Breakout Group #1:

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From the first discussions in the group arised the statement that solutions towards a better sustainability are getting developed and used every day, with a large part of them relying on Cyber-Physical Systems (CPS). These solutions might be wrong because of badly tuned models, or change in the contexts of usage. They are also defined as islands or silos. Nevertheless we cannot ignore these solutions and we should be able to ease their migration towards better solutions, empowered by software, towards sustainability.
From the group experiences, it was decided to focus on some sustainable campus scenarios: heat or sun-screening regulations on buildings, power conservations, water management, etc. Googling "sustainable campus" showed a large number of existing solutions. The group then classified issues according to two aspects: i) problems on a deployment site, with silos of sustainable regulations, underlying models, context and constraints of usage of solutions being not explicit; ii) problems on dimensions of sustainability, as no cross-fertilization is consistently possible, small to medium failures are not documented nor advertised to ease fine-tuning of existing solutions. As a result, they cannot be analyzed nor improved. As software for sustainability is usually organized as regulation loops (or feedback control loops), the group identified emerging challenges on making the loops i) more effective, with explicit and improvable models, and ii) composable, with ways to reasons on what is composable with what. As for the enabling technologies, issues were studied according to two complementary views, being internal or external to the software engineering discipline. A first problem relies in the application of exiting models from other disciplines, from simulation to implementation, while ensuring that all considered data and models are completely open to ease adoption. To do so, the knowledge must be easily transferable, for example by a fractal organization of models, so that they can be more easily grasped at a coarse grain with less detail, but can also be zoomed in with finer descriptions at different levels. On top of that, security and privacy issues must be tackled to complement data openness. A second problem was identified in the large scale of both the data to be handled and the architecture to convey them. Managing the relevance of these data, displaying the models based on them are challenges where our community must seek for solutions in other disciplines.