Open source building simulation with Modelica

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What is Modelica

Modelica is a <u>language</u> for modeling of physical systems

- open source
- object oriented
- A-causal modeling (equation based)
- multi-domain
- simulation and optimization
- many model libraries (free and commercial)
- textual and graphical modeling
- different Modelica tools

Modelica tools

Commercial software packages

- <u>Dymola</u> (Dassault Systèmes, Sweden)

- <u>MathModelica</u> (MathCore, Sweden)

- <u>SimulationX</u> (ITI, Germany)

- <u>MapleSim</u> (Maplesoft, Canada)

Free and open source packages

- <u>OpenModelica</u> (Open Source Modelica Consortium, Sweden and other countries)
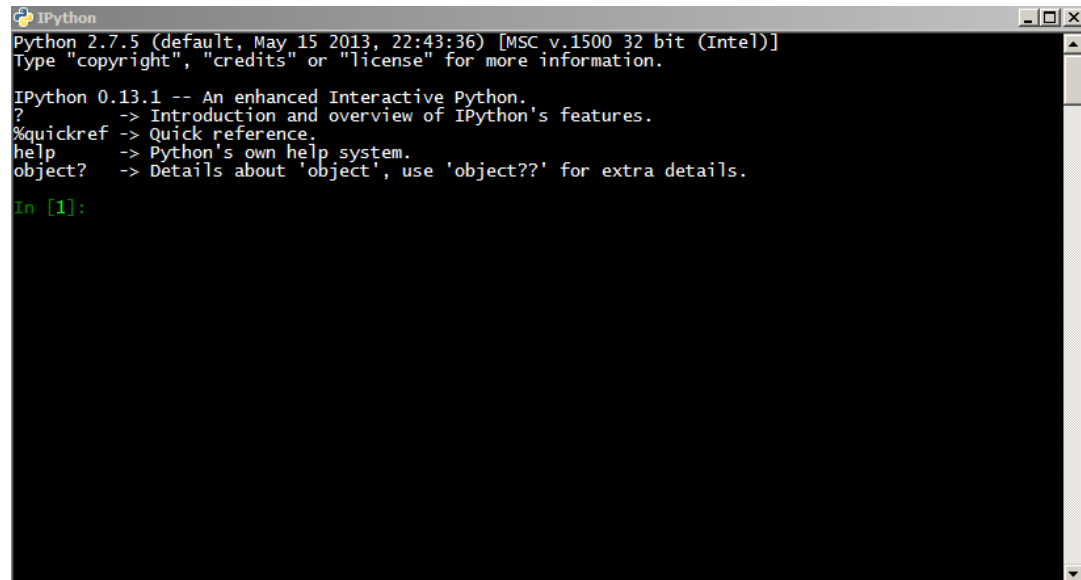
- <u>JModelica</u> (Modelon, Sweden)

OpenModelica

- Large ecosystem of tools, centered around the openmodelica compiler (omc)
- Graphical editor OMEdit
- OMNotebook
- OMOptim for optimization
- Python interface
- etc…
- https://www.openmodelica.org/

