



IBPSA Project 1

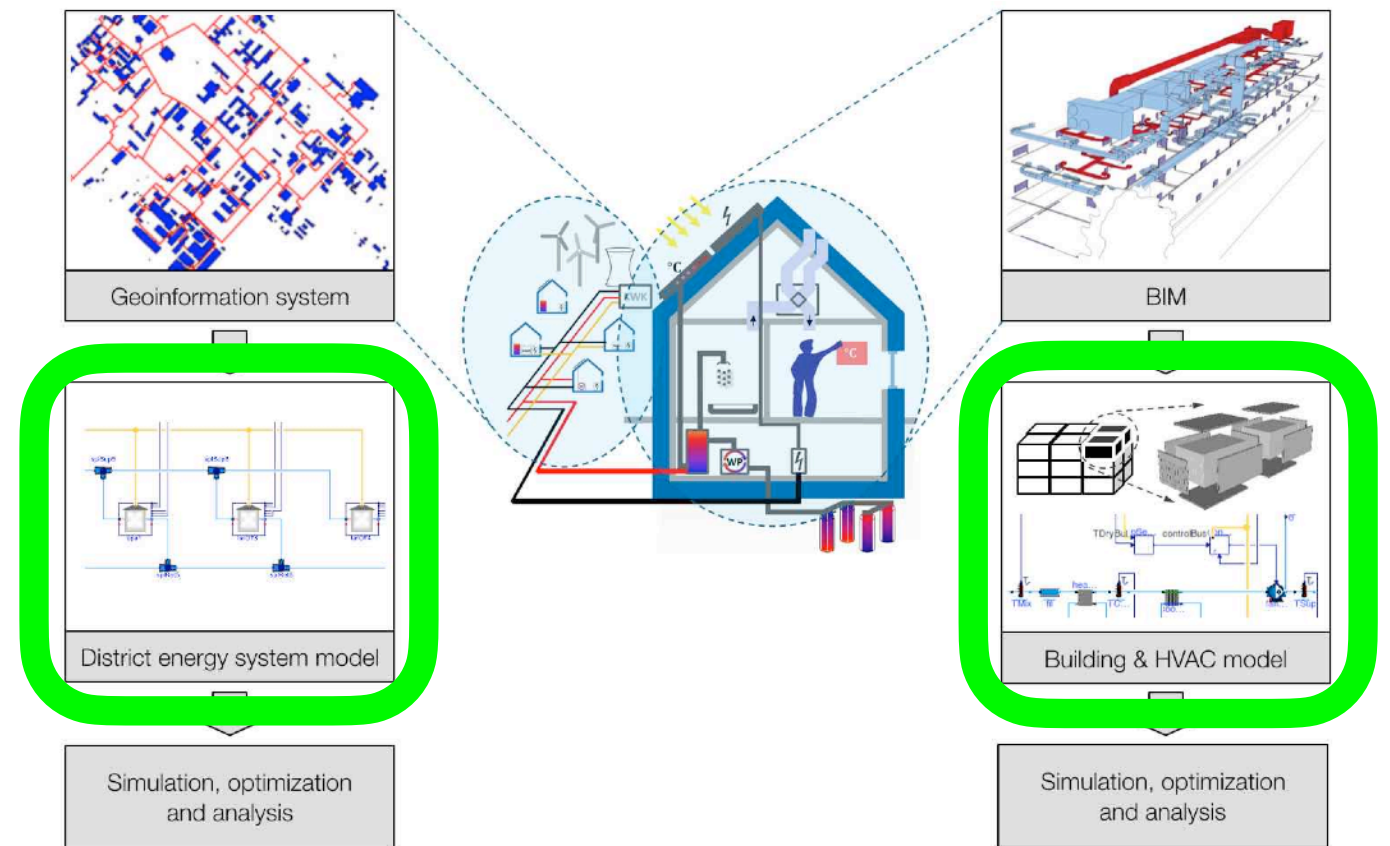
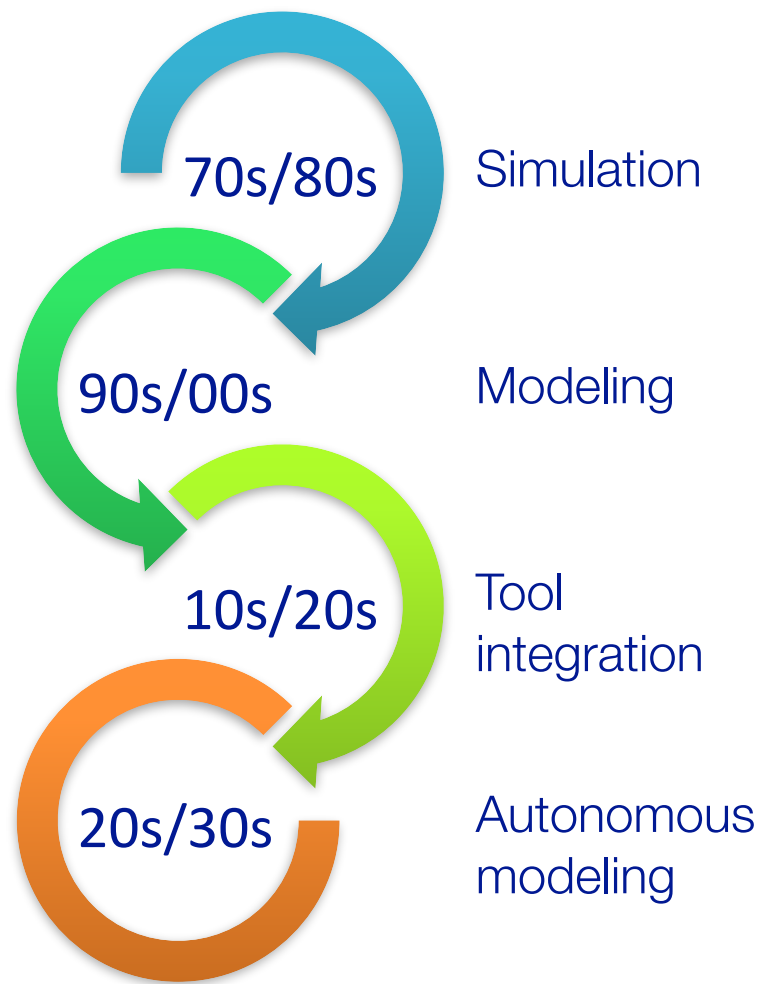
BIM/GIS and Modelica Framework
for
building and community energy system
design and operation

