The RTOS Chameleon for Linux

Jan Kiszka
Dipl.-Ing.

Leibniz Universität Hannover
Real-Time Systems Group

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Hard Real-Time for Linux – But How?

- Which RT-Linux technology?
  - Co-scheduling?
  - ...or native real-time Linux?
- Which kernel
  - Always latest 2.6?
  - Or also older revisions?
  - ...or even keep 2.4?
- How to port from $RTOS to Linux?
  - Migrate to POSIX API?
  - ...or emulate the legacy API?
- How to create and maintain RT-optimised drivers?

Presentation Outline

- Xenomai Approach
  - Provided APIs
  - Real-Time Driver Model
  - Architectures
  - New RT-Technologies
- Related Open Source Projects
- Application Example
- Summary & Prospects

The Xenomai Approach

- Generic RT-core (“nucleus”)
- RTOS APIs provided via “skins”
- Includes hard-RT Linux technology (“I-pipe”)
  - Kernel-independent
  - Light-weight
  - **But:** Highly integrated in Linux environment
- Portability framework for older kernels (2.4 and 2.6)
- Generic RT-driver model across all skins

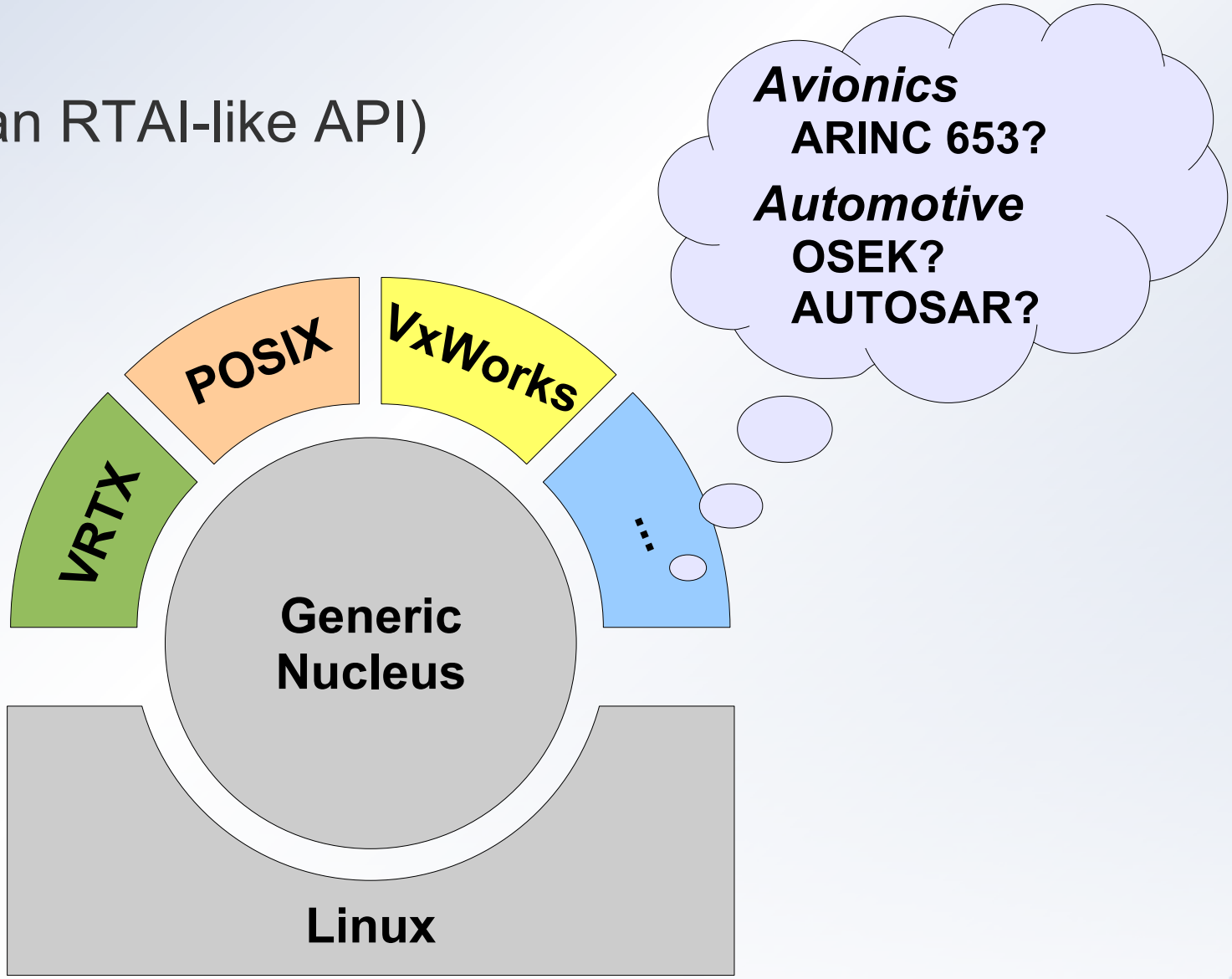
➡ Our goal:

Real-Time APIs for any Linux

(OK, almost any)

What Skin Do You Prefer?

