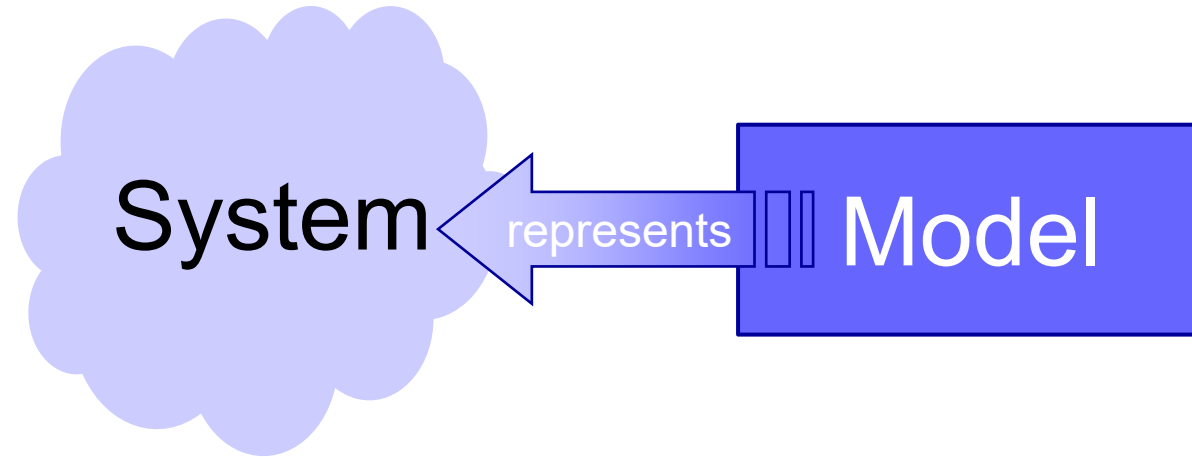


Towards seamless data integration through an open data model

Sabine Sint, Galina Paskaleva, Thomas Bednar

TU Wien

Models – What is a model?



Mapping Feature

A model is based on an original (=system)

Reduction Feature

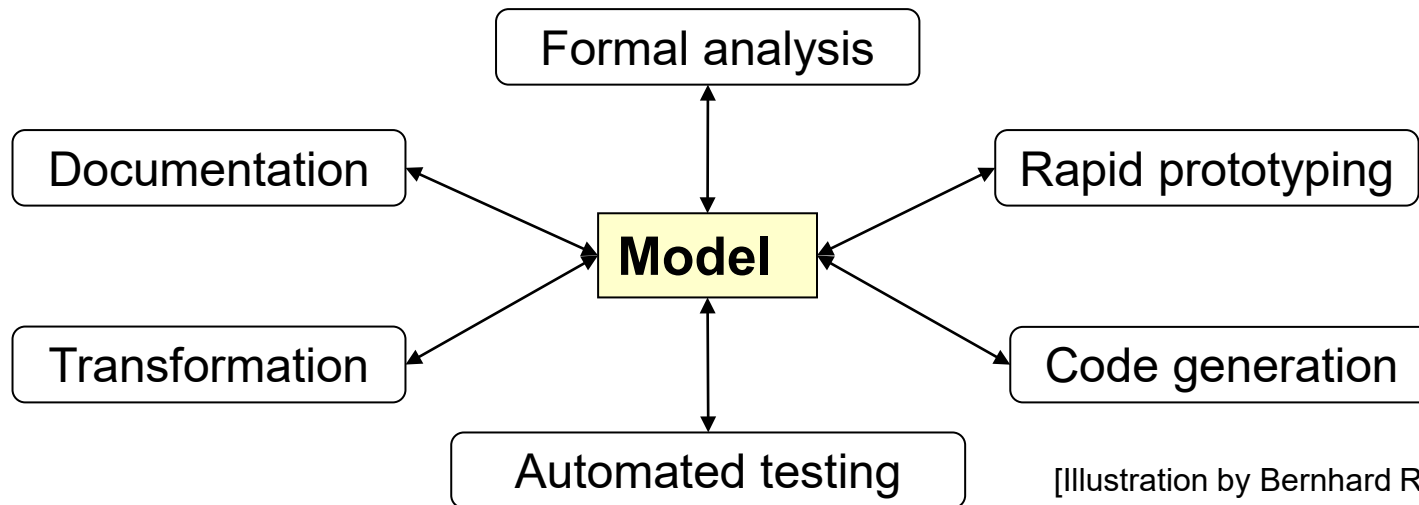
A model only reflects a (relevant) selection of the original's properties

Pragmatic Feature

A model needs to be usable in place of an original with respect to some purpose

What is Model-BASED Engineering?