OMedit
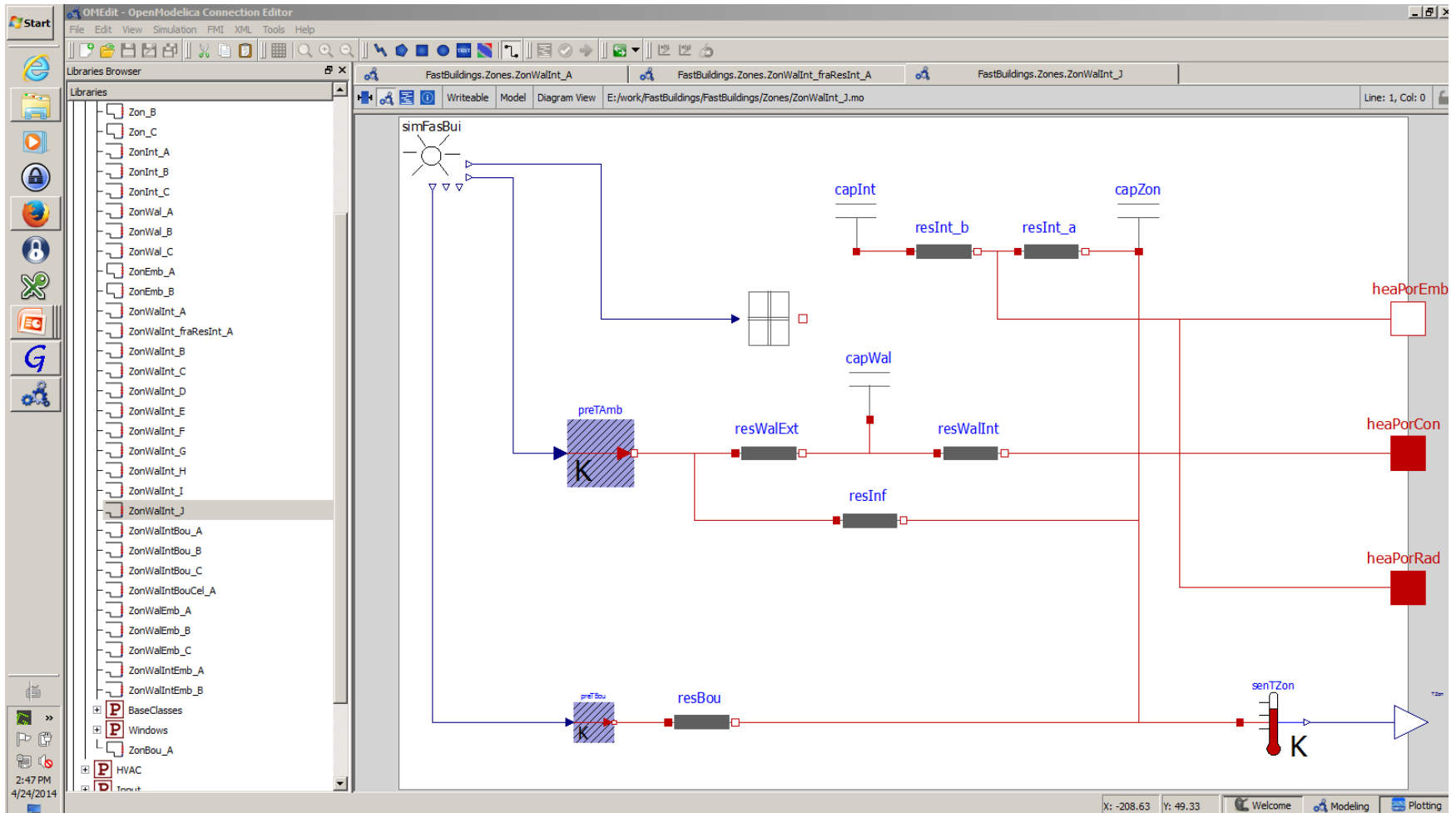
JModelica.org

- Java compiler

- Python interface

