Berner Fachhochschule
Haute école spécialisée bernoise
Bern University of Applied Sciences

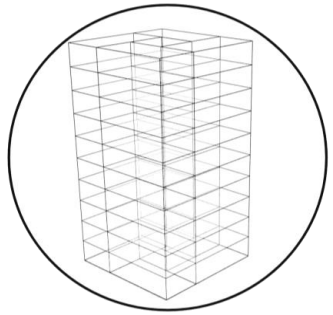
FORUM HOLZBAU INTERNATIONAL
30. November - 2. Dezember 2022

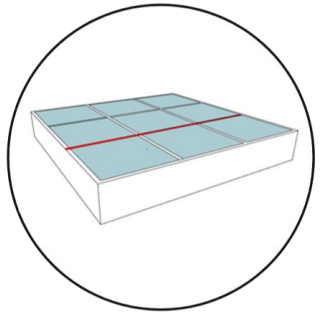
Real-time digital collaboration interphases for timber structure analysis and calculation

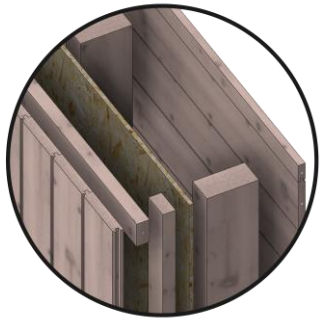
Matias Penrroz

Department of Architecture, Timber & Civil Engineering
Bern University of Applied Sciences

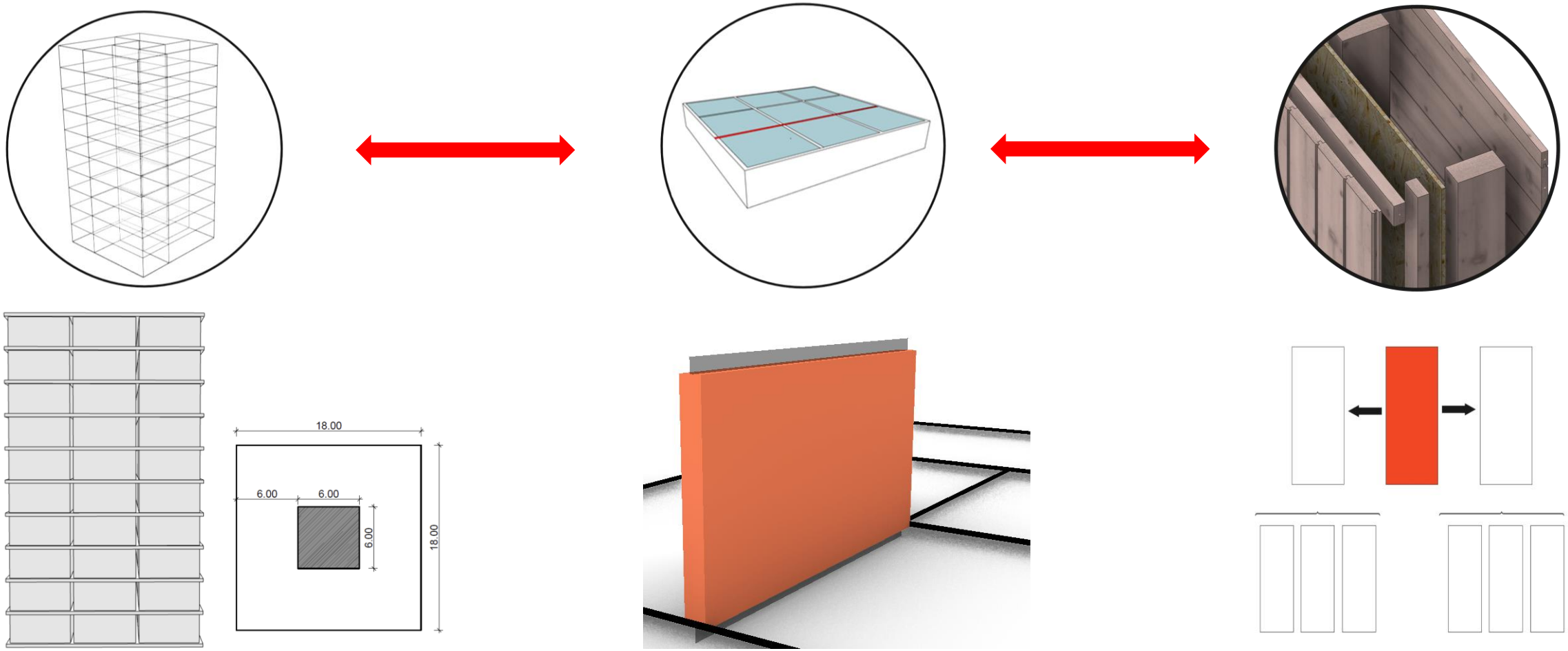
Institute for Digital Economy in the Construction and Wood Industry
IdBH