Model as the **central artifact** of software development



[Illustration by Bernhard Rumpe]

Related terms

- Model Driven Engineering (MDE)
- Model Driven [Software] Development (MDD/MDSD)
- Model Driven Architecture (MDA)
- Model Integrated Computing (MIC)
- Domain-Specific Modeling (DSM)
- Low-Code/No-Code Development

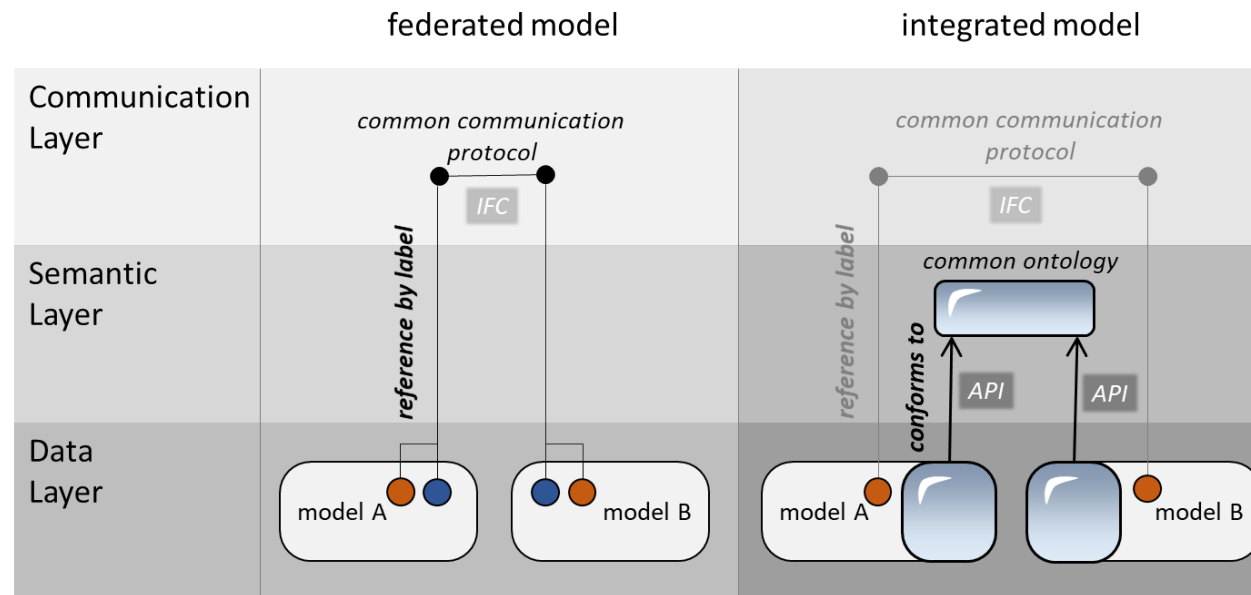
...

Model Driven Engineering (MDE)

- **Automation:** Uses tools for model transformations and code generation, enhancing development speed and productivity
- **Domain-Specific Languages (DSLs):** Employs tailored languages for easier expression of domain-specific ideas and designs
- **Consistency & Validation:** Ensures models are consistent and valid, minimizing implementation errors
- **Lifecycle Management:** Supports the entire software development lifecycle: from requirements to design, implementation, testing, and maintenance.

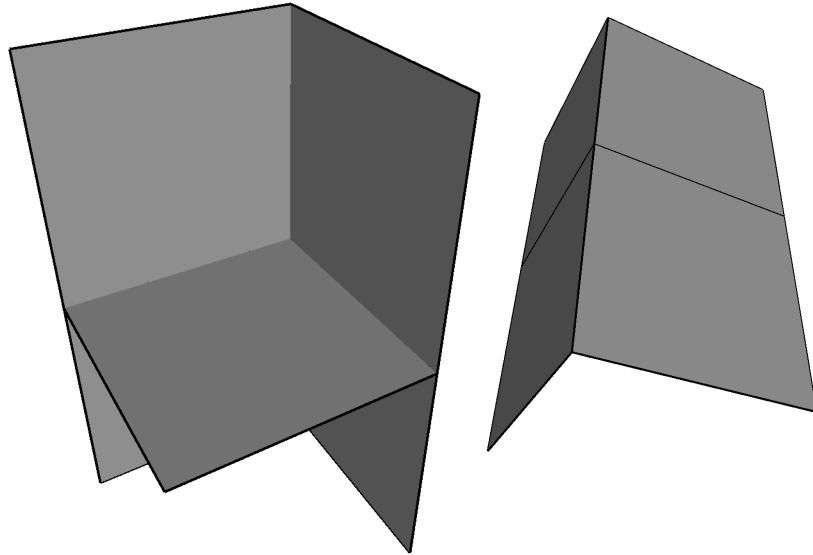
Data Integration & Building Information Modeling (BIM)

