Erlang Solutions Ltd.

Erlang-Embedded

Development environment for Erlang-Embedded

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Erlang Solutions Ltd.

Erlang Factory,
London, June 2010

Thesis Projects

Application

Embedded Erlang

Erlang VM Extensions

Embedded Platform

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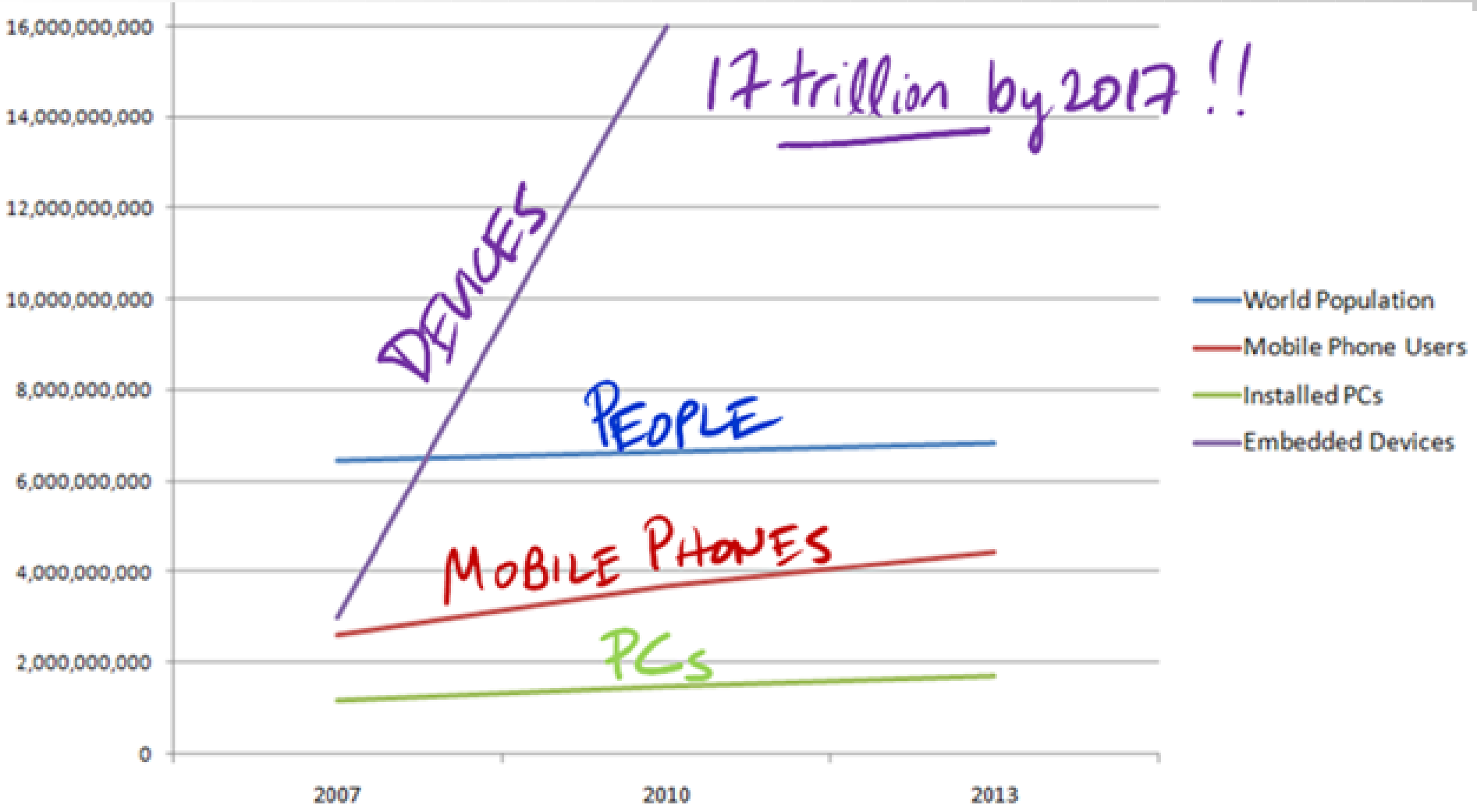
Motivation