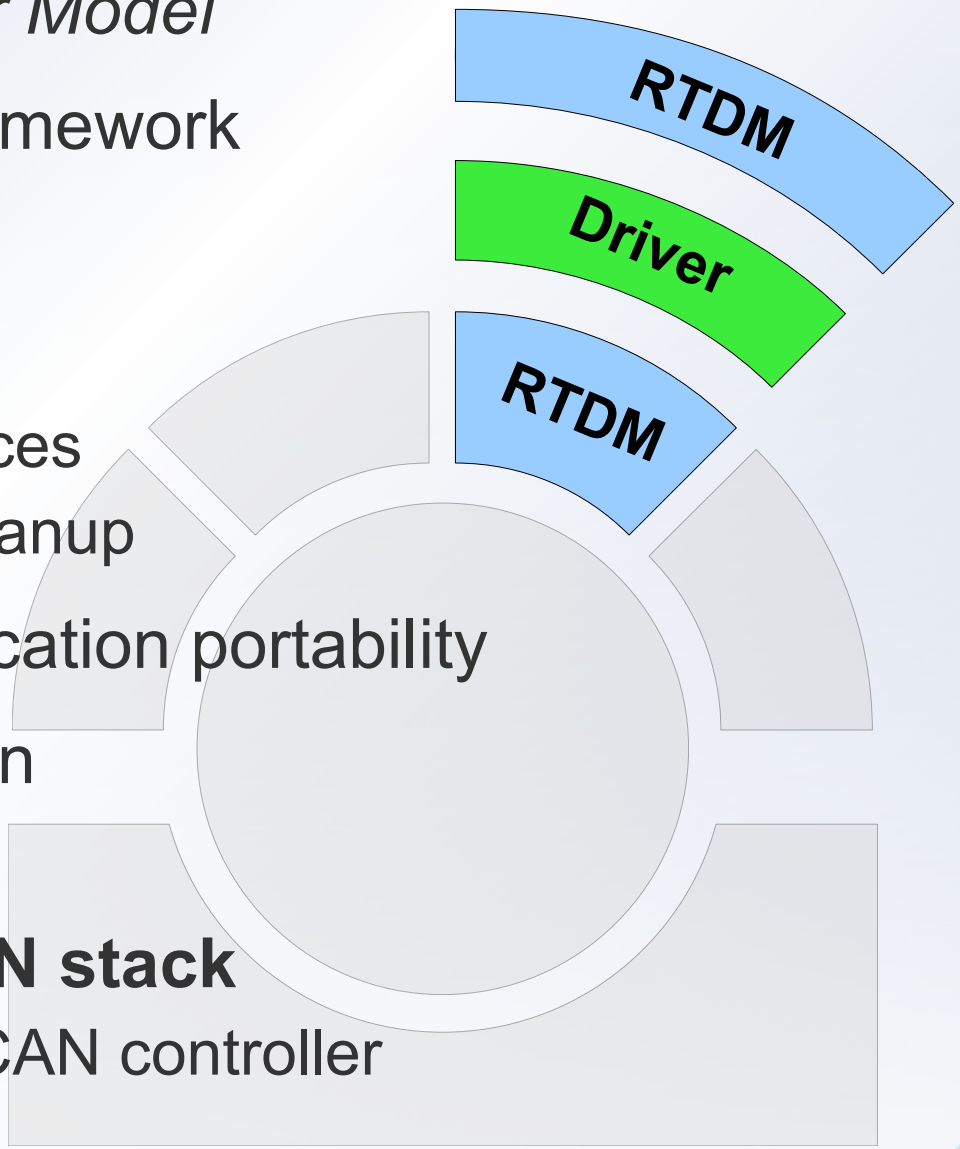
- POSIX
- Native (clean RTAI-like API)
- VxWorks
- VRTX
- pSOS+
- µITRON
- RTAI
- RTDM



Drive Hardware in Real-Time

RTDM – The Real-Time Driver Model

- Lean driver development framework
- POSIX I/O Model
- "Set-top box" for Linux
  - RTDM: time-critical services
  - Linux: non-RT setup/cleanup
- Device profiles ensure application portability
- Xenomai-independent design
  - RTAI integrates RTDM too
- Example: Integrated **RT-CAN stack**
  - Socket-based API for any CAN controller