- Single (federated) Model
- Multiple Contributors
- Consistent Information Hub
- Lifecycle Management
- Interoperability and Collaboration
- Data Exchange

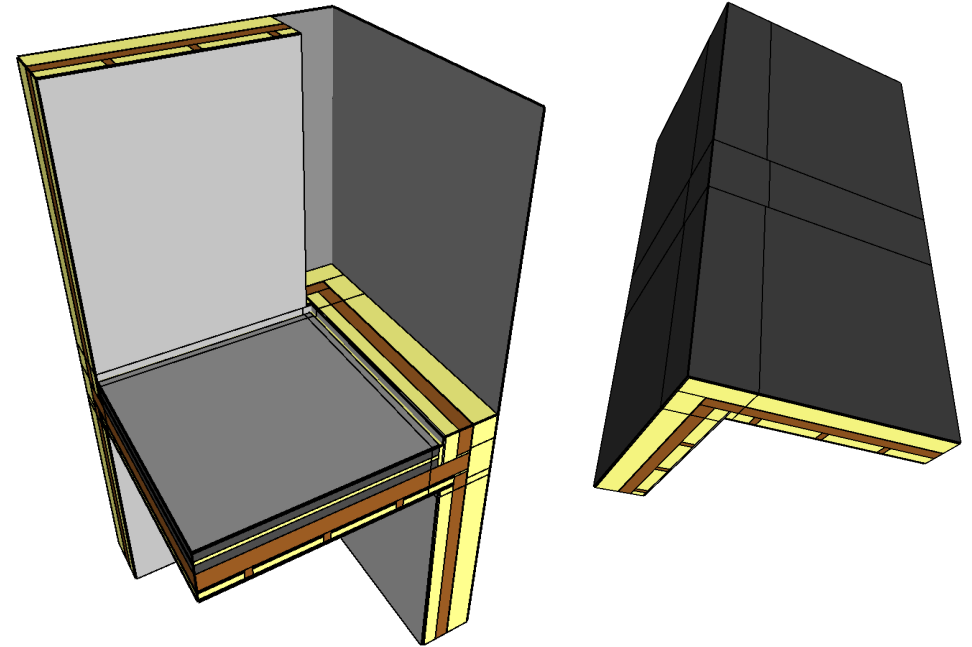


Application – Detailed Geometry

Example of a laminated timber bard structure



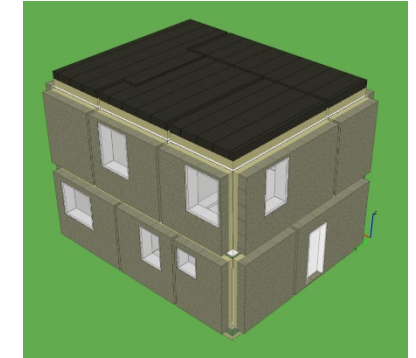
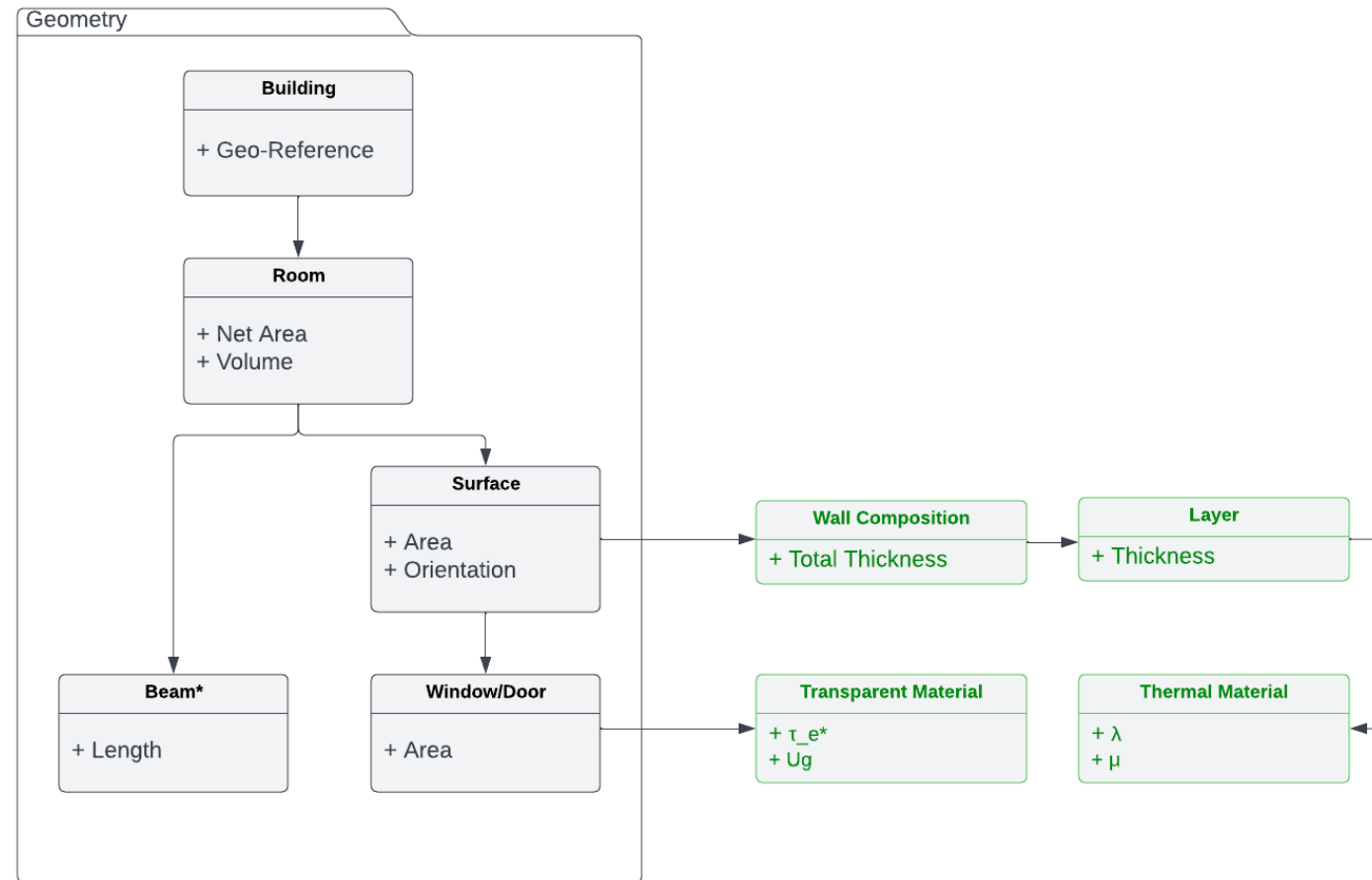
Concept geometry - LOG100