Embedded Market

- 2006: 4 billion embedded processors sold worldwide
- 2010: 16 billion
- 2020: 40 billion
- Intel estimates 15 billion will be connected in swarms or over Internet by 2015
- ARM announced embedded multi-core CPU in okt 2009

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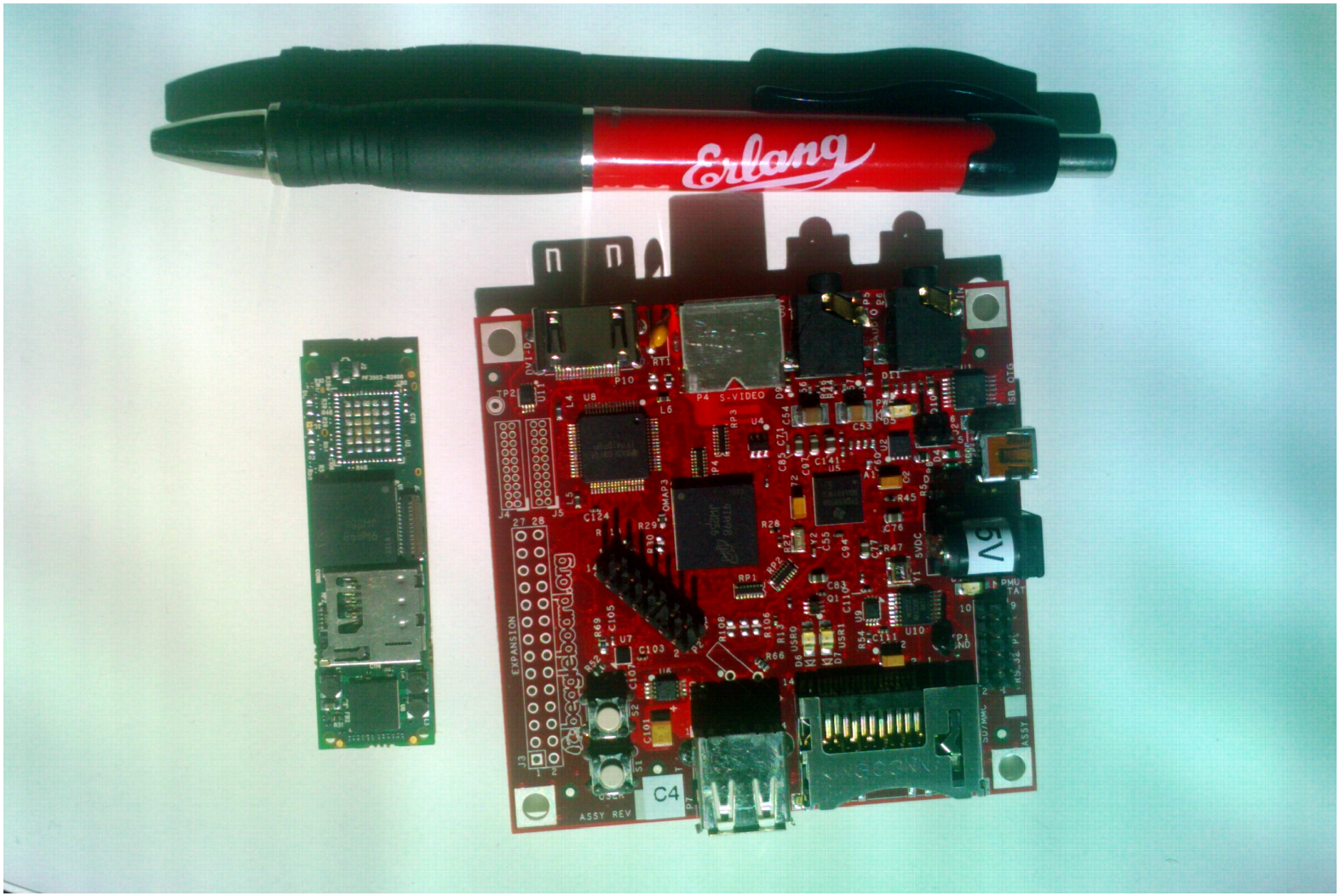
The Hardware