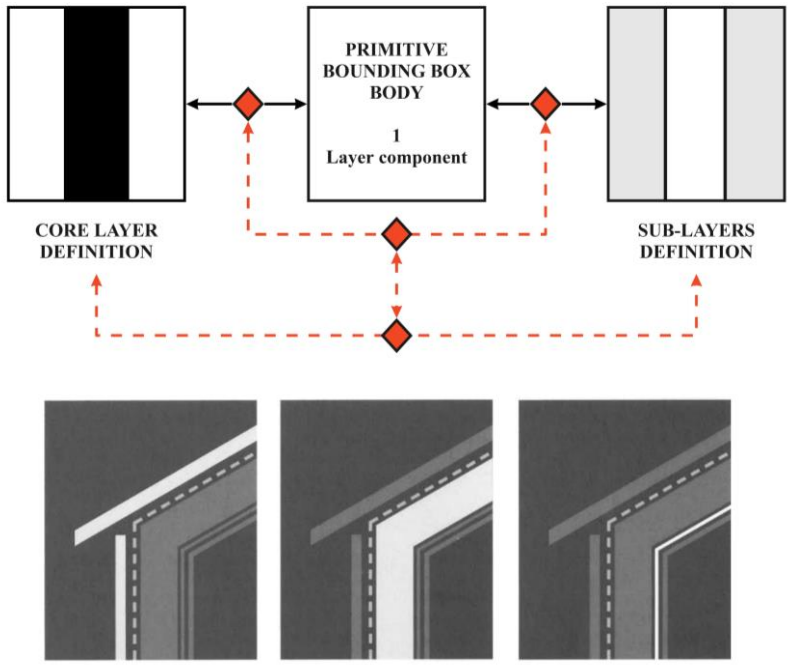


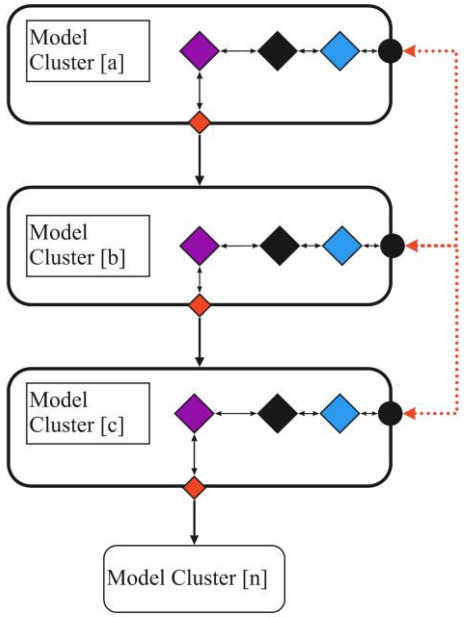
Real-time collaboration

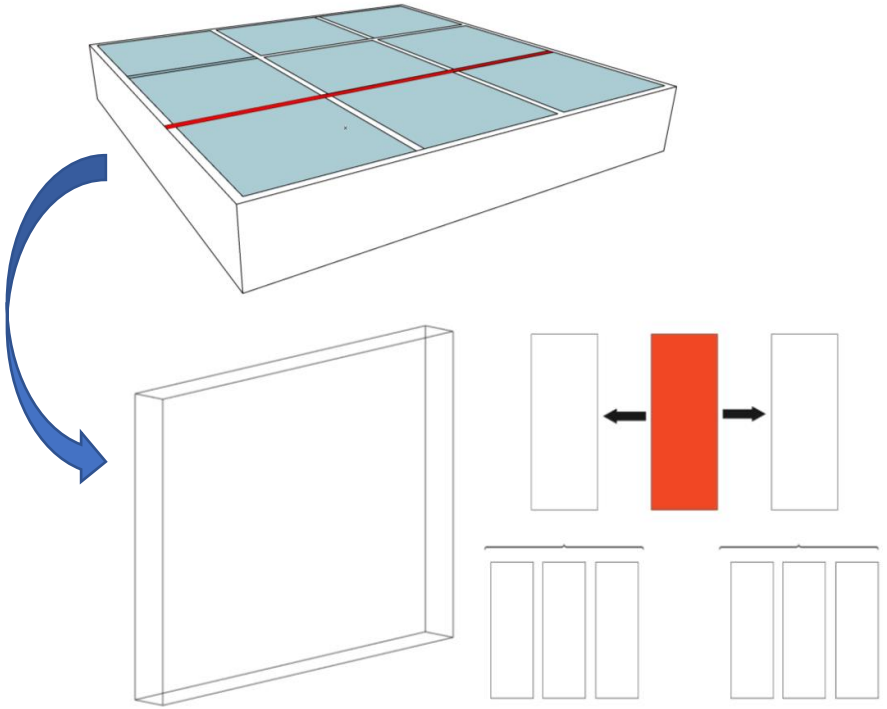


Modularisation in the planning of systems

1. Layering system in timber construction
2. Reference models and their boundaries
3. Traceability of the individual components over the various systems