Detailed geometry - LOG300 or LOG400

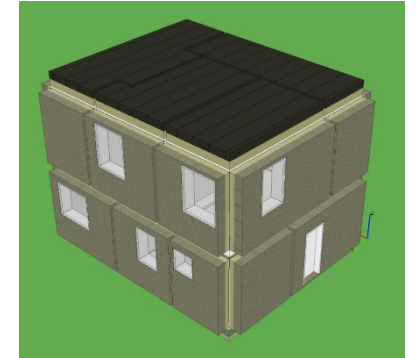
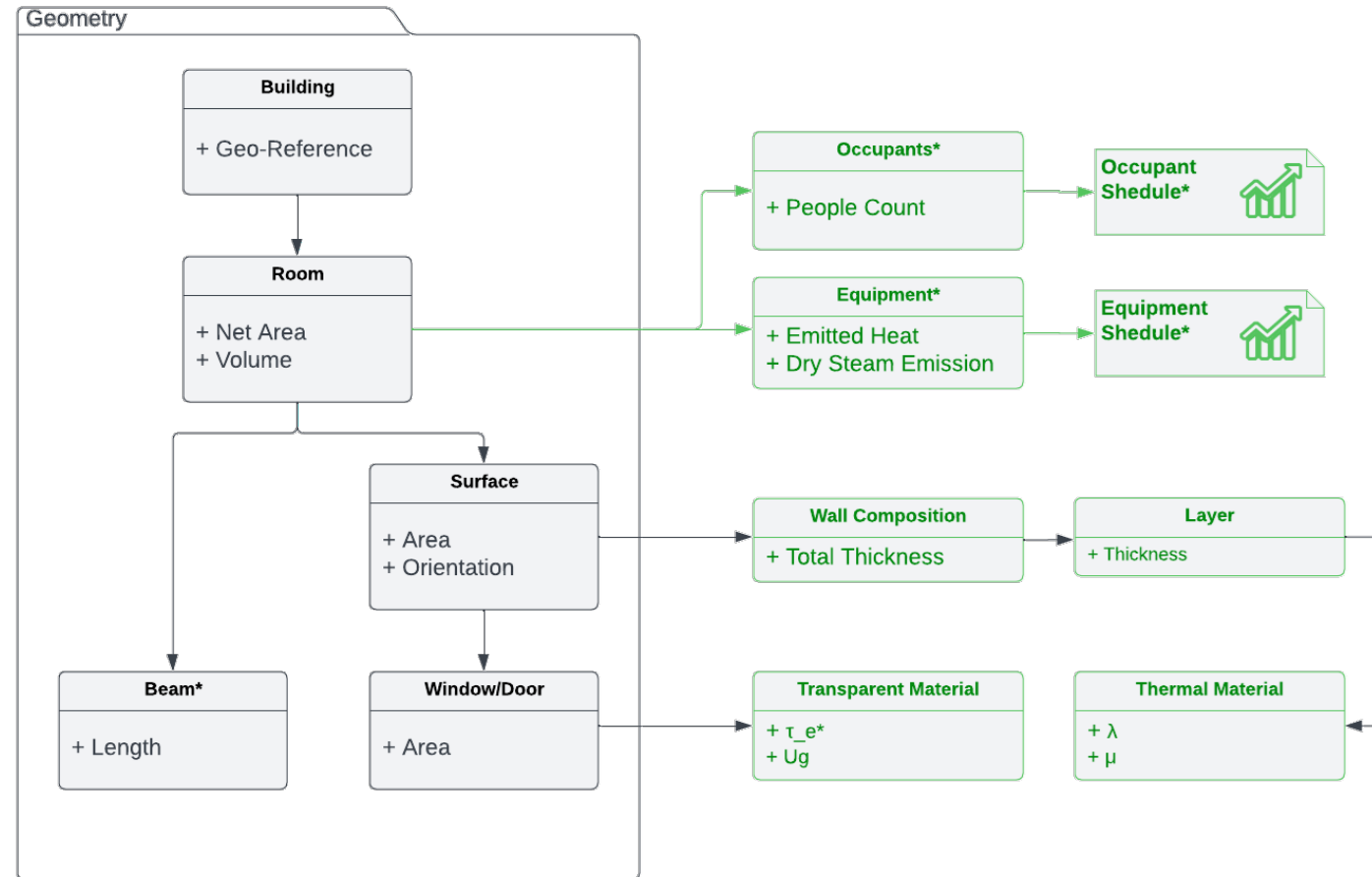
B. Steiner, G. Paskaleva, and T. Bednar, "From conceptual model to detailed geometry," in BauSIM 2024, September 2024