WP 1.1- Modelica Library for Design and Operation

May 6, 2020

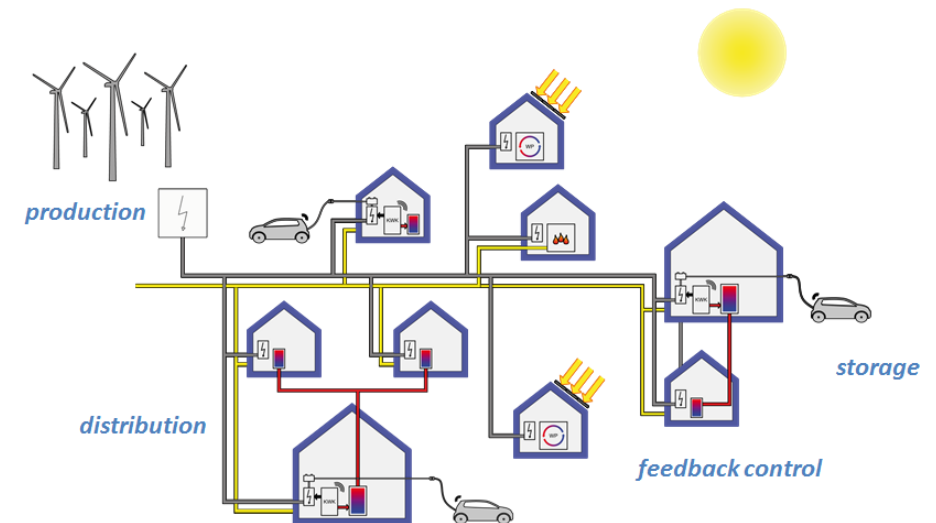
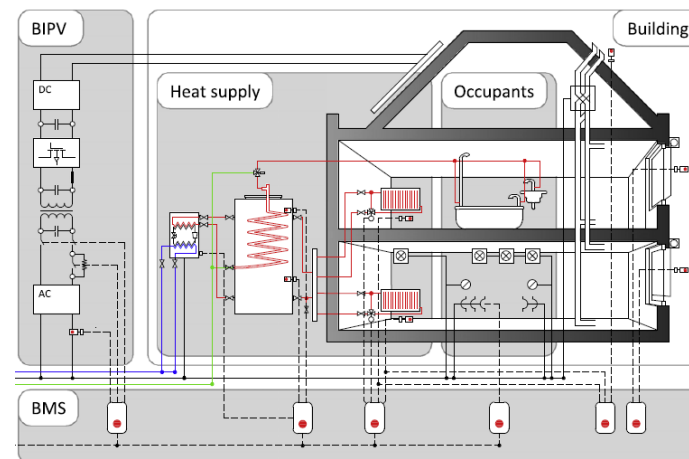
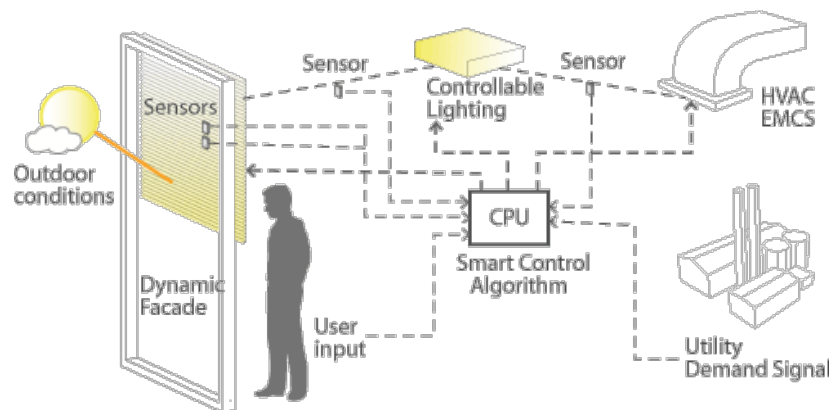
Michael Wetter

