calls (check the mailing list for reminders)
- Matrix channel for Xenomai 4 (evlproject:matrix.org)

Xenomai hackerspace

- Provided Xenomai 3 and linux-dovetail on https://gitlab.com/Xenomai
- Allows to manage issues for everyone with gitlab.com account (background: source.denx.de is maintainers-only)
- A way to manage / share larger change sets upfront
- We may enable CI / test lab access this way as well

Mirror on gitee.com

- See https://gitee.com/xenomai
- Does not work for dovetail and EVL kernels (size quota...)

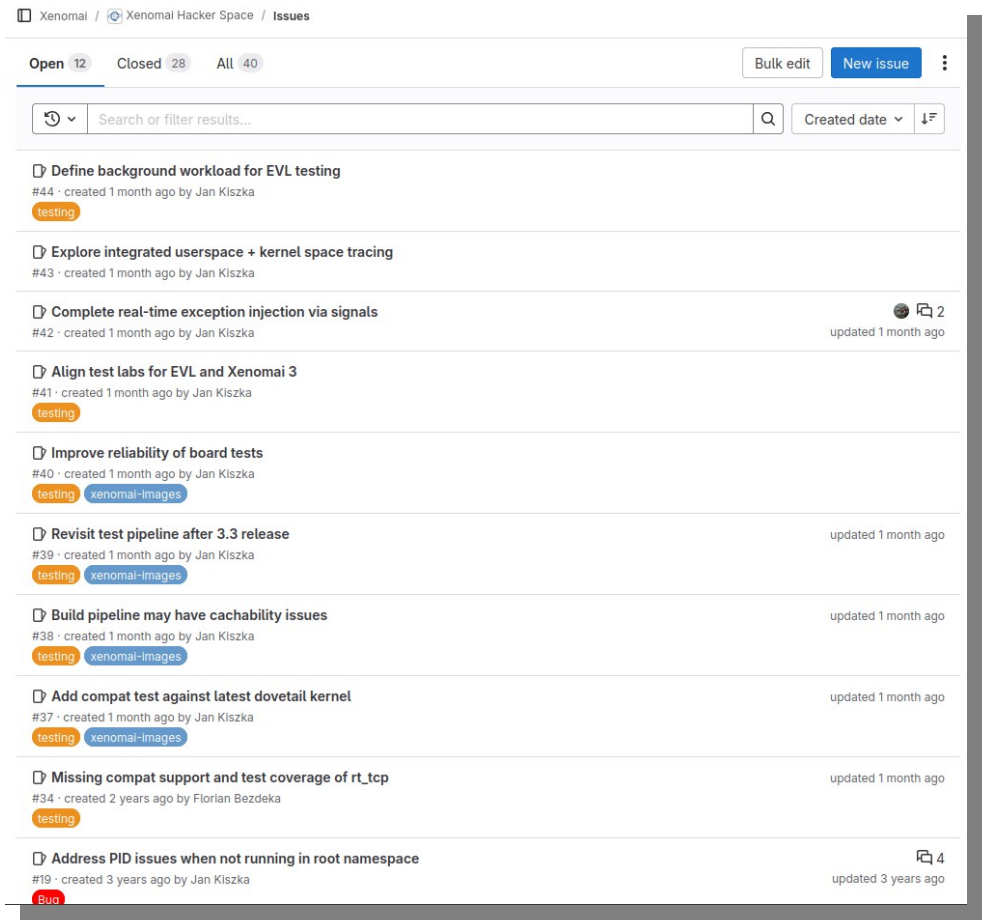
Want to Contribute? Our To-Do List

Have a look at the issue list

- https://gitlab.com/Xenomai/xenomai-hacker-space/-/issues
- Everyone can comment on issues
- Assign to you if you pick one up
- You may also create new issues
- List is not complete!

As listed last year: improve infrastructure

- Is my kernel configuration sufficiently represented?
- Enhance latency regression checks
- Work on providing also a tuned kernel configs
- Is my hardware represented? My SoC?
- Is my I/O path (driver) stressed already?