Application – Simulation



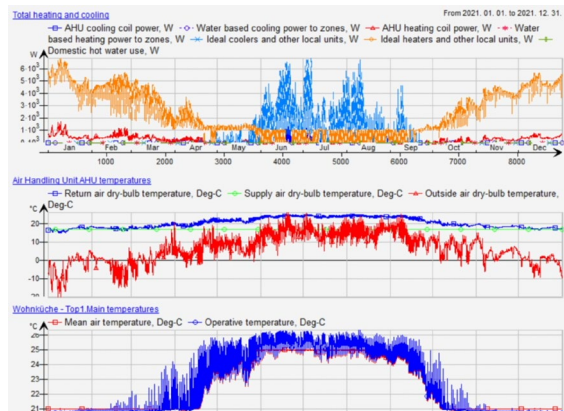
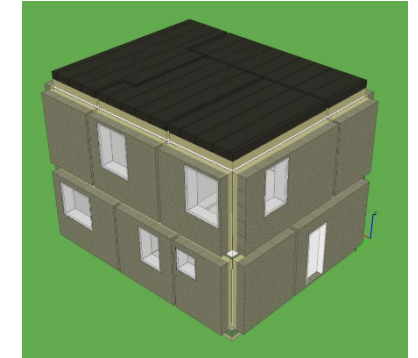
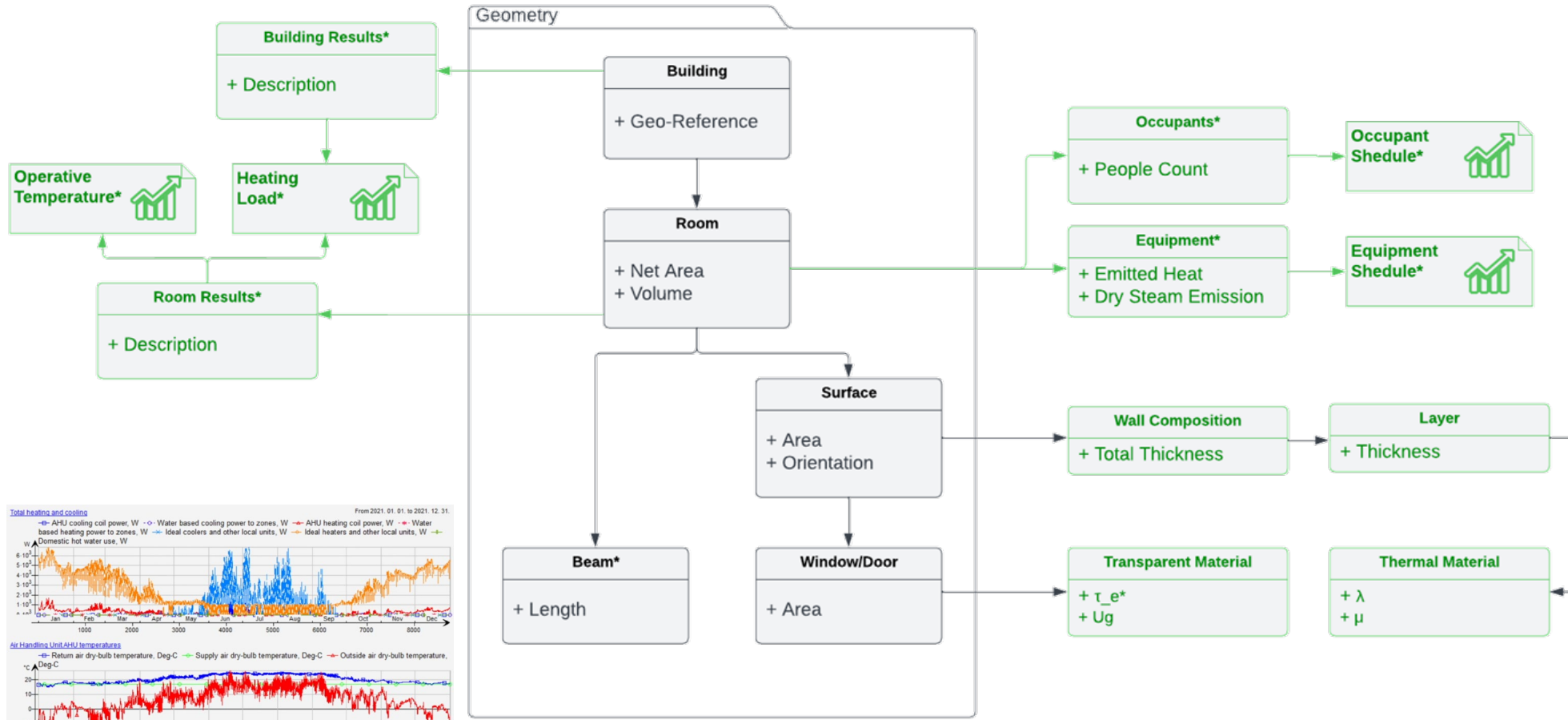
B. Steiner, A. Sarkany, Z. Jarois, G. Paskaleva, T. Bednar, and C. Bauer, “Development of plugins for seamless integration of the simultan meta data model with ida-ice and rfem 6,” in Proc. of the 13th Nordic Symposium on Building Physics (NSB-2023), Aalborg, Denmark, 2023.