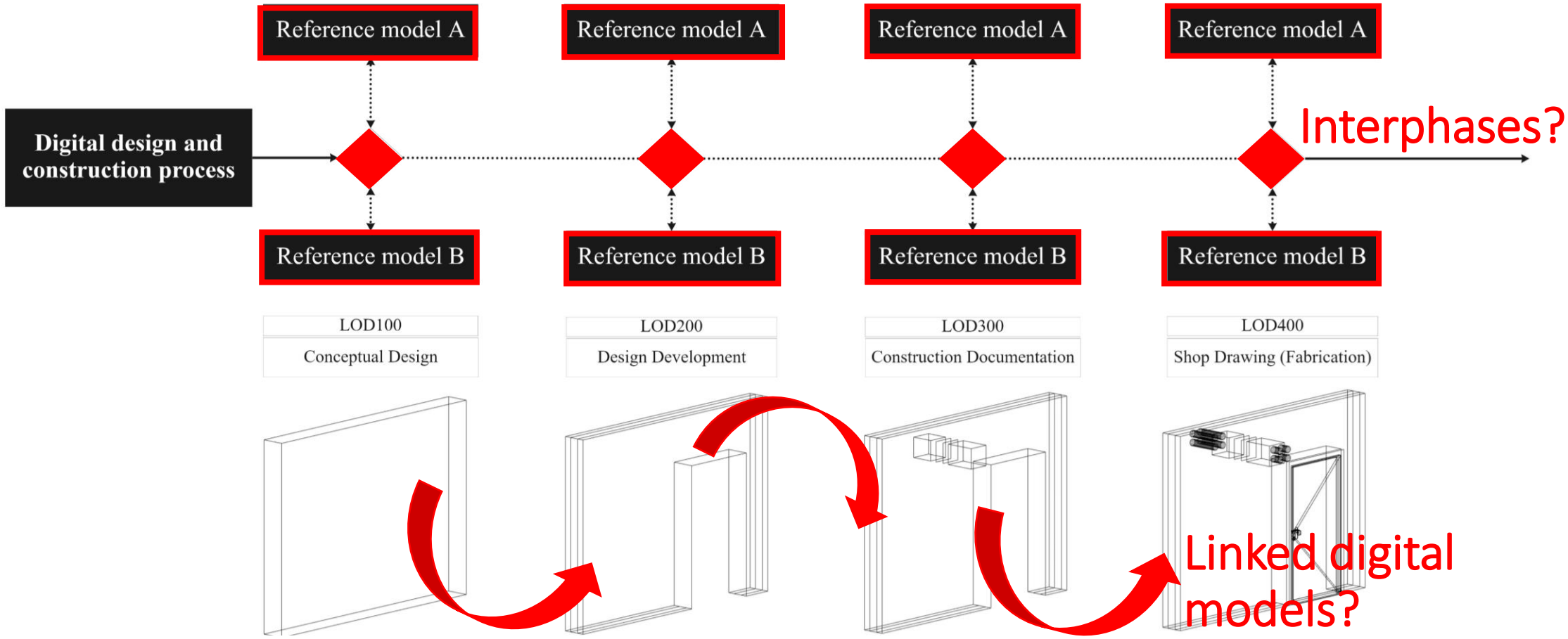






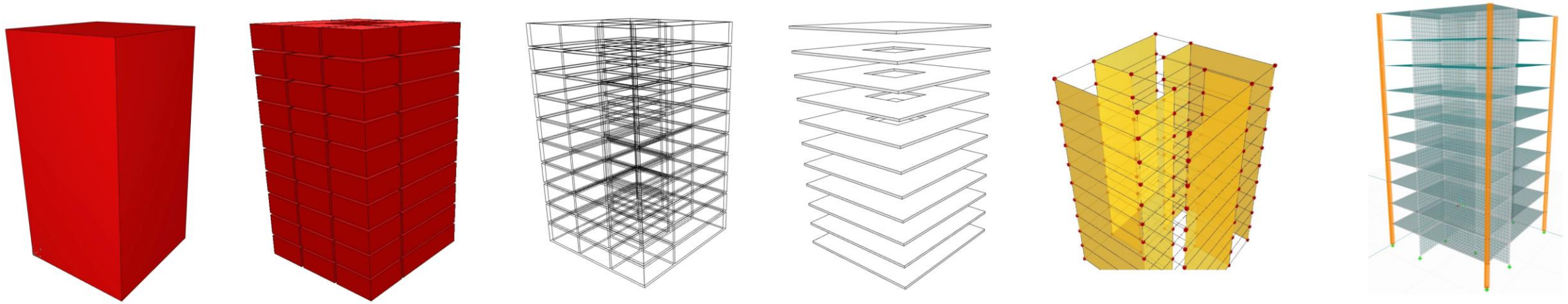
Modularisation in the planning of systems

Definition: Reference models?

