The agony of choice - the diversity of microkernels in Genode

Stefan Kalkowski
Outline

1. Advantages of diversity
   - Motivation
   - Code quality
   - Handling the multeity

2. Porting Genode to a kernel
   - What is needed
   - Course of action
   - Conclusion
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Get All-Inclusive

- Platform Drivers
  - PS/2
  - Vesa
  - NIC
  - Atapi
  - ...

- Libraries
  - Libc
  - Qt4
  - Webkit
  - lwIP
  - ...

- Services
  - Nitpicker
  - NIC-Bridge
  - Audio-Mixer
  - TCP-Terminal
  - ...

- Applications
  - Arora
  - VIM
  - Gcc
  - Launchpad
  - ...

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Convenient Developing Under Linux

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Develop For One, Debug With Another

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Enhanced Code Quality

- Design Principles
- Diversity

AND

Code Quality

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Essential Principles

- Low complexity
Essential Principles

- Low complexity
- Strive for a narrow API
Essential Principles

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- Unify wherever possible, avoid code duplication
Essential Principles

- Low complexity
- Strive for a narrow API
- Unify wherever possible, avoid code duplication
- No premature optimization
Component’s Lifecycle

Use Case

Primitive  Complex  Plain

Use Case
Timer - An Unfinished Example

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Frontend

msleep(...) → Serveractivation

calculate timeout → Backend

Linux

nanosleep

Fiasco

IPC Timeout
Timer - Introducing Pistachio

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Diagram:
- Frontend: `msleep(...)`, `Serveractivation`, `calculate timeout`
- Backend: `Linux nanosleep`, `Fiasco Pistachio IPC Timeout`
Timer - Introducing OKL4

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Frontend

msleep(…)

Serveractivation

calculate timeout

Backend

Linux

nanosleep

OKL4

PIT

Fiasco
Pistachio

IPC Timeout
Timer - Introducing NOVA

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Timer - Change API

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The Dark Side Of The Force

- Plethora of tools needed
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Knowledge of build-systems required
The Dark Side Of The Force

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- Knowledge of build-systems required
- How to boot the system
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- Plethora of tools needed
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- How to boot the system
- Unmaintained software
The Dark Side Of The Force

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**Solution:** unify toolchain + convenience tools
Demo

Short demo ...
Run-Scripts

# Example run-script
#

build {
    core init drivers/timer ...
}
create_boot_directory
install_config { ... }
set boot_modules {
    core init timer ...
}
lappend_if [have_spec linux] boot_modules fb_sdl
build_boot_image $boot_modules
append_qemu_args " -m 256 "
run_genode_until forever
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Goal

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Kernel-Specific Parts

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IPC Framework

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/**
 * base-<kernel>/src/base/lock_helper.h
 */

void thread_yield();
bool thread_check_stopped_and_restart(Native_thread_id id);
Native_thread_id thread_get_my_native_id();
Native_thread_id thread_invalid_id();
bool thread_id_valid(Native_thread_id id);
void thread_switch_to(Native_thread_id id);
void thread_stop_myself();
Platform Information

- Parse kernel + bootloader info
- Platform specific compile-time knowledge
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- Parse kernel + bootloader info
- Platform specific compile-time knowledge
- Sizing allocators and databases for
  - RAM
  - ROM modules
  - IRQ numbers
  - I/O memory (and ports)
Things Left

- Interrupts
- Timer
- Signals
Effort: Kernel-Specific LOC
What Benefit Do I Have?

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