Smart Systems
Definition Systems that sense and respond; composed of
- sensors that provide data
- command-and-control units that
  - process data
  - provide commands
- actuators that process commands
Examples
- Home automation, climate, lighting and security control
- Smart-grids, electric grid with renewable energies
- Industry 4.0, cyber-physical systems, IoT and cloud computing
Challenges
- integrating heterogeneous components and technologies
- merging interdisciplinary approaches and solutions
- improving system energy consumption and efficiency

Model-Driven Development
Definition Software development methodology that aims at
- design models (concepts of specific domains)
- generate software from models
- automatize manually-handled processes
Examples
- software functionality, behaviour, structure with UML
- parametric system requirements components with SysML
- business process modelling and execution with BPMN, BEPL
Abilities
- controlling software development complexity
- verifying system design consistency
- easing system evolution and understanding

Model-Driven Engineering of Smart Systems
Design define your smart system within a domain-specific model
Build verify and generate its operating application automatically
Enjoy launch the operating application and control your smart system

REIFIER
- data structure modelling
- service-oriented application modelling
- full JEE application code generation
- model-to-text transformation
- component-based approach
- component and resource flexibility
- formal verification support
- [Rocheteau and Sferruzza (2016)]

SMART REIFIER
- smart system modelling
- SCADA application code generation
- built on top of REIFIER
- sensor and actuator network modelling
- spatial and temporal system modelling
- event-based processing
- generic SCADA clients development
- [Bosshardt et al. (2017)]

EMIT
- software energy consumption analysis
- fine-grained smart metering of power
- smart metering of computer activities
- measures and metrics modelling in SMM
- measurement collect platform
- measurement analysis platform
- developed with REIFIER
- [Bagnato et al. (2016)]

On Going Research
Generation of Service-Oriented JEE Applications
- embedding theorem proving techniques
- modelling parametric services
- customizing component pre/post conditions
Generation of SCADA Applications from SAN Models
- automatic device inference from sensor/actuator specifications
- users/roles embedding in SAN models and SCADA clients
- automatic indicator inference from SAN models
Software Energy Consumption and Energy Efficiency
- evaluating power-meter reliability
- evaluating computer-meters reliability and power side-effects
- evaluating impact of runtime environment settings

Up Coming Research
Business Process
- business process modelling on top of REIFIER
- memorizing process traces between services and applications
- mining process traces
- embedding theorem proving techniques
Data Processing and Analysis
- formalizing design patterns of time series’s analysis
- embedding predictive analysis algorithms
- fixing time series’s management guidelines
- correlation between time series’s features
- managing huge data model into heterogeneous databases

Publications
Jérome Rocheteau and David Sferruzza.
REIFIER: Model-Driven Development of Component-Based and Service-Oriented JEE Applications.

Margaux Bosshardt, Clémentine Geslin, and Jérome Rocheteau.
SMART REIFIER: Model-Driven Development of Service-Oriented SCADA Applications from Models of Sensor and Actuator Networks.

Measuring Green Software Engineering, Monitoring Software Energy Consumption in the MEASURE ITEA3 Project.