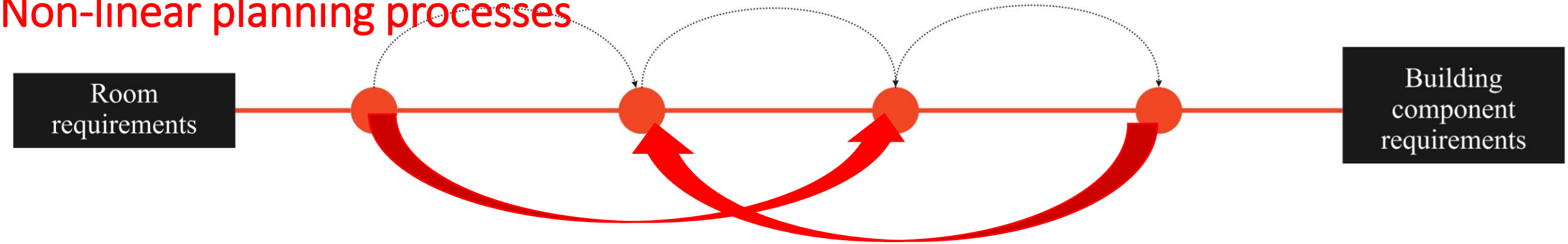


Controlled interphases: Model-based quality gates

Concept :«from the Rough to the smooth»