Work Package 1.1 Goal



Develop Modelica library applicable for system-level autonomous modeling.

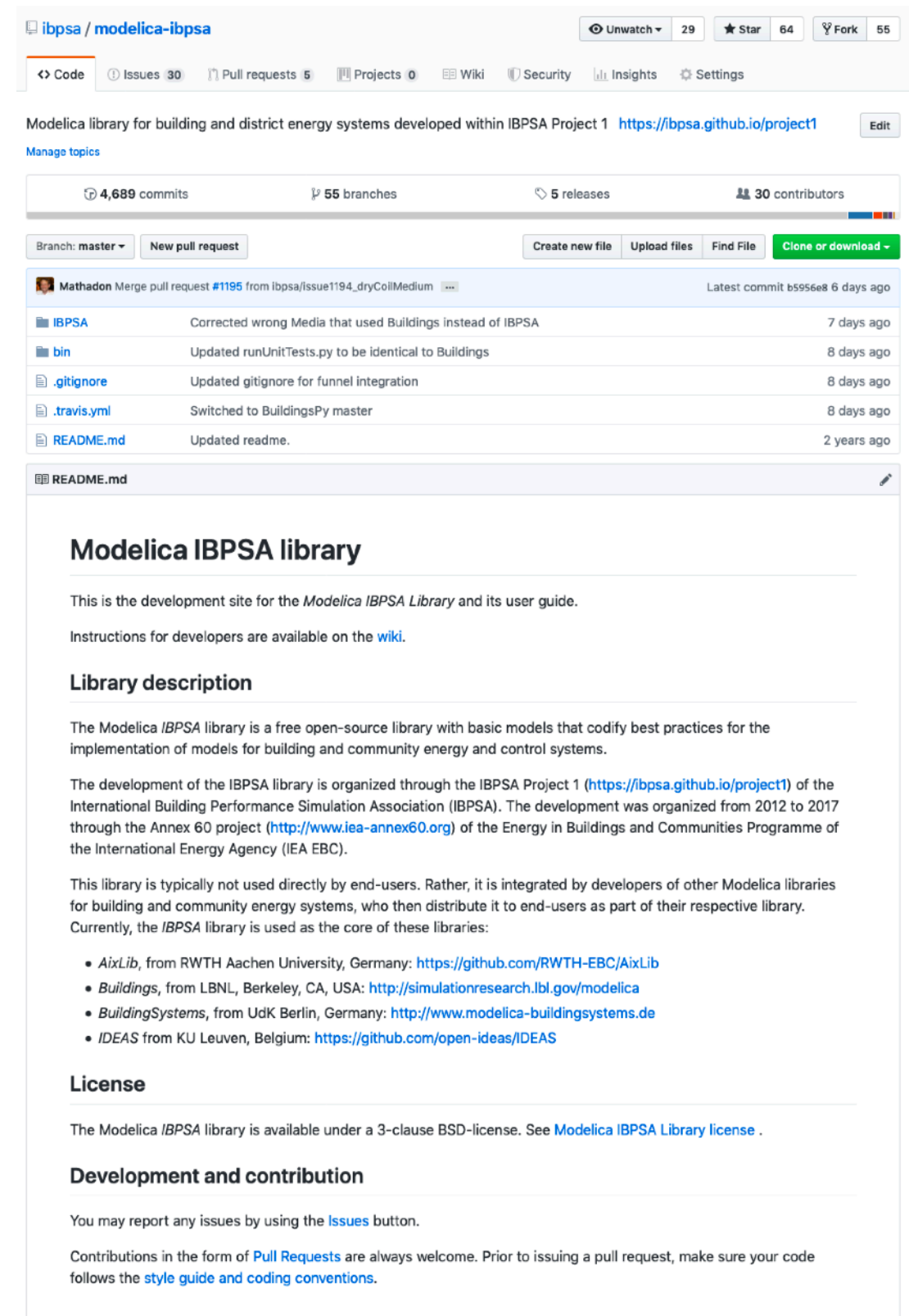
- validated
- well documented
- state-of-the-art physics and dynamics