- www.jmodelica.org

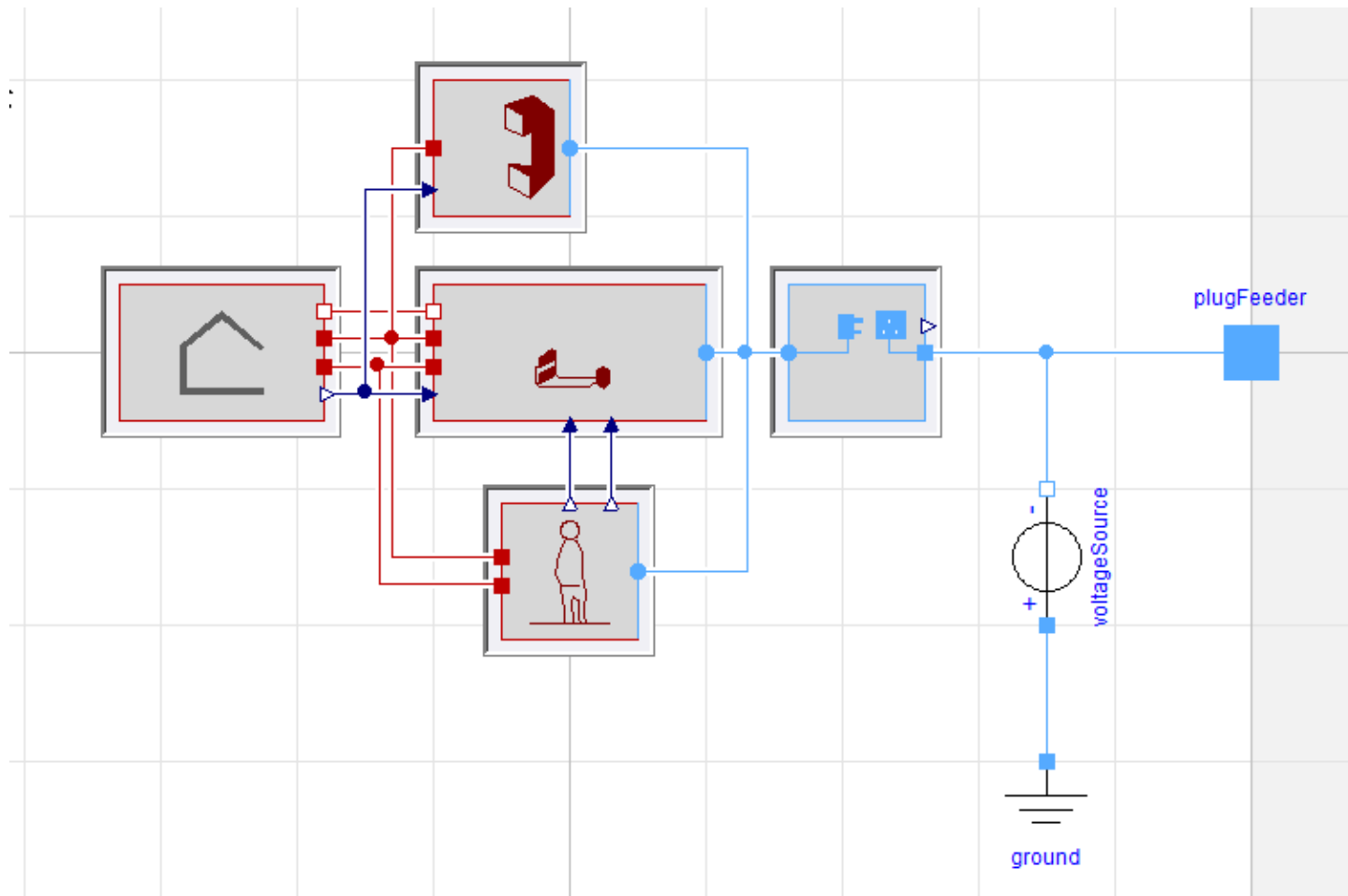- Focus on dynamic optimization

- No gui