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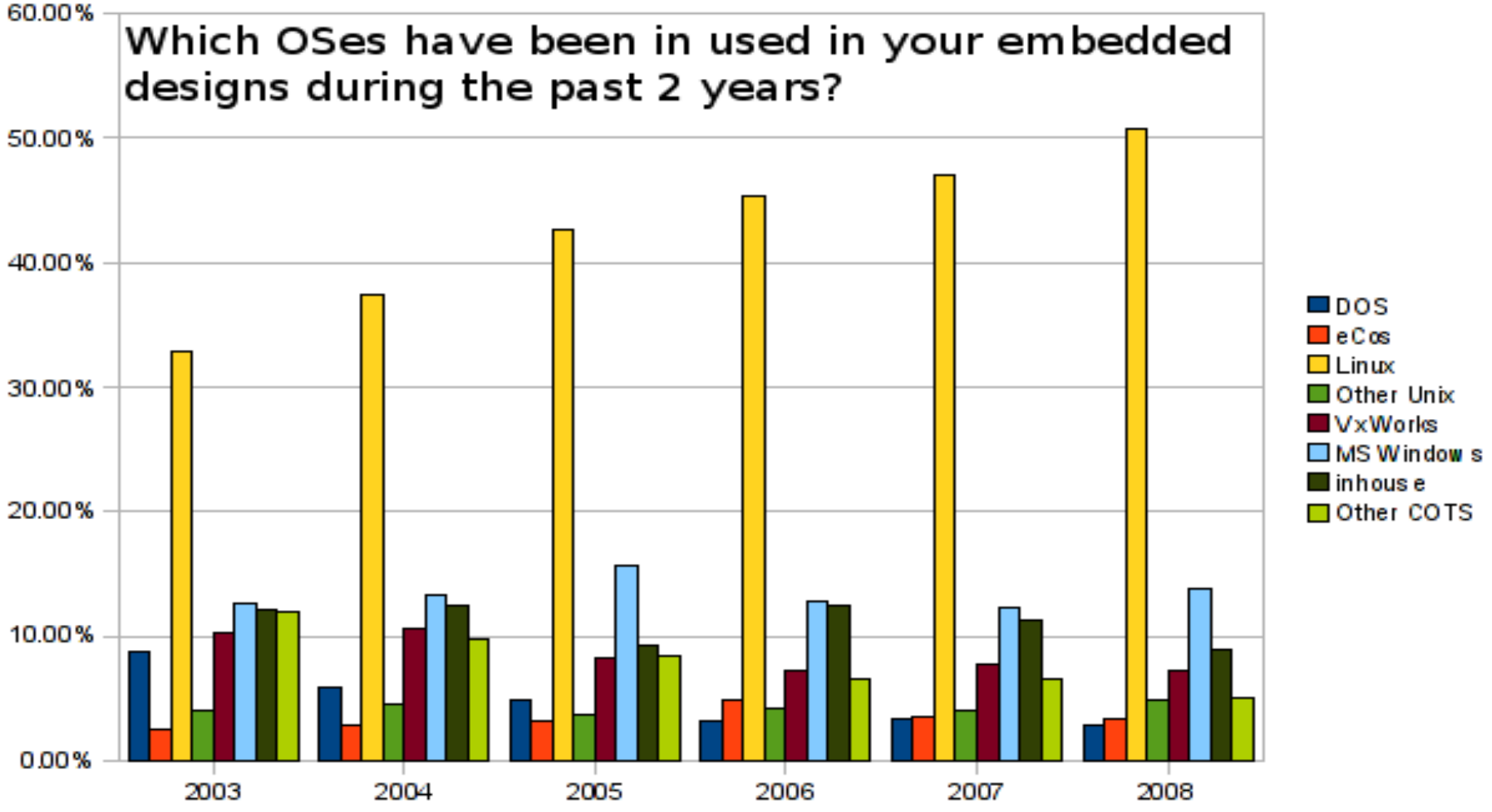
Embedded Platform