From controls to buildings and communities 2

Work Package 1.1 Approach

1. Development organized using github.
2. Continuous integration testing, 500 tests for Dymola and JModelica.
3. Workflow and coding guidelines at <https://github.com/ibpsa/modelica-ibpsa/wiki>.
4. Tools to merge to AixLib, Buildings, BuildingSystems and IDEAS libraries.



ibpsa / modelica-ibpsa

Unwatch 29 Star 64 Fork 55

Code Issues 30 Pull requests 5 Projects 0 Wiki Security Insights Settings

Modelica library for building and district energy systems developed within IBPSA Project 1 <https://ibpsa.github.io/project1> Edit

Manage topics

4,689 commits 55 branches 5 releases 30 contributors

Branch: master New pull request Create new file Upload files Find File Clone or download

Mathadon Merge pull request #1195 from ibpsa/issue1194_dryCoilMedium Latest commit b5956e8 6 days ago

| | | |
|-------------|--|-------------|
| IBPSA | Corrected wrong Media that used Buildings instead of IBPSA | 7 days ago |
| bin | Updated runUnitTests.py to be identical to Buildings | 8 days ago |
| .gitignore | Updated gitignore for funnel integration | 8 days ago |
| .travis.yml | Switched to BuildingsPy master | 8 days ago |
| README.md | Updated readme. | 2 years ago |

README.md

Modelica IBPSA library

This is the development site for the *Modelica IBPSA Library* and its user guide.

Instructions for developers are available on the [wiki](#).

Library description

The Modelica *IBPSA* library is a free open-source library with basic models that codify best practices for the implementation of models for building and community energy and control systems.

The development of the IBPSA library is organized through the IBPSA Project 1 (<https://ibpsa.github.io/project1>) of the International Building Performance Simulation Association (IBPSA). The development was organized from 2012 to 2017 through the Annex 60 project (<http://www.iea-annex60.org>) of the Energy in Buildings and Communities Programme of the International Energy Agency (IEA EBC).

This library is typically not used directly by end-users. Rather, it is integrated by developers of other Modelica libraries for building and community energy systems, who then distribute it to end-users as part of their respective library. Currently, the *IBPSA* library is used as the core of these libraries:

- *AixLib*, from RWTH Aachen University, Germany: <https://github.com/RWTH-EBC/AixLib>
- *Buildings*, from LBNL, Berkeley, CA, USA: <http://simulationresearch.lbl.gov/modelica>
- *BuildingSystems*, from UdK Berlin, Germany: <http://www.modelica-buildingsystems.de>
- *IDEAS* from KU Leuven, Belgium: <https://github.com/open-ideas/IDEAS>

License

The Modelica *IBPSA* library is available under a 3-clause BSD-license. See [Modelica IBPSA Library license](#).