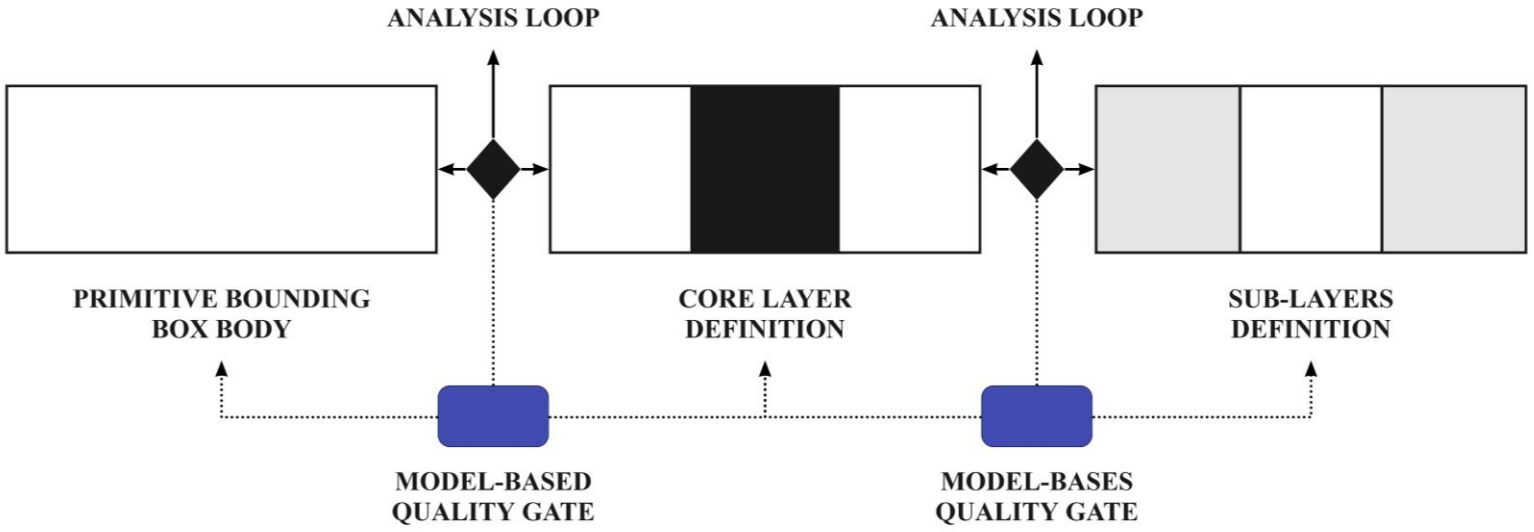
Non-linear planning processes

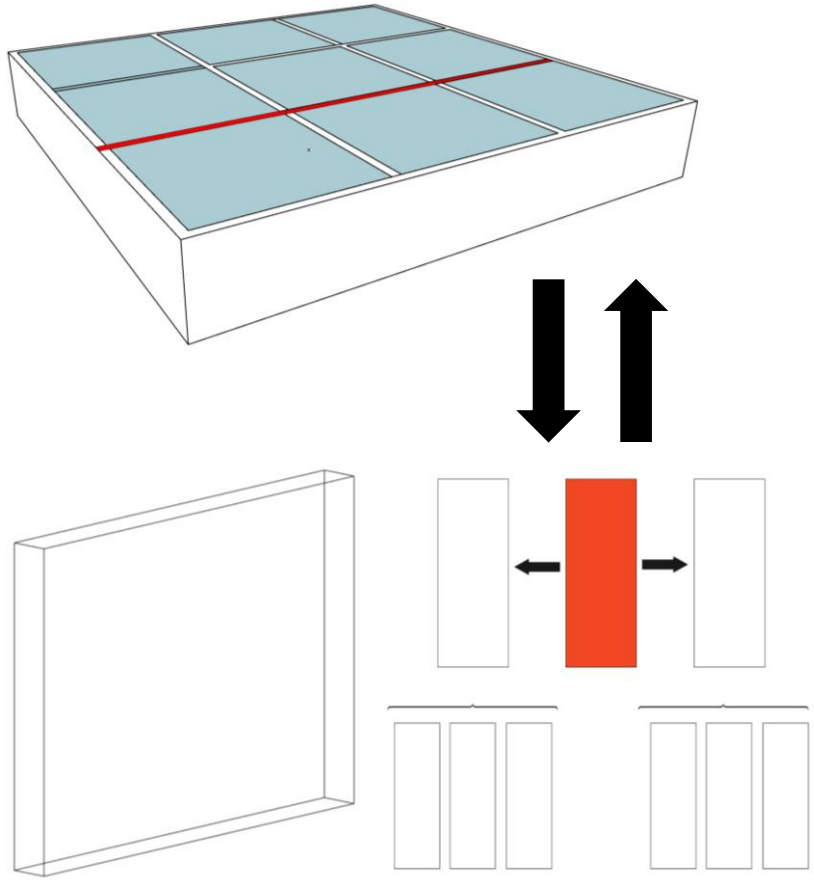


Model-based quality gates

Concept :«from the Rough to the smooth»

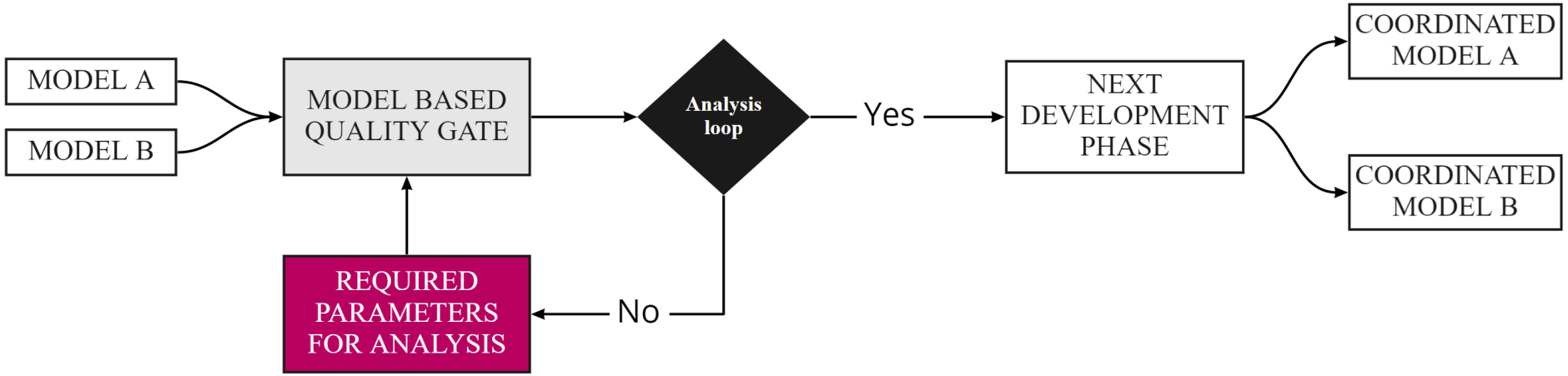
- To filter data from one model to another
- To define reference elements for the construction of models
- To define dependencies and constraints between models