Embedded OS Usage



Goals

- Minimal Linux system with Erlang and tools
- Different versions for different purposes
- Easy-to-install package
- Reduce time-to-productivity for embedded Erlang developers

Overview

- Derived from Ångström distribution
- Built with OpenEmbedded
- Glibc → uClibc
- BusyBox configuration
- Images for different architectures/purposes
- Erlang pre-installed

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Metrics

- Evaluating Linux distributions
  - memory
  - disk usage
  - boot times
  - harware support
- Embedded focus

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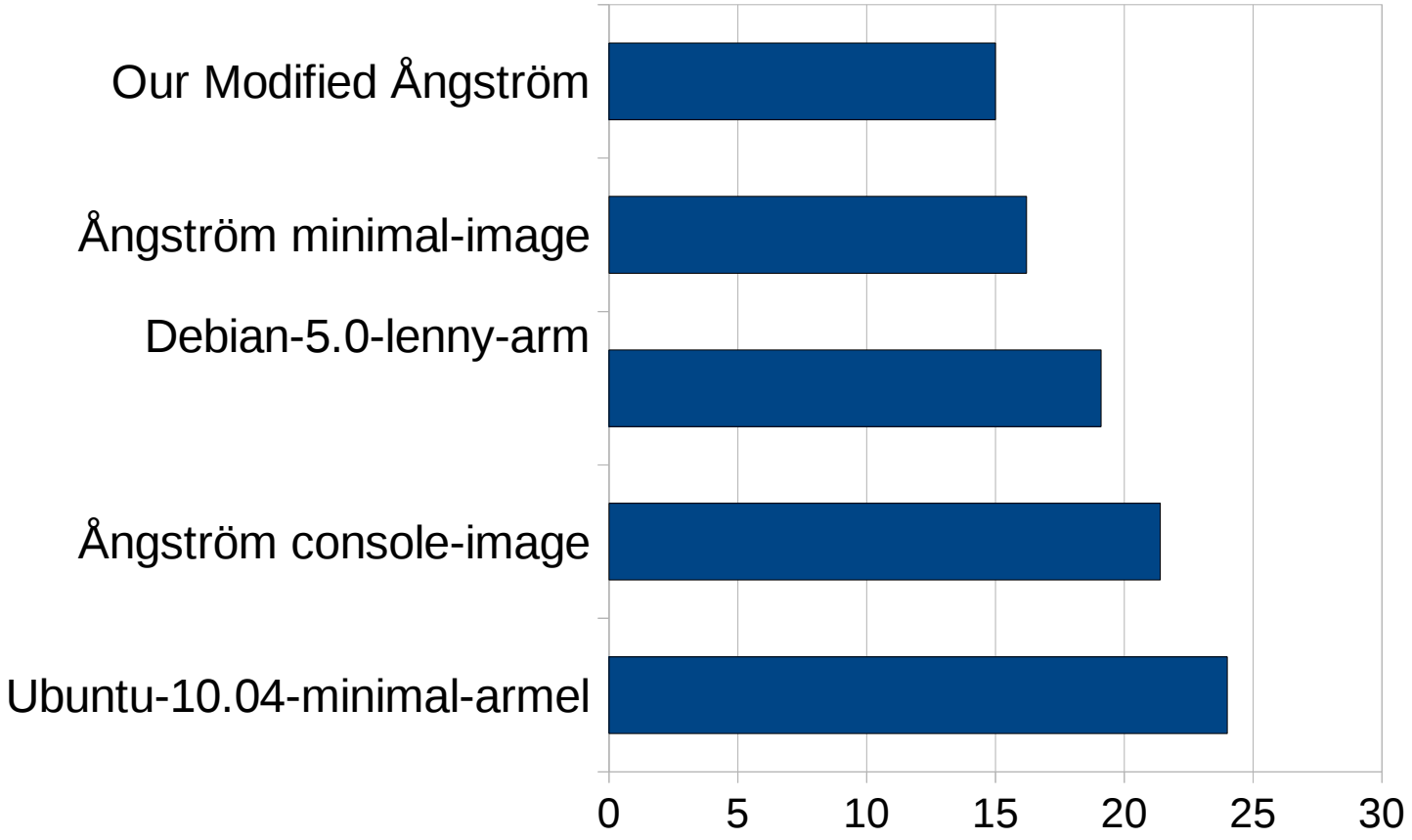
Allocated Memory After Boot