Development and contribution

You may report any issues by using the [Issues](#) button.

Contributions in the form of [Pull Requests](#) are always welcome. Prior to issuing a pull request, make sure your code follows the [style guide and coding conventions](#).

Progress in last half year

BoundaryConditions

- Weather data reader now allows for *exact* steady-state simulations
- In progress: Participation in new BESTEST for weather data processing

Fluid

- Pressure independent damper: Correction of actuator position in final review
- In progress: Partially wet coil

ThermalZones.ReducedOrder

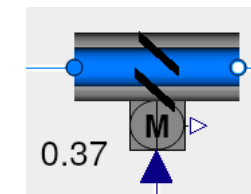
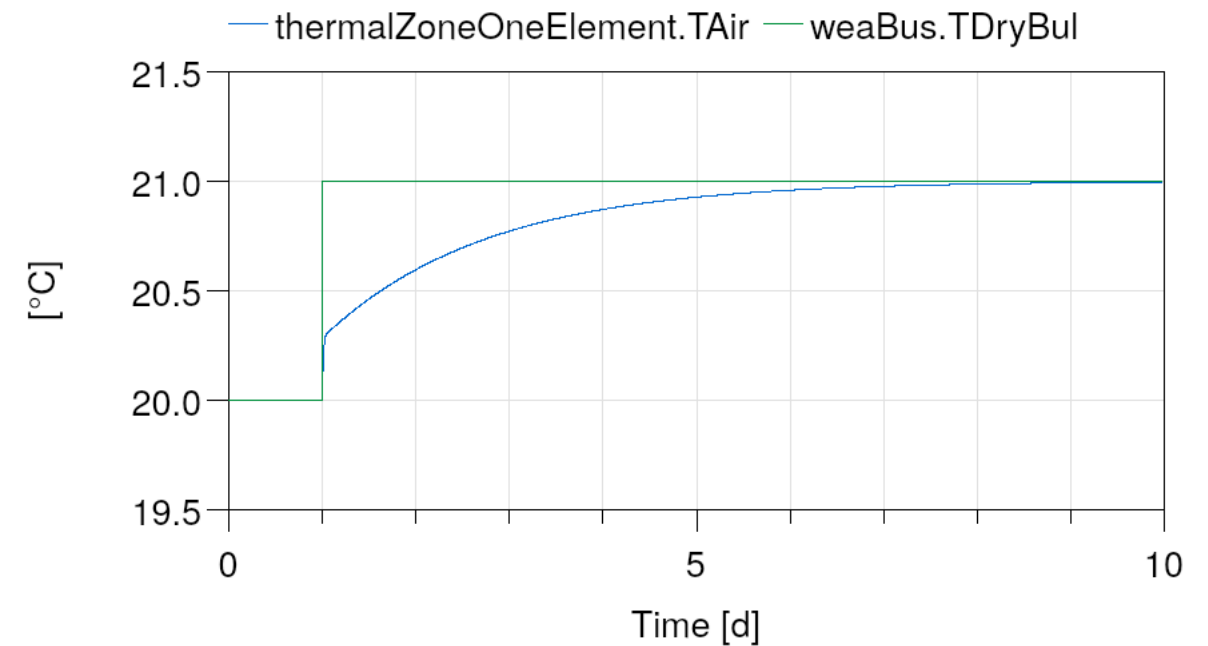
- Added option to model trace substances (e.g., CO₂)