Modelica libraries for building simulation
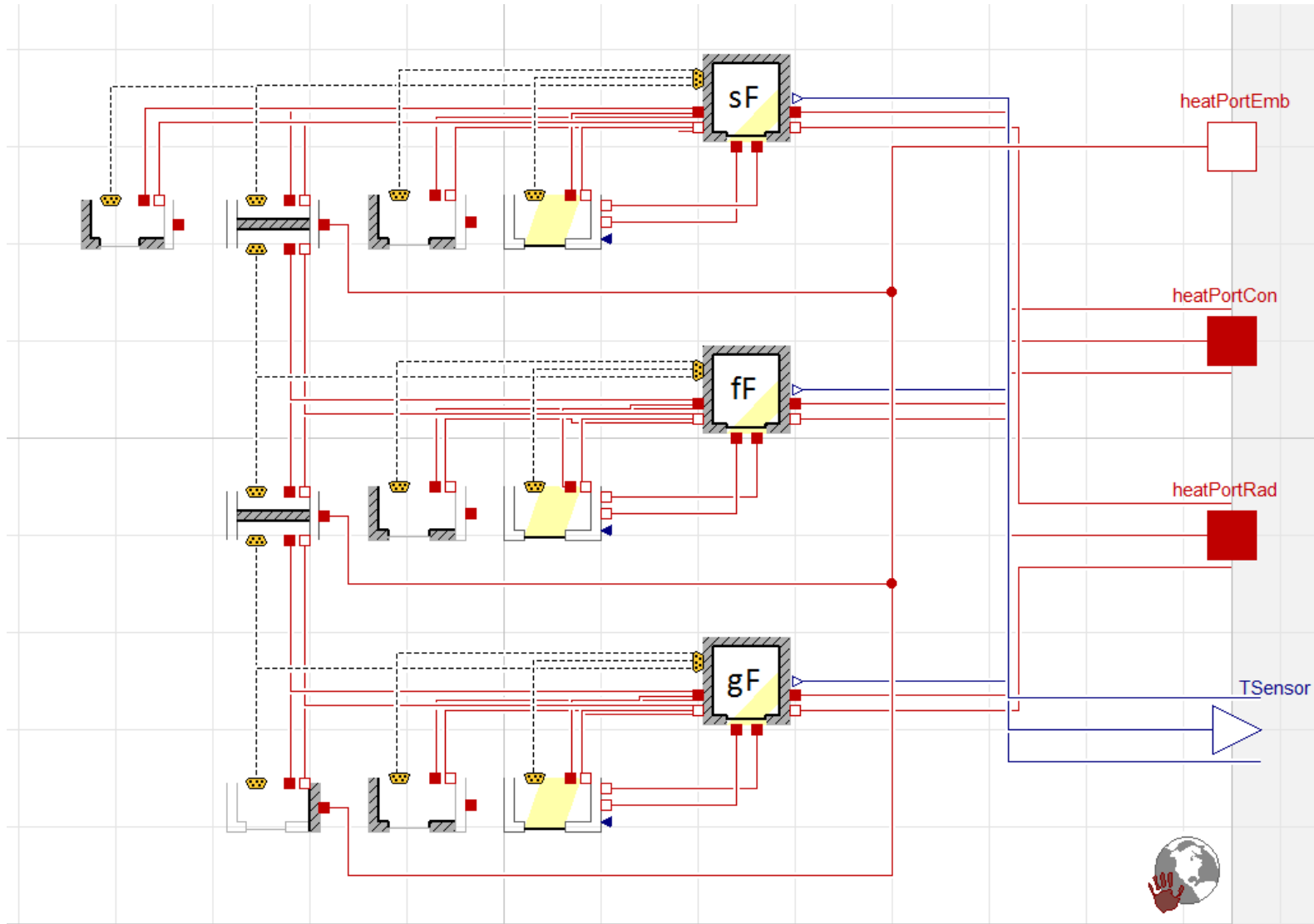
- IDEAS
- FastBuildings
- Buildings