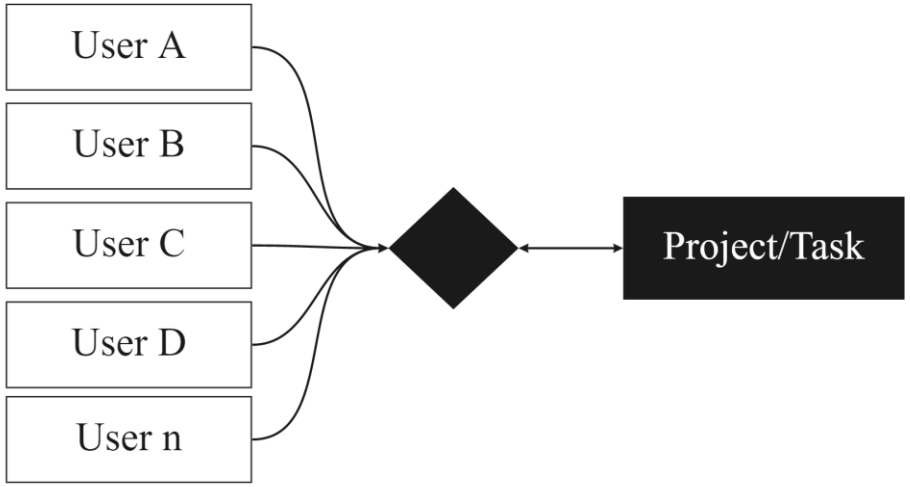
Model-based quality gates

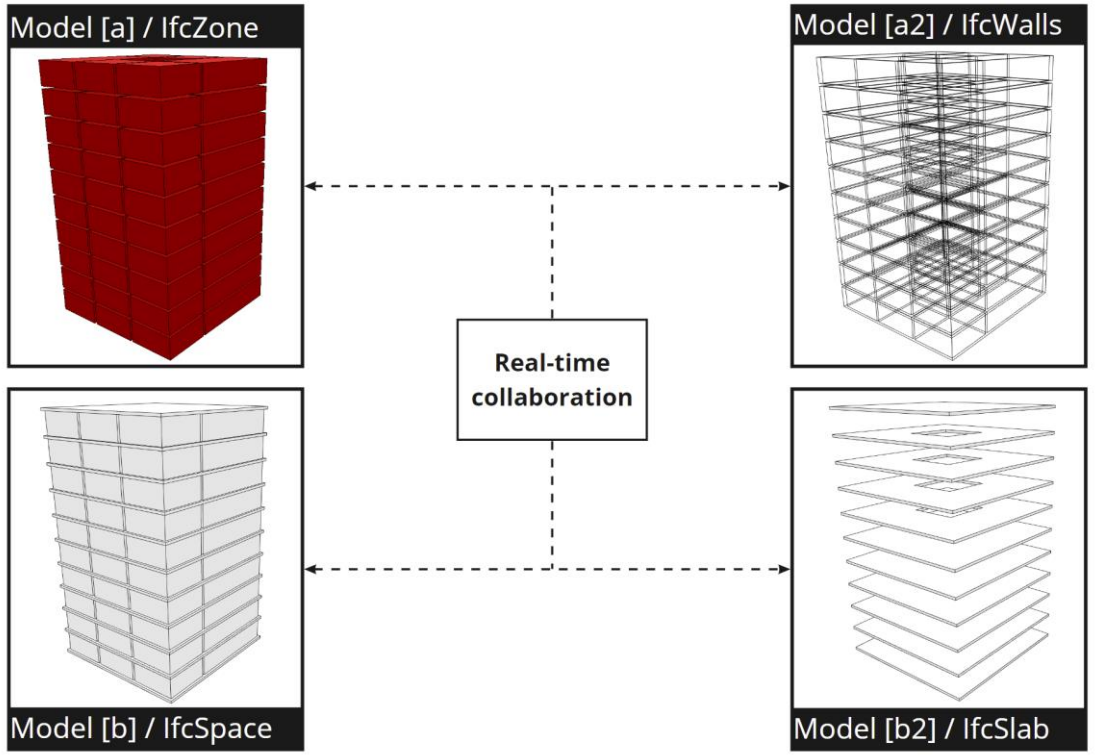
$$\text{Algorithm} = (\underbrace{\text{Semantic}}_{\text{IFC schema}} + \underbrace{\text{Geometry}}_{\text{Geometrical constraints, Dimensional constraints}} + \underbrace{\text{Topology}}_{\text{Spatial relations}})$$