Media

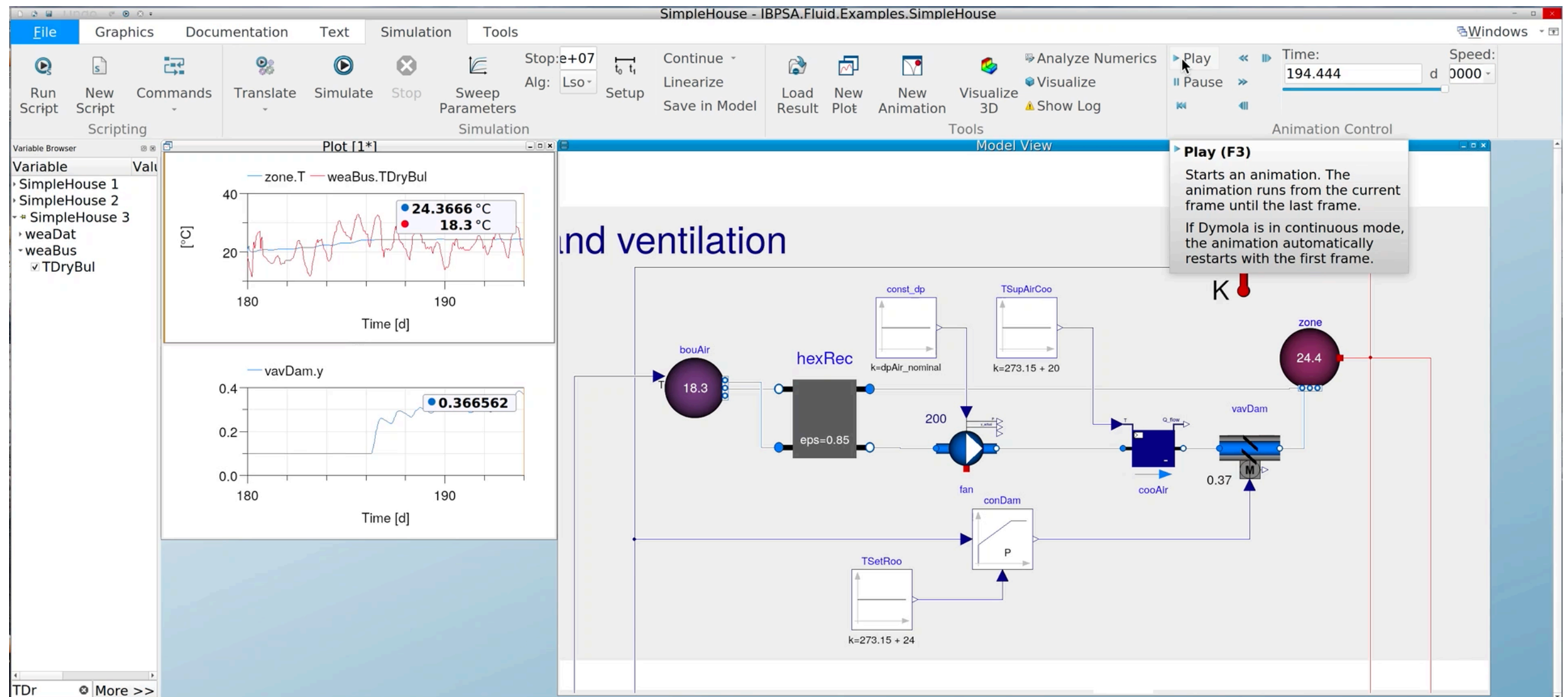
- Implement simplified steam model (no condensation)
- In progress: Implementation of R134a, R290, R410A, R744, and R32

General

- Added dynamic icons
- Updated regression testing to Dymola 2020x
- Tested with MSL 4.0.0 beta



