

A Pedagogical Approach for Developing a Firmware from Open Source Code: Case of WiAFirm, an OpenWRT-based Firmware for WiABox Appliance

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The desire to know, to share and to contribute to the ever changing scientific and technological development, the enthusiasm of exploiting open materials for other unpredicted purposes have motivated and favored the idea of open source solutions as well as their evolution. The industry of open hardware has given to individuals, scientists and researchers, the possibilities to design and develop open source firmware (OSF). The personal computer (PC) and Linux are to date respectively the perfect well-known examples that revolutionized the world of open hardware and open source operating systems. OSF provides to end-users the freedom of customization, to engineers the freedom of improvement, and to developers the opportunity to contribute in the field by experimenting and optimizing existing (or creating new) features. Despite the flexibility of OSC-based project, its development process is very complex and is mostly reserved to a certain elite that is predominantly professional. It is difficult to replicate or teach the methodology that drove the design and the development of open source code (OSC)-based projects. Indeed, they lack documentation that formally describe their development lifecycles, methodologies or models. At the best of our knowledge, the development of an OSC project is most of time based on the volunteering and the experience of a [group of] developer[s] and, this cannot help or encourage students to contribute in the field. What rules govern an OSC development project in a sustainable way? How to pedagogically passion a learner to progressively manage such project? This paper aims at proposing a pedagogical approach for developing a firmware from OSC solutions. The proposed approach is an extension of the Y development lifecycle, adapted from the “five-easy-steps” firmware development process proposed by Michael Barr, to which we couple the Y project development lifecycle model proposed by Capretz, L.F & al, considering the concept of reusability in the field of component based software engineering (CBSE). It consists of splitting some steps into more specific sub-steps to ease the comprehension of the learner. The experimental case consists to prototype WiAFirm, an OpenWRT-based firmware in the framework of the WiABox tutored project. OpenWRT is today the almost de-facto base OSF for embedded devices. It is at the origin of many others among which are Freifunk-Gluon, OpenWISP, Chillifire, just to name a few. WiAFirm is hardly inspired from Freifunk-Gluon, a modular framework for creating firmware for wireless mesh nodes and providing a uniform configuration for the entire German Freifunk Wireless Community Network. The main objective of WiAFirm is to operate multi-band IEEE 802.11x wireless access/mesh routers as the key components to build rural wireless community networks in developing countries. The main benefit of the proposed approach is the better quality control of the OSF development process and the knowledge sharing. Indeed, the learner is methodologically introduced and guided step-by-step in the OSF engineering paradigm.

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