Application – Simulation



B. Steiner, A. Sarkany, Z. Jarois, G. Paskaleva, T. Bednar, and C. Bauer, “Development of plugins for seamless integration of the simultan meta data model with ida-ice and rfem 6,” in Proc. of the 13th Nordic Symposium on Building Physics (NSB-2023), Aalborg, Denmark, 2023.

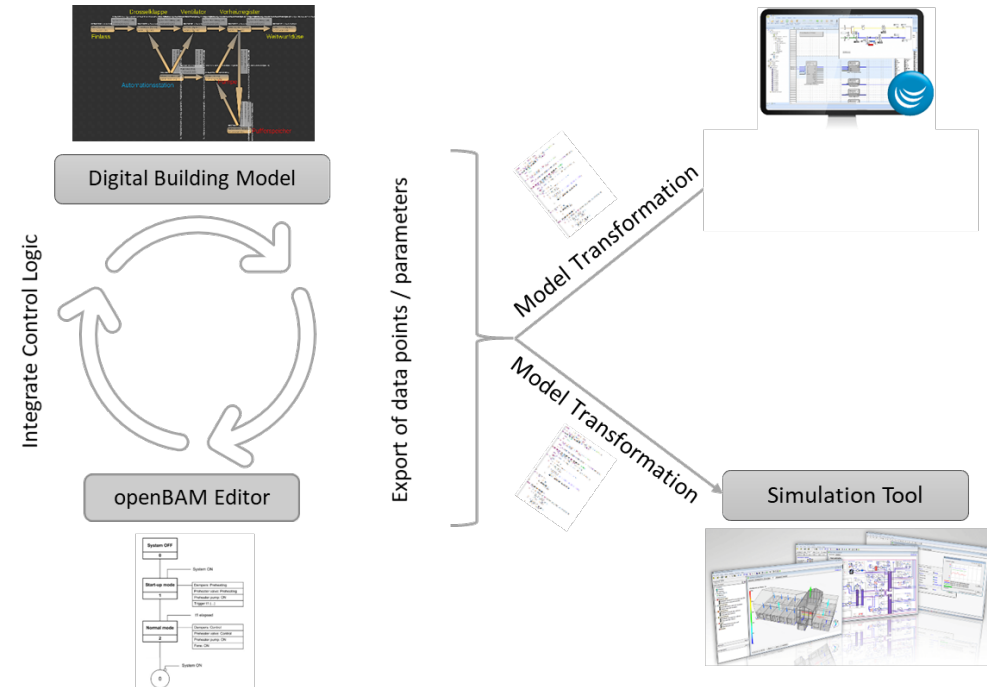
Application – Simulation



B. Steiner, A. Sarkany, Z. Jarois, G. Paskaleva, T. Bednar, and C. Bauer, “Development of plugins for seamless integration of the simultan meta data model with ida-ice and rfem 6,” in Proc. of the 13th Nordic Symposium on Building Physics (NSB-2023), Aalborg, Denmark, 2023.