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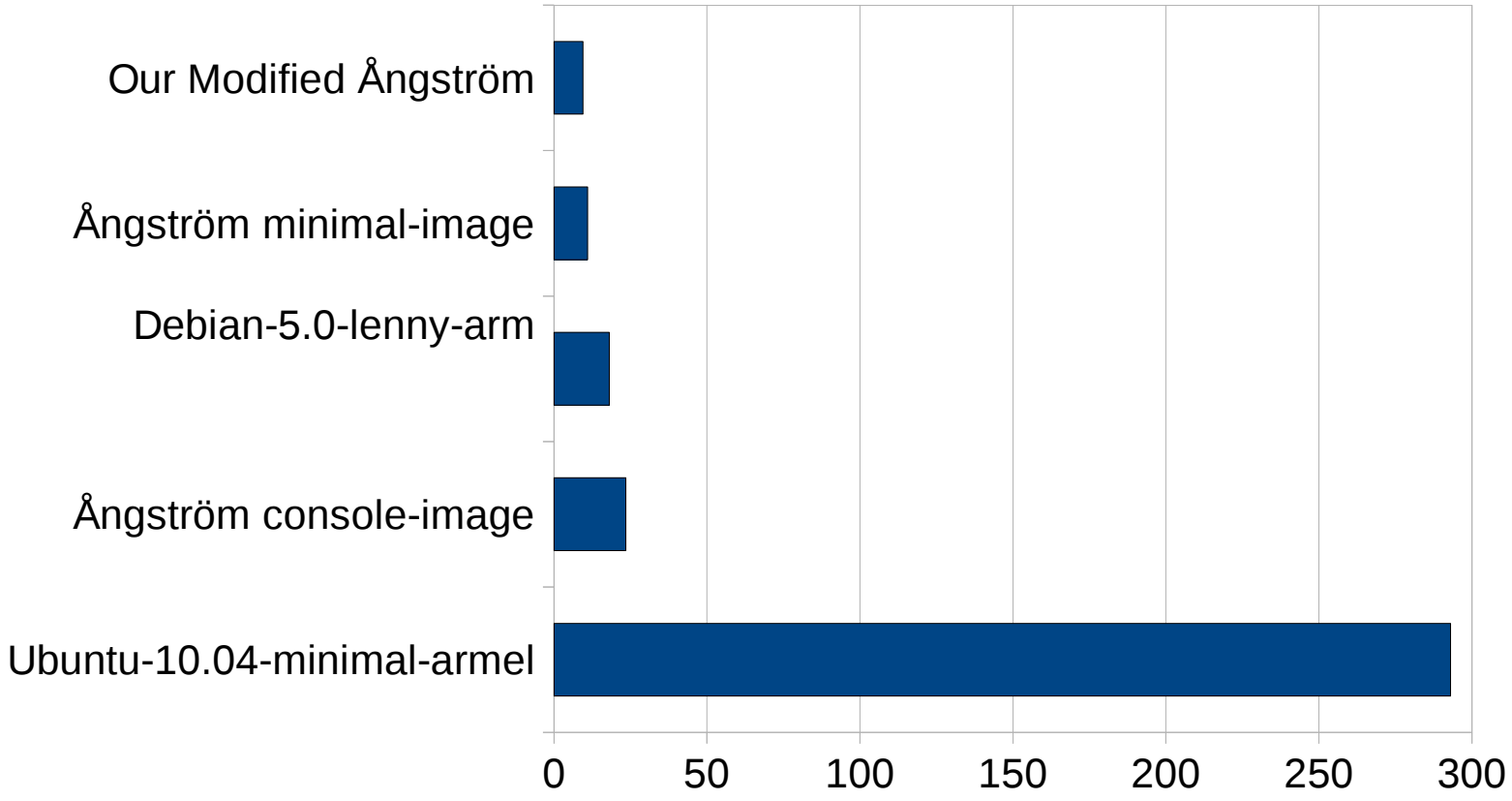
Root File System Size