IDEAS

- Integrated District Energy Assessment Simulation
- Detailed buildings and thermal systems
- KU Leuven and 3E
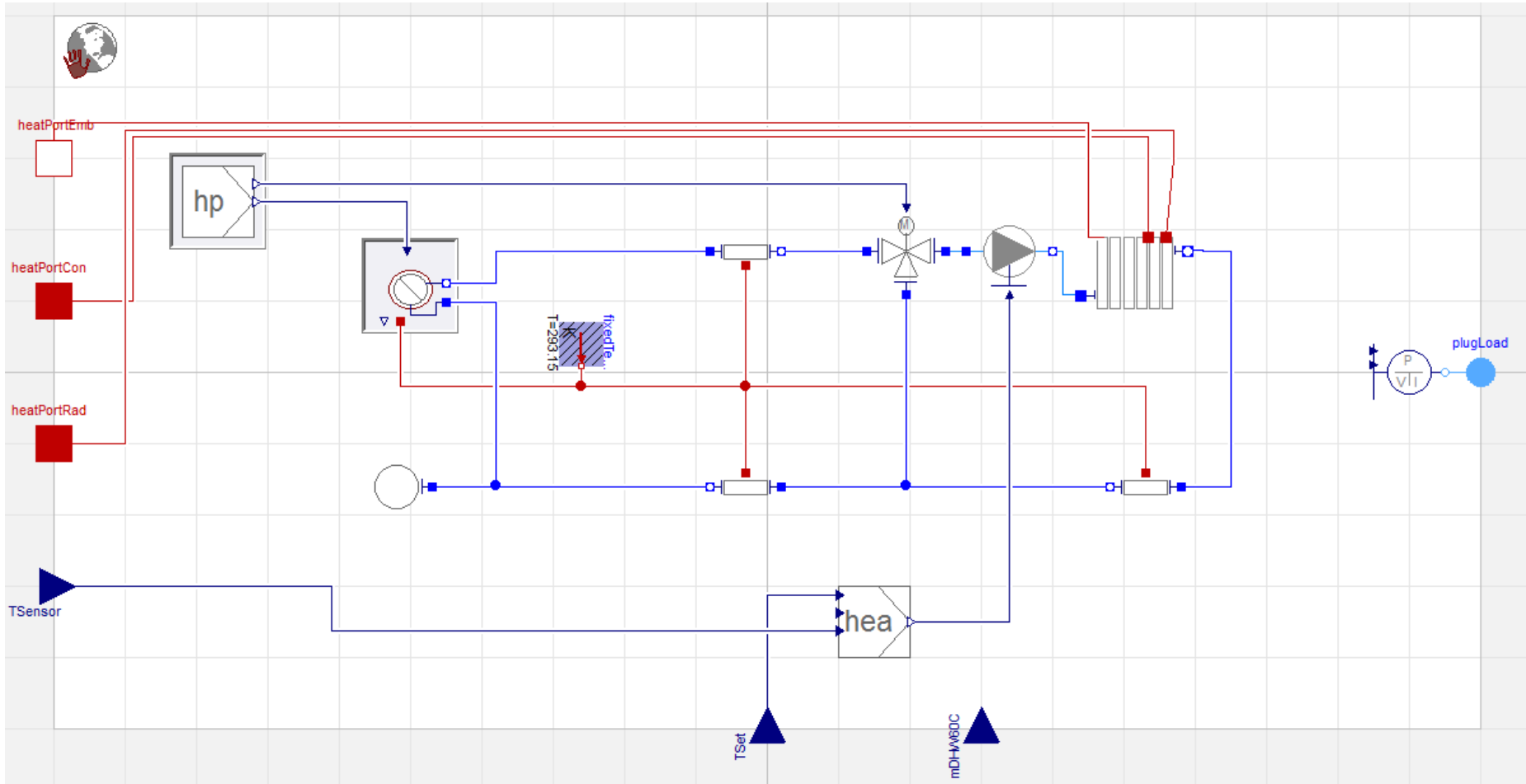- www.github.com/open-ideas/IDEAS