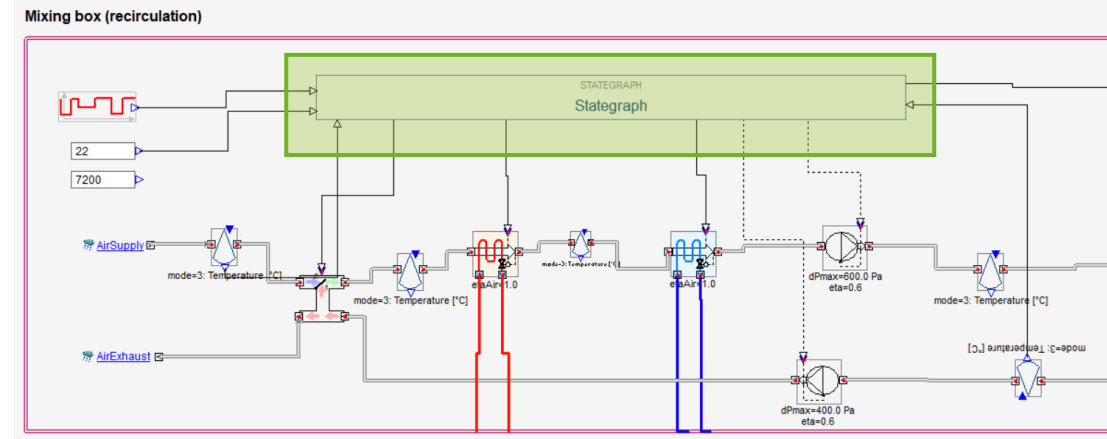
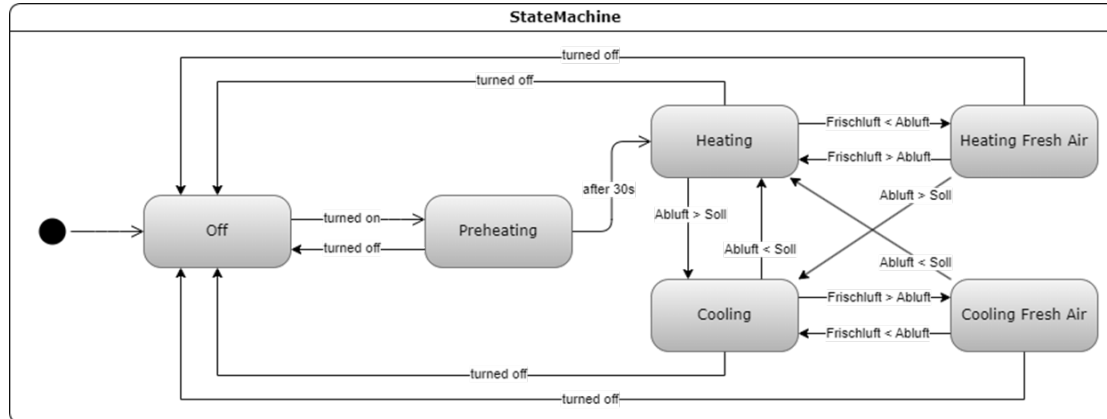
Application – Building Automation

- Building Information Model (BIM)
 - Structure
 - Devices
 - Data Points
 - ...
- I&C Template
 - All datapoints integrated
 - State Machine with start node
- Development of the control logic
 - Model logic
- Model Transformation
 - Direction Simulation Tool
 - Direction Engineering Tool



S. Sint, F. Knorr, J. Pannosch, J. Kromp, and T. Bednar, “Towards open modeling of building automation over the entire building life cycle,” in BauSIM 2024, September 2024