Dynamic icons

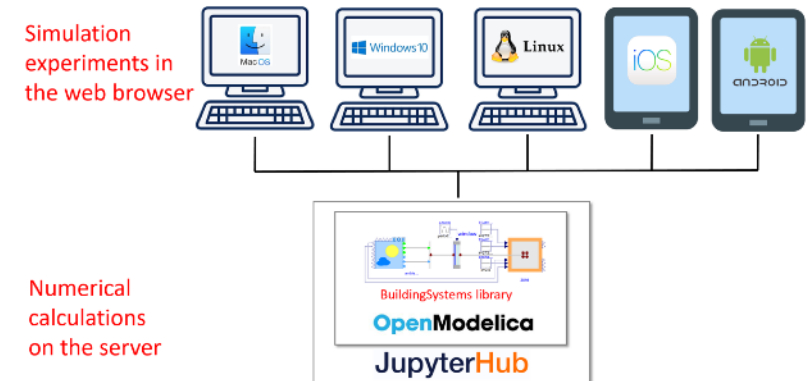
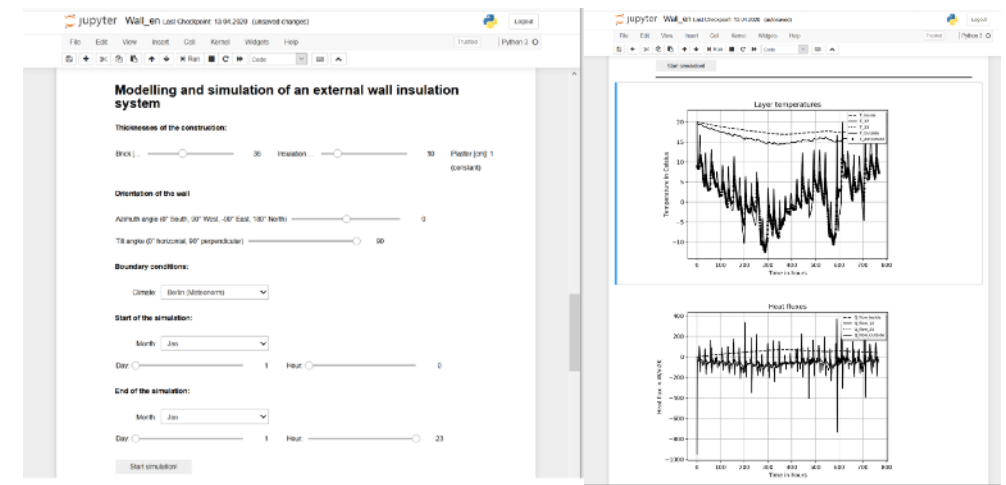


Updates from user-facing libraries

BuildingSystems

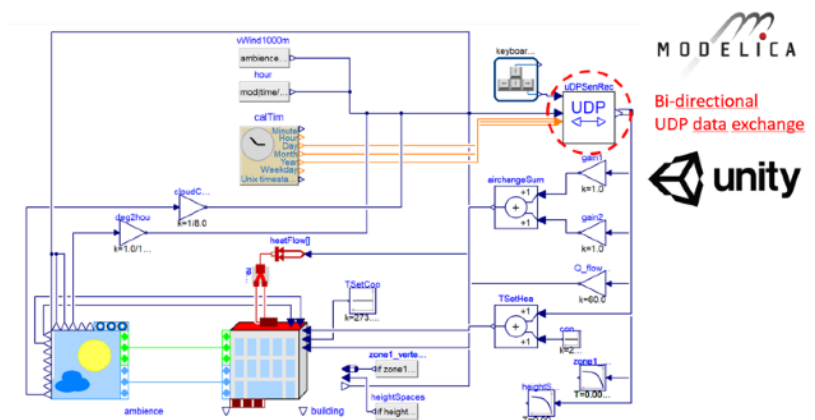
Jupyter notebooks based on OpenModelica

- Development of interactive Jupyter notebooks about building physics and building technology problems
- Usage of simulation models of the BuildingSystems library for student exercises
- Server-client approach for multi-user usage based on JupyterHub and OpenModelica as simulation engine



Virtual Reality building energy simulation environment

- Defining building models and performing simulation experiments within an interactive VR environment
- VR environment based on Unity and the multi-zone building model of the BuildingSystems library
- Real time data exchange between the VR environment and the Modelica building models