Example of total building model

# Example of 3-zone building in IDEAS

# Example of heating system with heat pump, storage tank and radiators

FastBuildings

- Low order (=simple) buildings and thermal systems

- Single and multizone buildings

- Data-driven modelling, controller models

- Used in Grey-Box Buildings toolbox

- Same interfaces as IDEAS: exchangeable models

- KU Leuven and 3E

- https://github.com/open-ideas/FastBuildings
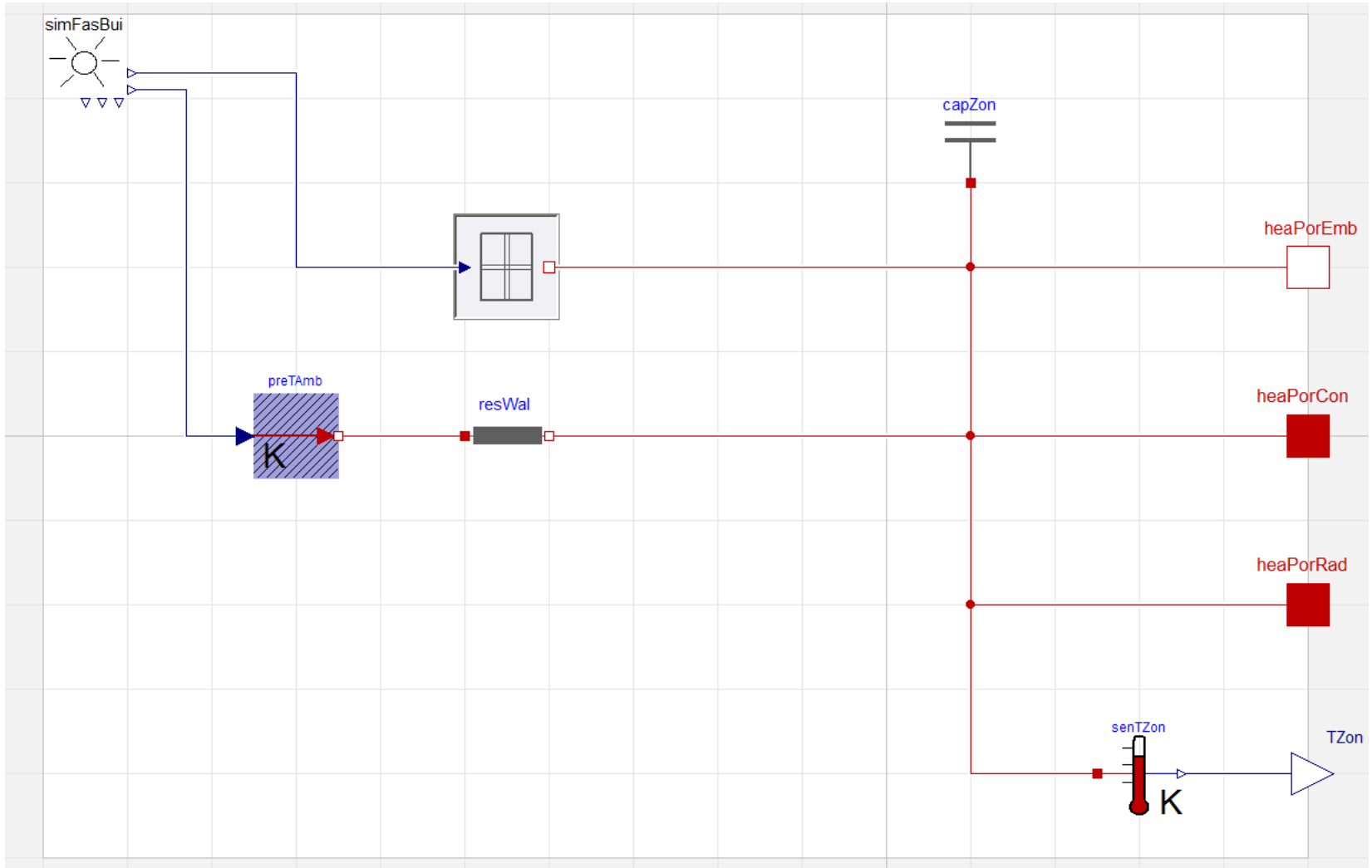
A 1ˢᵗ order model