Real-time Interphases

- Modelling purposes
- Definition of spaces and reference systems





Topological models

- Spatial relations between data vessels
- Link non-corresponding classes

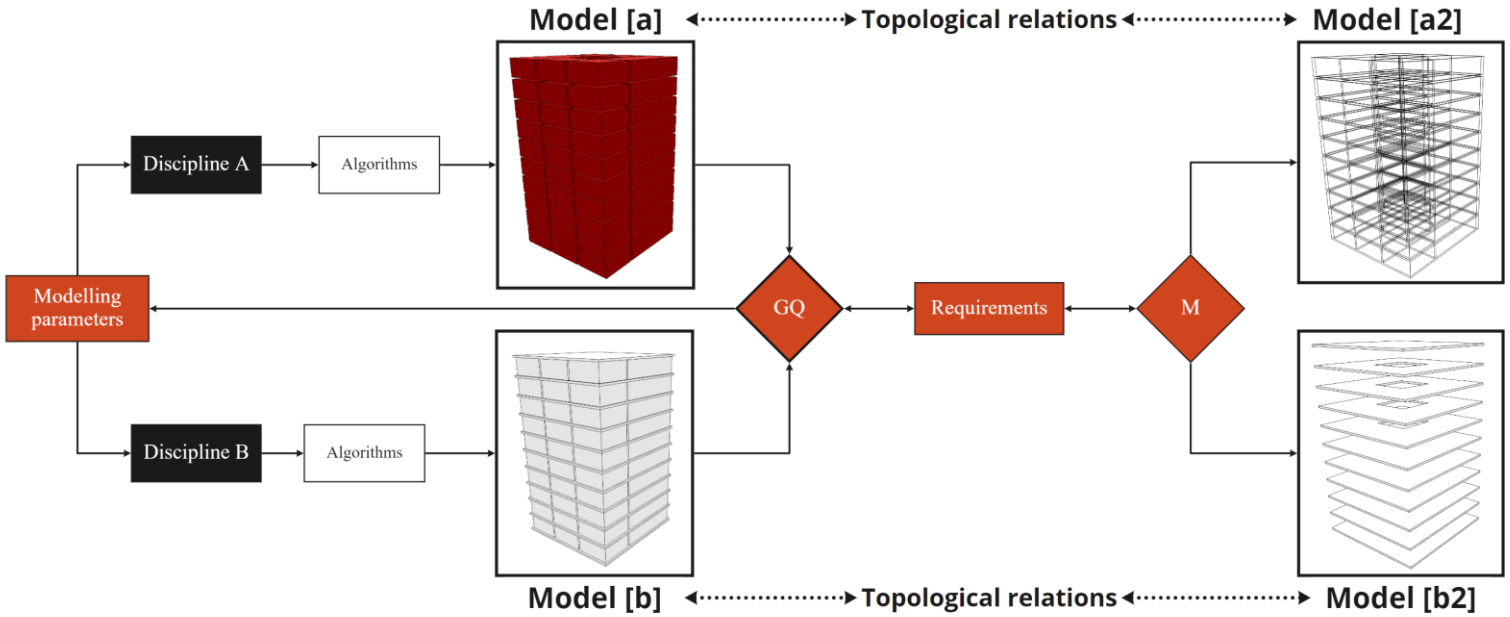
Requirements

Room.A + *Room.B* = *ConstructionComponent*

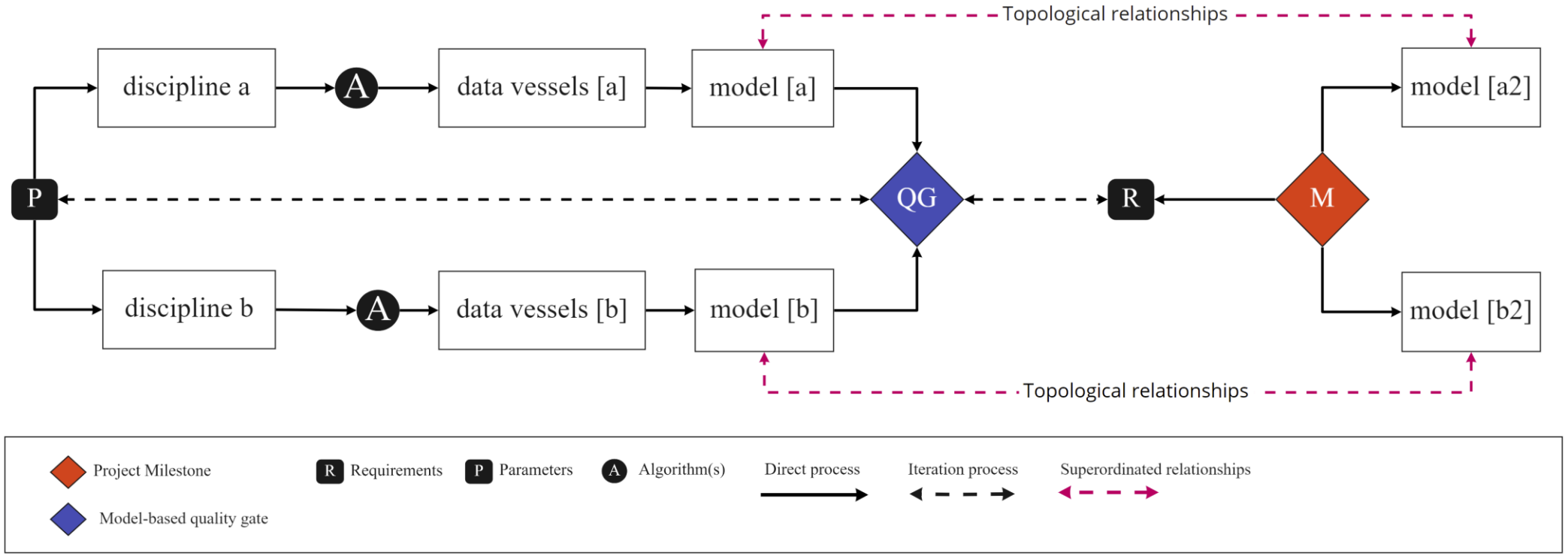
LayerConstruction

