

# Xenomai: Experiences with Testing and Continuous Integration

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# Outline

- 1 Motivation / My Question
  - Can Xenomai/vxSkin replace vxWorks in my application
  - 2006: Stay or switch?
- 2 Results/Contribution
  - Buildbot
  - PPC440 board
  - Relaunch in 2009

## “My” Application: Plastic Injection Moulding Machine

- Over 1000 IO-elements on a big machine (analog, digital, temperature, servo-drives)
- Move 10 tons a few decimeters in a second
- ClosedLoopControl use 1 ms steps

# PET-Preform



## The software

- Up to 5 PPC405GPr/PPC440EPx based board sharing a custom IO-bus, running vxWorks
- > 500 kLOC
- Good testing/continuous integration setup
- HMI has a separate Windows-XP-embedded IPC

## The software

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## Testing environments

- Subsystems have C++ unit-tests running natively (MinGW) or cross (vxWorks) on the targets
- IO-subsystem has test-rackets with a
  - very high rate of changing IO (analog/digital outputs fed back to inputs)
  - CANOpen-Simulator for 10 servos drives
- Machine simulated using MatLab with physical model of the machine
  - 1 test run takes approximately 2 hours
  - a release must also pass one week running (simulated) production
  - still chasing a few bugs that occur once per 100 runs

## Xenomai: Management Summary

- 2006: Discussion: use vxWorks or switch to a free OS for the new PPC440 based board
- Out-Source => then we have no more problems (the engineers whisper “We have to show/prove them where they have their problems”)
- We want the market leader as partner
- The Market Leaders Price is too high
- Is the Market leader fast in solving trivial and other problems?
- Linux/Free Software is a risk (GPL)

No change decided. Xenomai port pursued as my personal pet project. Stalled for two years because of personal problems and 12 months of work for OLPC Switzerland. Was allowed to check-in changes/ifdefs used for Xenomai.

# Continuous Integration

- Selected Buildbot for Xenomai
  - Distributed Master/Slave
  - Running tests on target
  - Complicated, time consuming setup of project (Python/Twisted)
  - Aimed too high. Never got anybody else contributing, only PPC tested
  - Xenomai is a moving target
- “My” project
  - Cleaned up a lot of code gcc 2.9x => 4.1
  - Allow compilation of code for MinGW, vxWorks, Xenomai
  - Made OS-abstraction library pass (most) UnitTests under Xenomai/vxSkin

# Experiences with free SW

- U-Boot
  - Much more functionality than vxWorks boot-eprom.
  - The HW engineers liked it.
  - Lot of nifty procedures.
- Linux-Kernel
  - Compiled itself using NFS root based ELDK 10 days after first HW bring-up (2.6 kernel is very easy for PPC targets!)
  - Time to compile the kernel gave good benchmarks compared to PPC405 targets
  - Nobody wanted to believe the (belows expectations) results
  - Disaster going from HW bringup to application development
    - PPC440 much more parallelism than PPC405
    - Bad project management (moving target)
    - Big jump ahead insted of small steps

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## Work completed in 2009

- U-Boot
  - Much more functionality than vxWorks boot-prom.
  - The HW engineers liked it.
  - Lot of nifty procedures.
- Use Hudson for continuous integration
  - Easy to setup (15 mn)
  - Git-Integration okay
  - Master + (Linux-)slaves possible

## Work in progress

- Launched a debate about advantages of free SW  
Ease of installation, independance/freedom, virtualization
- Automated testing with real board (Sequoia, HCU4, HCU5)
  - DUTS (dulg) ported to Ruby, about 90% of tests ported
  - Some small improvements to DUTS
  - TODO: Integration into Hudson
- More targets for Hudson:
  - Compile Xenomai kernel and test it
  - LTP? Parts of it?
  - “My” C++ unit tests
  - “My” hardware IO test racks. Get performance figures
  - Support for Intel 82527 CAN-Chip under Xenomai??
  - CANOpen test rack??

# Summary

- I cannot give you an answer, yet!
- **Continuos integration** is my hope to keep my work up-to-date with Xenomai
- **Testing => proven results** is the only hope to get a design win for “my” project
- Thanks for all the help I always received when asking questions!