A 3ʳᵈ order model
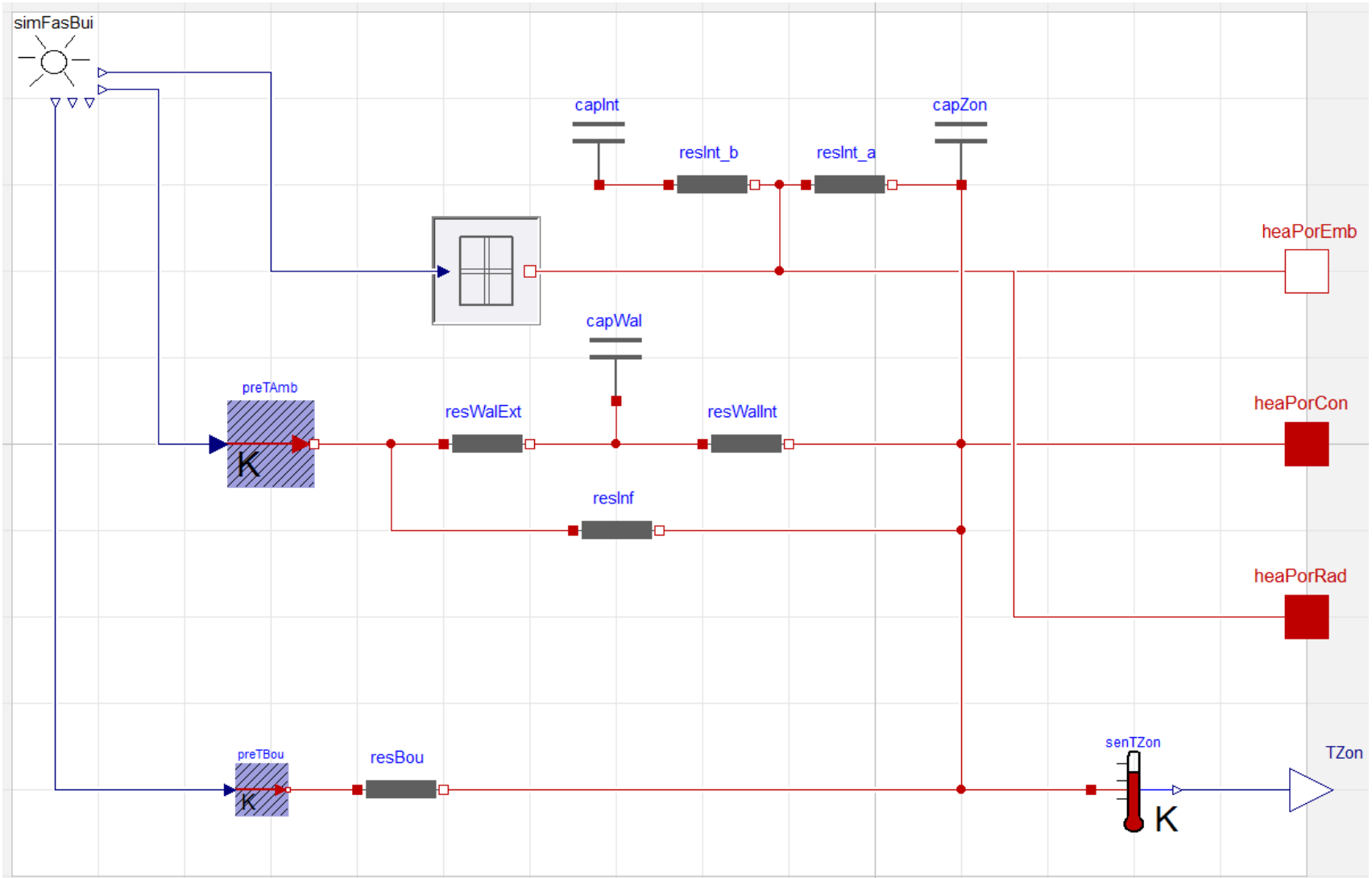
Buildings

- Detailed buildings and thermal systems

- More focus on detailed HVAC

- Lawrence Berkeley National Lab

- https://github.com/lbl-srg/modelica-buildings

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New generation computational tools for building and community energy systems based on the Modelica and Functional Mockup Interface standards