Proposition de recherche doctorale

Exploration de la génétique des pilotes périphériques

Mots clés :

- Directeur de thèse : Julia LAWALL
- Co-encadrant(s) :
- Unité de recherche : INRIA-Paris
- Ecole doctorale : École Doctorale Informatique, Télécommunications, Électronique de Paris
- Domaine scientifique principal: Divers

Résumé du projet de recherche (Langue 1)

A device driver is a piece of software that forms the glue between an operating system (OS) and a device, giving applications access to hardware resources. For many applications, the availability and reliability of appropriate device drivers completely determines the viability of a target platform. Nevertheless, developing a device driver is challenging and error-prone. In particular, it requires a good knowledge of the target OS, to choose appropriate APIs and to compose them to achieve the desired functionality, and a good knowledge of device details, to produce the low-level code required to interact with the device. Any errors can not only make the device inaccessible, they can also introduce a serious security threat, as device driver code runs with full OS privileges. These challenges are compounded in the case of operations such as backporting drivers to older versions of the same OS or porting drivers to other OSes, which require knowing the APIs and recommended coding strategies of multiple systems. The goal of our research is to explore the vision of a device driver as being composed of a collection of genes. In this context, we consider a gene to be a sequence of operations that implement a single functionality. A device driver then results from the composition of these genes, according to the requirements of the particular device and targeted operating system. In this view, backporting or porting requires simple “gene therapy,” ie replacement of the set of genes for one system by the corresponding genes for another. This work will be carried out in the Whisper group at Inria Paris, under the supervision of Julia Lawall and Gilles Muller. Lawall and Muller have over 15 years of experience working on issues related to Linux code, and their research has led to the development of tools that have resulted in over 1000 patches to the Linux kernel.

Résumé du projet de recherche (Langue 2)

The project will be divided into three tasks, of one year each: * Study the code of existing related drivers for a given OS, with the goal of decomposing the code into a collection of genes. A gene will represent OS interaction code, device interaction code, or glue code, but not a mixture. The result of this task will be a classification of these genes according to their functionality and code type. * Design tools for automating gene identification and composition. This task will build on the expertise acquired in the first year on what a gene is and how individual genes can be isolated within a code base, and then on how they interact with each other, in particular in the kind of glue code that must be introduced to allow their composition. The result of this task will be a methodology for generating a driver skeleton from a collection of related drivers for a given OS. * Evaluate the approach. This task will investigate how to integrate a generated driver skeleton with device-specific information, to generate a complete driver, either for the same version as the one from which the skeleton was inferred (driver generation), for an earlier or later one (backporting or forward porting), or for a different OS.

Informations complémentaires (Langue 2)

This position is already filled.