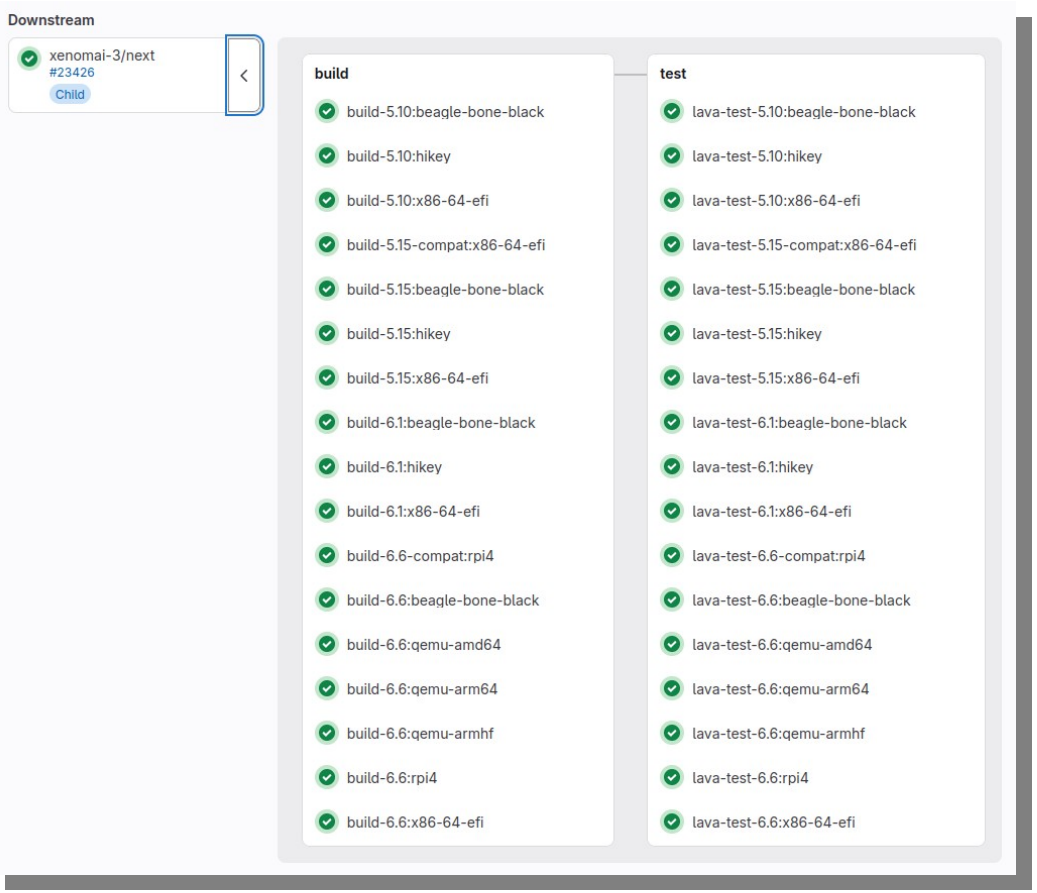
Test Lab(s)

Cloud-based CI, LAVA test lab

- CI and one LAVA worker site funded by Siemens, another worker site by Intel
- Driven via xenomai-images
- Only covers Xenomai 3 so far, lacks automated test for EVL – to-be-fixed
- We could attach more hardware via more worker site
- CI artifacts on AWS S3 in Europe – unreliable in China?

Philippe's test setup

- Used for Xenomai 4 and dovetail maintenance
- Some boards are used "ad-hoc"
- See https://v4.xenomai.org/ports for coverage
- Needs a second thought with more dovetail or EVL contributors



Contribution Workflow

Common to (almost) all sub-projects

- Use kernel coding style for kernel patches, Xenomai 3 and libevl
- Email-based patch workflow using xenomai@lists.linux.dev
- Use git format-patch, git send-email
  or tools like b4 (https://b4.docs.kernel.org)
- Ideally, use extra tag to mark target repo,
  e.g. "`[xenomai-image][PATCH]`..." or "`[PATCH dovetail 6.6]`..."
- Don't forget Developer Certificat of Origin
  ("`Signed-off-by`", https://developercertificate.org)
- If you don't get feedback, remind the maintainer after a week or two
- See also CONTRIBUTING.md in Xenomai 3

Does this fit everyone?

- Defined by most active developers and maitainers right now
- We can reconsider aspects if percived as hurdle

New Architectures on the Horizon

RISC-V (64-bit)

- High attention word-wide
- Hardware is now accessible
- Merged into mainline kernel 7 years ago
- Official Debian port in upcoming trixie

LoongArch (64-bit)

- Strong interest in China
- So far little traction outside
- Merged into mainline kernel 2 years ago
- Accepted as Debian port last year

Common aspects

- Hardware availability
- How to hook into our test labs?
- Maturity of software ecosystem
- Self-built rootfs vs.
  Debian-based xenomai-images
- Focus will be on Xenomai 4
- How to coordinate maintenance efforts?
- How to ensure continuity?
  - Support for new kernels
  - Maintenance in LTS trees

Happy to discuss, also today!

Summary

- **The Co-kernel is here to stay**
  - Used in production for >20 years
  - Valid use cases aside PREEMPT-RT
- **It's great to see so much traction in China!**
  - New architectures on the horizon
  - Many users start on Xenomai 4 right away
  - More contributions are coming
- **The co-kernel community is not large**
  - Let's work together, make it stronger
  - Any hurdles to use and contribute?
    Speak up, and we will try to address them

Any Questions?

Thank you!

http://xenomai.org

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