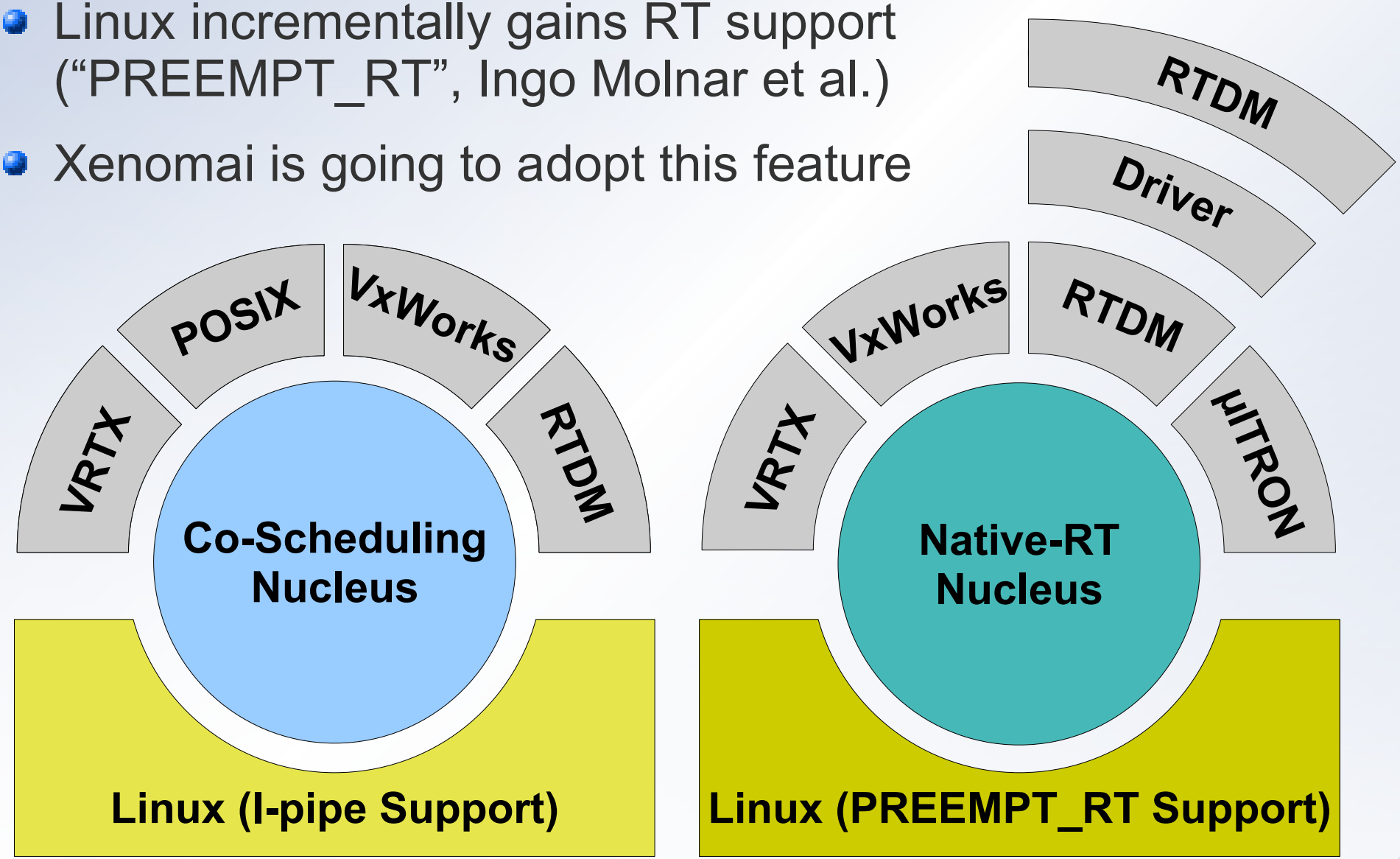
Permanent Work in Progress

- Supported architectures

Kernel / Architecture	2.4	2.6
i386	✔	✔
PPC32	✔	✔
PPC64		✔
ARM		✔
IA64		✔
Blackfin		✔
Simulator	*User-Space Application*	
x86-64		*WIP*

Select Your RT-Technology

- Linux incrementally gains RT support ("PREEMPT_RT", Ingo Molnar et al.)
- Xenomai is going to adopt this feature



Xenomai Featuring...

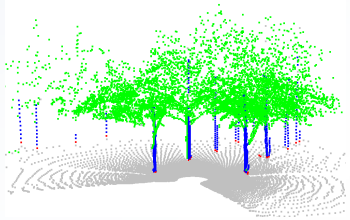
- RTnet  (RT-networking stack)
- RT-FireWire (RT-IEEE1394 stack)
- USB4RT, USB20RT (RT-USB stacks)
- COMEDI over RTDM (DAC driver framework)

- OROCOS  (RT-middleware)
- RACK  (Robotics RT-middleware)
- CanFestival  (CANopen library)
- Xeno-- (C++ & Python wrapping library)

- LTTng  (System event tracing)
- kgdb (Remote kernel debugger)

- ...

Application Example: Real-Time Robotics



- Modular autonomous service robots
- Research and industrial scenarios
- Real-time 3D ladar sensor
- Low-end x86 IPCs
- RACK, RT-CAN, RTnet, fast UARTs
- Integrates standard hardware/software with strict RT

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Summery & Prospects

- Xenomai: RTOS construction kit for Linux
- Portability as major goal
  - Between architectures
  - Between RT-technologies
  - Between kernel versions
- Home for RT-drivers / stacks
- What is the future about?
  - PREEMPT_RT support, more RTOS skins & drivers, ...
  - **One stop for RT**: kernel, drivers, libs, community
- And when?
  - *Counter question:* What do you need first?
  - **Any contribution/support can accelerate development!**

Thank You!

www.xenomai.org

Jan Kiszka