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The Ångström Distribution

- Linux for embedded devices
- Smallest image uses 11 MB disk, 16.2 MB memory
- Default distribution for several devices
  - BeagleBoard
  - Gumstix
  - Pandora (portable gaming console)
- Easy to customise with OpenEmbedded

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OpenEmbedded

- Framework for building embedded Linux Distributions
- Several hardware architectures
- 1000+ packages pre-defined
- Quite complex, but powerful
- Handles dependencies, sources, configuration, cross-compilation etc.

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uClibc

“ [...] glibc is not the right thing for [an embedded OS]. It is designed as a native library (as opposed to embedded). Many functions (e.g., printf) contain functionality which is not wanted in embedded systems.” – Ulrich Drepper, glibc maintainer, 1999

- Much smaller than glibc, smaller than EGLIBC
- Source compatible with glibc, not binary compatible
- Highly configurable

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BusyBox

- Smaller versions of UNIX utilities in a single binary
- Written with size-optimisation and limited resources in mind
- Very modular and configurable
- Well-tested against uClibc

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Maintaining Different Versions

- “Minimal”
- “Debug”
- Binary installation packages for common platforms
- Latest Erlang version included

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Adapting Erlang for Embedded Systems

Goals

The virtual machine must be adapted to the limited resources of embedded systems.

- Low RAM consumption
  - How can we reduce RAM usage?
  - How will this impact performance?
- Low Disk usage
  - How can we keep disk usage low?
  - Performance?
- Benchmarking, analysis, documentation

