Computer Science & Engineering Department

Diploma Project Proposal

2010-2011, 4th year of study, 2nd semester

Component-Based VMXL4 Networking Server

1 Context

There is a class of microkernels, called L4[1], providing basic services (Thread Management, Memory Space and I/O Management, Interrupt Control) that were derived from research done at Karlsruhe and Dresden Universities. The most advanced version, freely available, is L4 "Pistachio". It was used by OK Labs as a basis for their product called OKL4[2].

Part of our collaboration with VirtualMetrix, Inc. (VMX)[3], we are developing an L4-based microkernel, called VMXL4. This is an effort to develop a microkernel that will offer virtualization support on embedded systems (i.e. smartphones) and allow the running of the VMX Linux – an updated version of Linux that uses "Performance Management" (PerfMan)[4]. PerfMan is a new class of control developed by VirtualMetrix. It manages all performance-related resources such as CPU runtime (Task Scheduling), Clock/Idle Management, cache space and I/O bandwidth allocation to software.

2 General Description

The project aims to design and develop a component based VMXL4 networking server. A networking server is a microkernel component running in user-space and implementing a networking stack.

The project will require the selection of a lightweight open source TCP/IP Stack. Students will design server interfaces (IPC, Shared Memory, Protocol) that virtual drivers in guest systems

use to communicate with the network server. In case of using the BeagleBoard as the hardware platform, this will also include bringing up a USB stack.

Project delivery requires creating an application to demonstrate the networking server functionality.

2.1 Objectives

1. bring up a networking stack component
2. select/port an IDL tool to use produce the IPC based component interfaces
3. create an application to demonstrate the networking server
4. students will get acquainted with:
   (a) component/microkernel based I/O servers
   (b) networking stacks
   (c) implementing device drivers
   (d) using the VMXL4 microkernel

2.2 Technologies Employed

- GNU toolchain
- C, Python
- shell scripting
- VMXL4 microkernel

2.3 Resources

- **Software management**: wiki, Trac, Git repository
- **Documentation**: wiki (component description etc.), LaTeX (Bachelor Thesis)

3 Coordination

The project coordinators are Răzvan Deaconescu (razvan.deaconescu@cs.pub.ro), part of the Automatic Control and Computers Faculty, and Gary Gibson (gary@VirtualMetrix.com), part of VirtualMetrix.

Project coordination will employ:

- review on the architectural description and development of a project roadmap
- weekly meetings for progress reporting
- review and feedback sessions after each milestone
- periodic Skype calls with Gary Gibson for progress reporting and general decisions

4 Prerequisites

Students must have good knowledge on the following topics:

- Linux development environment (CLI, editors, GNU toolchain)
- Basic operating systems concepts
- Programming languages: C, Python, shell scripting

5 Planning

The project requires a 2 students team. It will be developed during the 2nd semester for 5 months.

6 Bibliography

- The Linux TCP/IP Stack: Networking for Embedded Systems, Thomas Herbert
- The Linux Programming Interface: A Linux and UNIX System Programming Handbook, Michael Kerrisk
- Operating System Concepts, 7th Edition, Avi Silberschatz, Peter Galvin, Greg Gagne

7 Other Information

[1] `http://en.wikipedia.org/wiki/L4_microkernel_family`

[2] `http://www.ok-labs.com/products/okl4-microvisor`

[3] `http://www.virtualmetrix.com/`

[4] `http://embedded-computing.com/performance-management-new-dimension-operating-systems`