



# Xenomai

## 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: maintenance 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](mailto: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](https://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](https://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...)



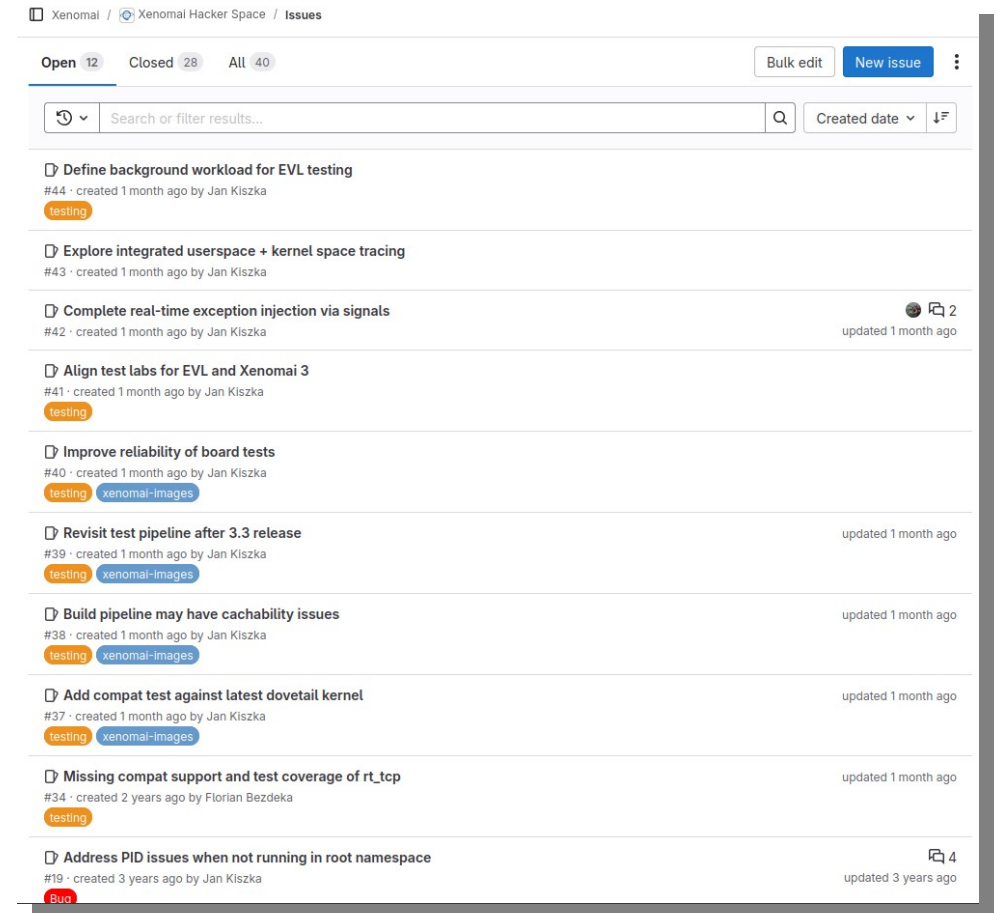
# Want to Contribute? Our To-Do List

## 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?



The screenshot shows the 'Issues' page for the 'Xenomai Hacker Space' project on GitLab. The page header includes the project name and a navigation bar with 'Open 12', 'Closed 28', and 'All 40' tabs. A search bar and a 'New issue' button are also present. The main content area lists 12 issues, each with a title, a description, a status label (e.g., 'testing'), and a creation/update date. The issues are:

- #44: Define background workload for EVL testing (created 1 month ago by Jan Kiszka, status: testing)
- #43: Explore integrated userspace + kernel space tracing (created 1 month ago by Jan Kiszka)
- #42: Complete real-time exception injection via signals (created 1 month ago by Jan Kiszka, updated 1 month ago, 2 comments)
- #41: Align test labs for EVL and Xenomai 3 (created 1 month ago by Jan Kiszka, status: testing)
- #40: Improve reliability of board tests (created 1 month ago by Jan Kiszka, status: testing, xenomai-images)
- #39: Revisit test pipeline after 3.3 release (created 1 month ago by Jan Kiszka, status: testing, xenomai-images, updated 1 month ago)
- #38: Build pipeline may have cachability issues (created 1 month ago by Jan Kiszka, status: testing, xenomai-images, updated 1 month ago)
- #37: Add compat test against latest dovetail kernel (created 1 month ago by Jan Kiszka, status: testing, xenomai-images, updated 1 month ago)
- #34: Missing compat support and test coverage of rt\_tcp (created 2 years ago by Florian Bezdeka, status: testing, updated 1 month ago)
- #19: Address PID issues when not running in root namespace (created 3 years ago by Jan Kiszka, status: Bug, updated 3 years ago, 4 comments)

# 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

The screenshot displays a CI/CD pipeline interface. At the top, a 'Downstream' job is shown with a green checkmark, labeled 'xenomai-3/next #23426' and 'Child'. Below this, there are two columns of tasks, each with a green checkmark indicating success.

build	test
build-5.10:beagle-bone-black	lava-test-5.10:beagle-bone-black
build-5.10:hikey	lava-test-5.10:hikey
build-5.10:x86-64-efi	lava-test-5.10:x86-64-efi
build-5.15:compat:x86-64-efi	lava-test-5.15:compat:x86-64-efi
build-5.15:beagle-bone-black	lava-test-5.15:beagle-bone-black
build-5.15:hikey	lava-test-5.15:hikey
build-5.15:x86-64-efi	lava-test-5.15:x86-64-efi
build-6.1:beagle-bone-black	lava-test-6.1:beagle-bone-black
build-6.1:hikey	lava-test-6.1:hikey
build-6.1:x86-64-efi	lava-test-6.1:x86-64-efi
build-6.6:compat:rpi4	lava-test-6.6:compat:rpi4
build-6.6:beagle-bone-black	lava-test-6.6:beagle-bone-black
build-6.6:qemu-amd64	lava-test-6.6:qemu-amd64
build-6.6:qemu-arm64	lava-test-6.6:qemu-arm64
build-6.6:qemu-armhf	lava-test-6.6:qemu-armhf
build-6.6:rpi4	lava-test-6.6:rpi4
build-6.6:x86-64-efi	lava-test-6.6:x86-64-efi

# 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 maintainers right now
- We can reconsider aspects if perceived 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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