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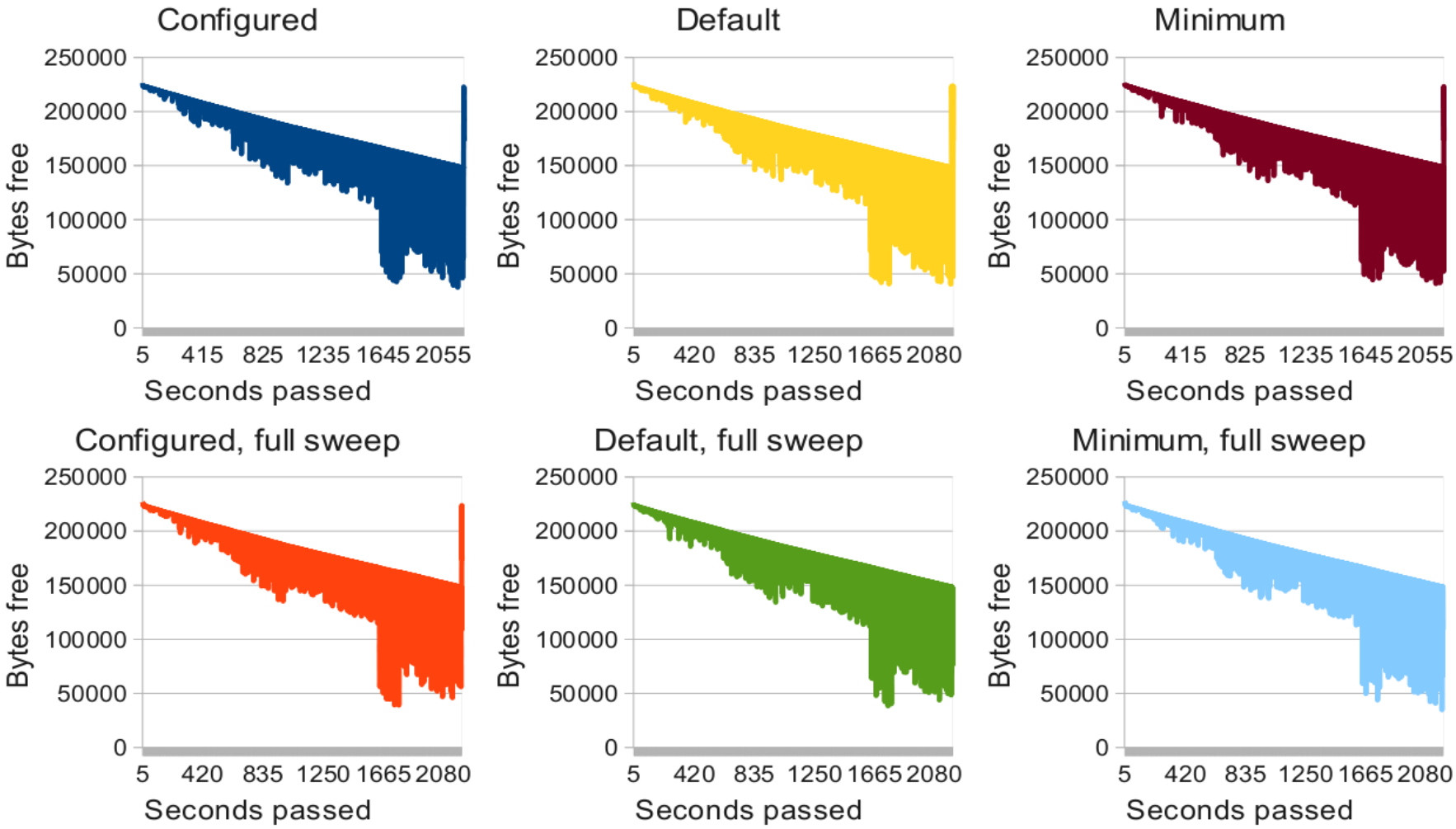
Progress, Memory Usage