Application – Building Automation



```

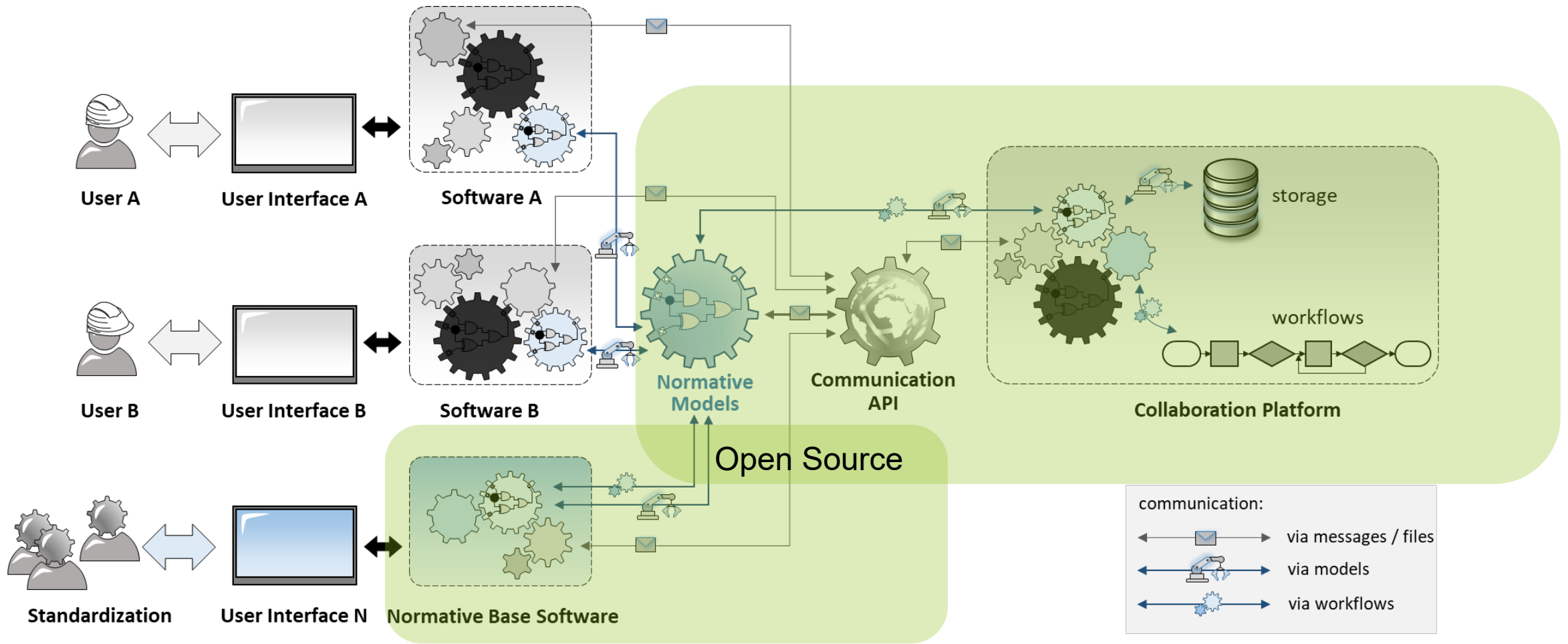
CONTINUOUS_MODEL StateGraph
ABSTRACT "ExtendedUsecase"
EQUATIONS
M021SB01 = IF state == 1 THEN 0 ELSE_IF state == 2 THEN 0 ELSE_IF state
M011SB01 = IF state == 1 THEN 0 ELSE_IF state == 2 THEN 0 ELSE_IF state
Y102YB01 = IF state == 1 THEN 0 ELSE_IF state == 2 THEN 0 ELSE_IF state
SW01XC01 = IF state == 1 THEN 0 ELSE_IF state == 2 THEN 20 ELSE_IF state
SimL_Time := Sim_Time + timeStep;

IF state == 1 THEN
  state := 2;
  timer_value := 0;
ELSE_IF state == 2 AND SW01SB01 == 1 THEN
  state := 3;
  timer_value := 0;
ELSE_IF state == 3 AND SimL_Time > timer_value THEN
  state := 4;
  timer_value := 0;
ELSE_IF state == 3 AND timer_value == 0 THEN
  state := 3;
  timer_value := SimL_Time + pt;
ELSE_IF state == 3 AND SW01SB01 == 0 THEN
  state := 2;
  timer_value := 0;
ELSE_IF state == 4 AND B231ME01 > SW01XC02 THEN
  state := 5;
  timer_value := 0;
ELSE_IF state == 4 AND SW01SB01 == 0 THEN
  state := 2;
  timer_value := 0;
ELSE_IF state == 4 AND B101ME01 > B231ME01 THEN
  state := 6;
  timer_value := 0;
ELSE_IF state == 5 AND B231ME01 < SW01XC02 THEN
  state := 4;
  timer_value := 0;
ELSE_IF state == 5 AND SW01SB01 == 0 THEN
  state := 2;
  timer_value := 0;

```

S. Sint, F. Knorr, J. Pannosch, J. Kromp, and T. Bednar, "Towards open modeling of building automation over the entire building life cycle," in BauSIM 2024, September 2024

Conclusion



If you would like further information, please contact us at

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galina.paskaleva@tuwien.ac.at

<https://github.com/bph-tuwien/SIMULTAN>