Genode as general-purpose OS progress report and demonstration

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Outline

1. Introduction

2. The long way towards general-purpose computing
   - Fundamentals
   - Functionality
   - Resource utilization
   - Stability

3. What is left to be desired?

4. Sidelines

5. Road map 2014
1. Introduction

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4. Sidelines

5. Road map 2014
Myths

Ease of use ↔ Security

Resource utilization ↔ Resource accountability

Complexity ↔ Scalability
Key technologies

- Microkernels
- Decomponentization, kernelization
- Capability-based security
- Virtualization
Genode architecture

→ Application-specific TCB
Combined with virtualization
How to get there? Found a company!

- Genode Labs, founded in May 2008, self-funded
- Systems research and development
- Idea: *Start small, build sustainable business, grow organically*
- Team of 8 people
- Small yet diverse customer base
- Main source of income is contracting work
Components
Components

Genode as general-purpose OS progress report and demonstration

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Components
Components

- Noux
- GDB Monitor
- Loader
- CLI Monitor
- Init
- VirtualBox
- Seoul
- NOVA Microhypervisor
- FIASCO
- FIASCO-OC
- L4Linux
- L4Ka
- FB SDL
- PCI
- SATA
- Audio
- UART
- OMAP4
- PS2
- NIC
- VESA
- USB
- GPIO
- Exynos-5
- Rpi
- nitpicker
- mixer
- part blk
- NIC bridge
- ACPI
- ATA
- Timer
- SD-card
- I.MX
Components
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Fundamentals - NOVA kernel

- IOMMU support
- Kernel-memory reuse
- Multi-processor support
Fundamentals - Affinity management
Device drivers
   → essential drivers are in place
       (NIC, graphics, input, USB, audio, SATA)

File systems
   ▶ per-process virtual file system
   ▶ FUSE
   ▶ Rump

TCP/IP
   ▶ lwIP
   ▶ Linux TCP/IP for gigabit networking
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Functionality

- Simple CLI

- Virtualization as a stop-gap solution
  - Vancouver aka Seoul
  - VirtualBox

- Noux runtime for GNU software

- GNU debugger

- Qt5
  - Change from QWS to QPA
  - QML
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Tracing: Wish list

- Negligible performance overhead
- Kernel independence
- Accountability of used resources
- Useful level of abstraction
- Runtime-defined tracing policies
- Low-complexity implementation
- Online and offline analysis
Explicit assignment of physical resources to processes
Resources can be attached to sessions
Server-side heap partitioning
Dynamic resource balancing

Not all use cases could be covered.

- Caches (i.e., block cache)
- Ballooning

→ refined parent interface
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Automated tests

Report about executed Genode's run scripts

- Successful tests
- Failing tests
- Missing tests

Number of tests

Date

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### Automated tests (II)

#### Summary of native hardware runs

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5. Road map 2014
User interface that matches Genode’s concepts

Ideas:

- Composed out of many small inter-changeable building blocks
- Data centric
- Capability-based
- Command-line and graphical interface
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Sidelines

- Samsung Exynos-5
  \((SATA\ 3.0,\ USB\ 3,\ HDMI,\ eMMC,\ NIC,\ DVFS)\)

- Freescale i.MX

- Raspberry Pi
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Road map 2014

- Capability-based user interface
- Custom base-hw kernel platform
  - MP support
  - Capability-based security
  - Virtualization
- 3rd-party source-code package management
- Improved block-level infrastructure
  \textit{(block cache, block encryption)}
- Wireless networking
Thank you

Genode OS Framework
http://genode.org

Genode Labs GmbH
http://www.genode-labs.com

Source code at GitHub
http://github.com/genodelabs/genode