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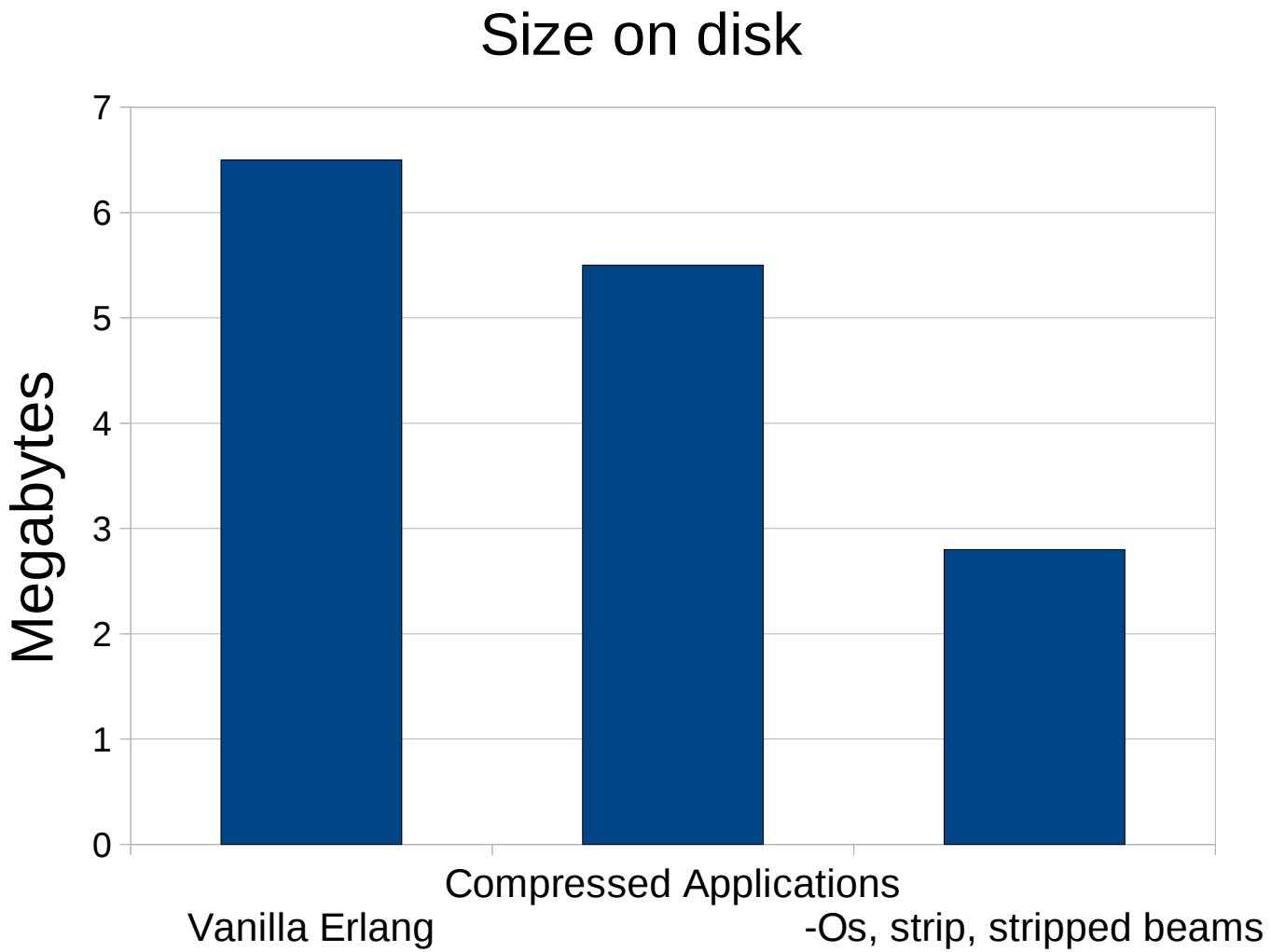
Progress, Disk Usage



Progress, Hardware

- VM compiled for Gumstix, BeagleBoard
- BeagleBoard is a prototyping platform
- Gumstix is a much smaller system for commercial use
- TI OMAP35x
  - Another thesis project for OpenGL and DSP from Erlang

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The Future

- More benchmarks and analysis
  - Bstone
- Documentation for embedded Erlang development
  - How you should use reltool/systool

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Niclas Axelsson

Framework for Data Exchange Between Mobile Nodes

Introduction

- Mobile devices with limited resources
- Dynamic ad-hoc networks
- Delay tolerant data

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Features

- Written in Erlang
- Simple to configure
- Takes care of the communication between nodes
- Handles storage of data
- A subscription system

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Example Applications

- Music player – share songs
- Announcement systems
- Statistics gathering

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Christofer Ferm

Adding support for special purpose computing units to the Erlang VM

Erlang VM Charasterics

- Good support for SMP
- Easy approach to utilizing SMP for developers
  - Message passing
  - Lightweight processes

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Modern Processing Units

- CPU
  - Already supported
- GPU
  - OpenCL
  - GPGPU
- Digitial Signal Processor
- Cryptoprocessors

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The erlang-embedded homepage

www.erlang-embedded.com

- First release “Stag Beetle” is already out.
- Mailinglist
  - erlang-embedded@googlegroups.com
- Our code is on github
  - http://github.com/esl/erlang-embedded

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Thank you

Questions?

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