Buildings

OpenBuildingControl

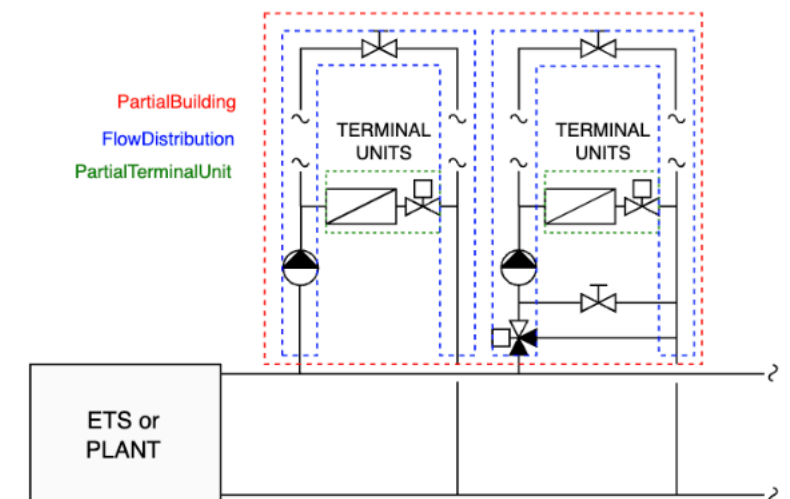
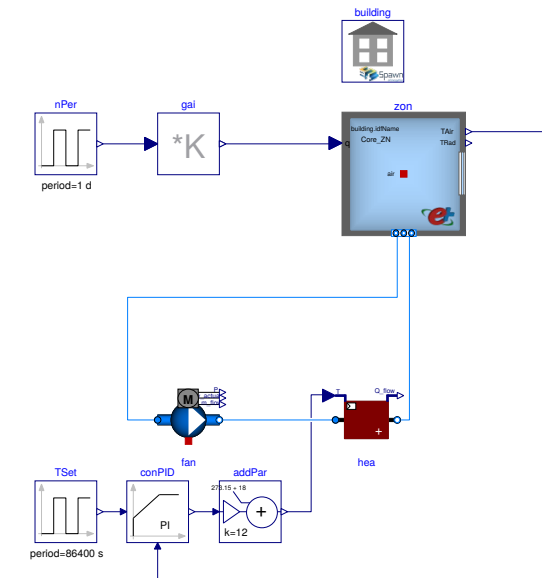
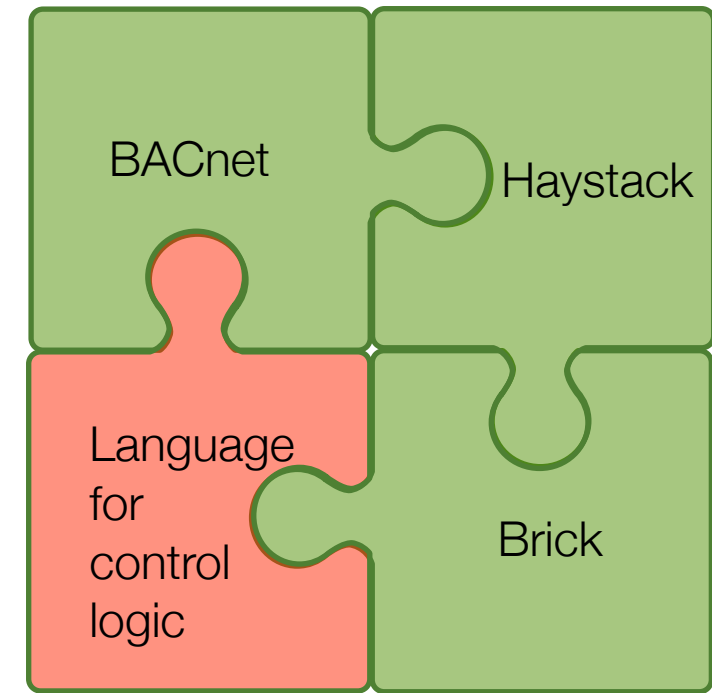
- Work started on making Buildings.Controls.OBC.CDL an ASHRAE standard
- In progress: Update of control sequences for
 - VAV (ASHRAE Guideline 36)
 - boiler & chiller plants (ASHRAE RP 1711)
 - radiant systems

Spawn of EnergyPlus (branch issue1129_energyPlus_zone)

- Beta release in summer/fall 2020
- Can model multiple buildings, read E+ output variables to Modelica
- Next: Writing to E+ schedules and actuators, adding radiant systems

District heating and cooling

- Engine for URBANopt
- Templates for 5th generation DHC



AixLib v0.9.1

New AixLib release on 20.01.20

- The new Heat pump model from v0.7 is now also integrated for FastHVAC
- New modular CHP model for calibration
- New boiler model AixLib.Fluid.BoilerCHP.BoilerNoControl where the input is the part load rate
- New pump model in package AixLib.Fluid.Movers.PumpsPolynomialBased that is based on polynomial functions
- New heat exchanger model AixLib.Fluid.HeatExchangers.DynamicHX with dynamic behavior
- New humidifier model AixLib.Fluid.Humidifiers.GenericHumidifier_u for steam and adiabatic humidification and part load rate as input
- New air medium AixLib.Media.AirIncompressible with constant density for duct work simulations
- Continuous Integration with regression tests to check simulation results

New Toolbox-Homepage including AixLib and Teaser

<https://ebc-tools.eonerc.rwth-aachen.de/en>

