Sustainability in software engineering

By Bennie Mols | Images Ivar Pel
GROUP PASSPORT

RESEARCH FIELD
Software and Sustainability: creating software engineering knowledge that makes software better, smarter, and more sustainable; Software architecture; Software design and modelling; Software quality assessment.

INSTITUTION
Vrije Universiteit Amsterdam

WEBSITES
http://patricalago.nl
http://s2group.cs.vu.nl

EMPLOYEES
1 Professor
9 assistant and associate professors
6 postdocs and PhD students
1 junior lecturer
2 research assistants.

FACILITIES
Green Lab: a lab for experiments with the optimisation of the energy efficiency and other quality properties of software deployed on servers and mobile devices like smartphones.
Darkness falls in the early afternoon in the Swedish town of Uppsala during the winter. Not particularly attractive for children to play outside. However, in 2015 the municipality of Uppsala, together with Philips, showed that smart LED-lighting of a local playground, by installing a system which allows remote control of light levels and tones, increased the time kids played outside and improved the children’s mood. This is an example of the transformational power of software and IT to improve people’s lives. Professor Patricia Lago gave this example during her inaugural speech in January 2016 at VU Amsterdam, one year after she started her position in the new field of Software and Sustainability, which at that time was mainly focused on the energy efficiency of software.

Better, smarter, more sustainable

Four years later, Lago has expanded her VU Amsterdam research group both in size and research scope. ‘The goal of our group is to create software engineering knowledge that helps software to become better, smarter and more sustainable’, says Lago. In essence, sustainability is the ability to continue a defined behaviour for a long time. Nowadays, sustainability is considered to have four dimensions: not just the environmental dimension that is traditionally associated with sustainability, but also the social, technological and economic dimensions. Lago: ‘In all these dimensions we should treat sustainability as a quality property of software. They should already be taken into account during the design phase.’

In the environmental dimension, engineers try to reduce the energy consumption of software. ‘Surprisingly there is a lot to be gained in efficient software’, says Lago. ‘We once showed how optimising the software of a website saved up to 45% of the energy consumed by the webserver.’ Lago and her colleagues set up their own Green Lab where they experiment with the energy consumption of software in servers and more recently also the energy consumption of software in smartphones and in robots.

Lago’s research group was the first in the world to develop a Sustainability Quality Assessment Model for all four dimensions. ‘Basically, it is a set of instruments to help software architects and other professionals to identify which of the software quality properties are relevant for them. At the same time, it is an instrument to measure the impact on the target sustainability goals.’

Software engineering is about more than getting the software to function properly. It is also about getting software to consume as little energy as possible and to take care of the diversity of developers and users. The research group Software and Sustainability at VU Amsterdam studies these and other dimensions of sustainability in software engineering.
Lago believes in the power that software has in shaping our society. ‘That’s also the reason why we cooperate with many industrial partners. Connecting software with sustainability is quite a new IT field, but my dream is that the societal relevance of software engineering will be increasingly recognised by the international community. I already see how the new generation of students wants to have a meaningful impact on society.’

Green Lab

Ivano Malavolta is assistant professor in data-driven software engineering in Lago’s group. His work is structured around the Green Lab. ‘If you entered the lab, you would see a rack of servers for collecting energy measurements. And you would also see a large table with twenty smartphones for doing experiments. All these devices can be controlled remotely via a dedicated website.’

The Green Lab is also a mental gym for students, as Malavolta calls it. ‘We teach a master course where around forty students per year learn to design and conduct scientific experiments in the energy efficiency of software. Finally, the Green Lab is also a platform to collaborate with companies. They come to us with their problems, we talk with them and design an experiment to investigate the energy efficiency of their software. It’s a form of scientific consultancy. Since software engineering is such an applied field, we need this type of cooperation with companies. It keeps us fully updated with professional practice.’

What Malavolta especially likes in the group is the fact that not just the publication of academic papers counts, but most of all the impact they have on society. ‘For us, academic papers are a means to achieve something else. That is Patricia’s school of thought that all our group members share. And then, in the informal sense, there is an Italian backbone: eating pizza is another unifier, as both Patricia and I are Italian.’

Social dimension

Mexican-raised Emitzá Guzmán Ortega is another assistant professor in Lago’s group. Her research focuses on the social dimension of software sustainability, studying both the side of the developers and the side of the users. ‘I investigate, for example, which social barriers software developers encounter when working in the field. I did a survey about the differences that diverse genders encounter. How often did they get interrupted? How often were they excluded from social or networking events? How often did they have the feeling that they were not met with eye contact during a discussion? Micro-inequities might not make you cry, but they affect your confidence and ultimately, your work performance. We expected a gender gap, but it turned out to be much larger than expected.’

At the side of the user, Guzmán Ortega investigated, for example, whether user feedback on certain software applications is culturally influenced and how companies deal with this. Finally, she also studies how ethical concerns can best be integrated in the early development of software. ‘In previous groups where I was working’, tells Guzmán Ortega, ‘I was usually the only one working on the social impact of software. Now I am surrounded by many more people interested in this. And although I do not yet work in the environmental dimension of sustainability myself, in my private life, I care a lot about the environment, so I also really like the fact that other group members concretely work on the environmental impact.’