



Internship: new features and improvements for the Elixir Cross Referencer, an Open-Source source code indexing engine

Bootlin

This document was taken from <https://bootlin.com/blog/2020-internships/>

Company overview

Bootlin proposes development and training services around embedded Linux and its kernel. Founded in 2004 and now employing 12 people, it has gained a strong reputation for its expertise in Linux kernel development and embedded Linux system integration. With a mostly international customer base, Bootlin works for major semiconductor vendors and multiple embedded system makers.

With strong roots in Free Software and Open Source, Bootlin releases all its training materials for free under a free documentation license, and makes a great number of contributions to the Linux kernel and to other community projects. Bootlin often appears in the top 20 worldwide list of companies contributing to the mainline Linux kernel.

Bootlin also invests a lot in the involvement of its engineers in the technical community, which gives them visibility and a good reputation beyond the limits of the company employing them, which is quite rarely offered by other companies throughout the world.

Topic

The *Elixir Cross Referencer* engine is used by Bootlin to index and present the sources of numerous Free Software projects, such as the Linux kernel, BusyBox, C libraries and bootloaders. You can see it in action on <https://elixir.bootlin.com>.

Thousands of developers use it every day to help them to understand the source code of projects that they use or modify.

Elixir was developed by Bootlin to replace an older solution (LXR), which was pretty bad at handling all published versions of projects as large as the Linux kernel. Elixir's source code, mainly written in Python, is available under the AGPLv3 free software license on <https://github.com/bootlin/elixir>.

Elixir was designed to be a generic and modular utility which in the long term should be able to support all types of programming languages and all types of projects. The internship topic that



we're proposing will allow to make progress towards these goals :

- By adding support for other projects on <https://elixir.bootlin.com>, in particular by making sure that C++ projects are properly indexed.
- By setting up hyperlinks to sources included in C code (`#include`), in Device Tree code, in Makefile files and in Kconfig files.
- By adding simultaneous support for different languages. One of the goals is to be able to index definitions of kernel configuration parameters, and to provide references to such symbols in C code or in Makefiles. It would also be interesting to index *Device Tree* symbols, between their definitions and the references to them.
- By extending the Pygments project to do syntax highlighting for more languages (in particular the Device Tree language which is currently displayed as plain text)
- By implementing a feature that was present in LXR, and which allowed to compare two different versions of the same source code.
- By optimizing the structure of the indexing database, to improve the query times and thus performance. With supported projects getting bigger and bigger, we are now hitting the scalability limitations of the current structure, each new version taking more and more time to index. We'd like you to explore the use of self-balancing binary search trees¹ for such optimizations.
- By fixing bugs reported on GitHub.

This internship will bring you development experience in a GNU/Linux environment, with programming languages such as Python and the Bourne Shell. It will also be an opportunity to get familiar with source management software such as `git`, `make` and `ctags`, and of course to interact with an active community of users and contributors.

As a bonus, according to how long the internship is, we could add variety by proposing a few improvements to the Linux kernel build system (`make menuconfig`, `make nconfig` and `make xconfig`).

In any case, what you create will be appreciated (and visible) by thousands of Linux kernel developers and users.

Internship supervision

This internship will be supervised by Michael Odenacker, the creator of Bootlin, and current maintainer of the Elixir project.

Useful skills

- Familiarity with the GNU/Linux environment and its command line interface.
- Python programming experience.
- Ability to interact with project users and contributors, by e-mail and through GitHub's interface.

1. https://en.wikipedia.org/wiki/Self-balancing_binary_search_tree



Practical information

- Who can apply: all students from the European Union, studying in a European University
- Location:
 - Orange, near Avignon, France, at the Bootlin headquarters.
- Dates: between February and September 2020
- Gross monthly compensation: between 500 and 1000 EUR, according to profile (end of studies or half-way, experience, etc.)
- Duration: at least 4 months
- How to apply: send your resume and interests to jobs@bootlin.com