ConstructionComponent = *1LayerConstructionComponent*

1LayerConstructionComponent = *L1+L2+L3+... Ln*



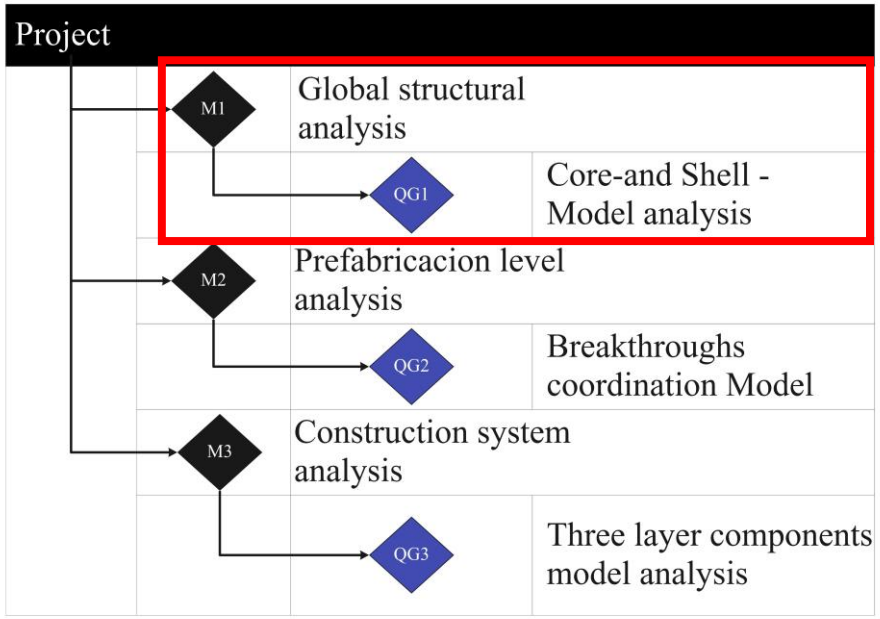
Real-time interphase process flow

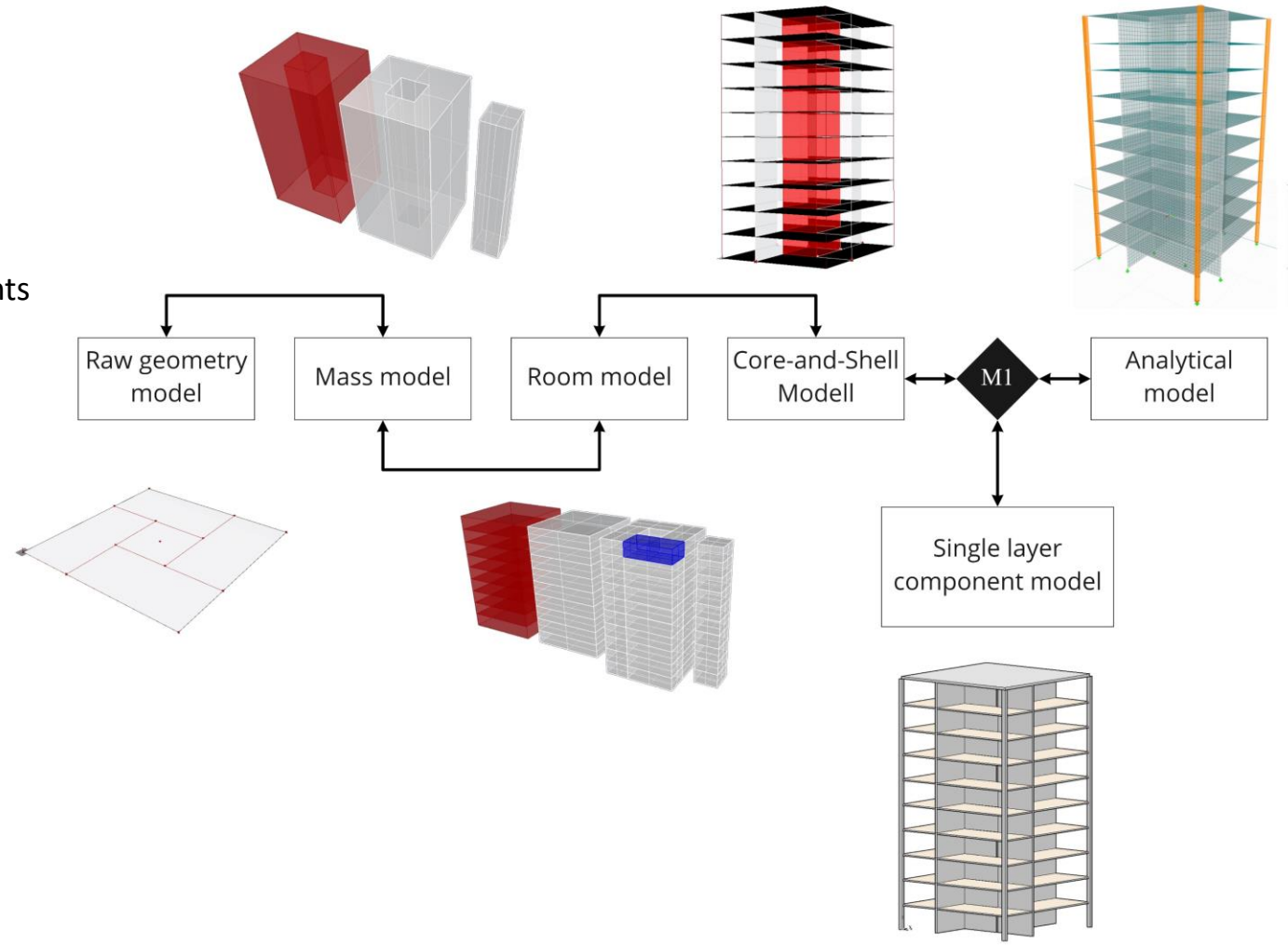


Implementation

Planning the «load-bearing» layer

- 3 Milestones
- 3 Model-based quality gates
- 3 Target models for the coordination of technical requirements



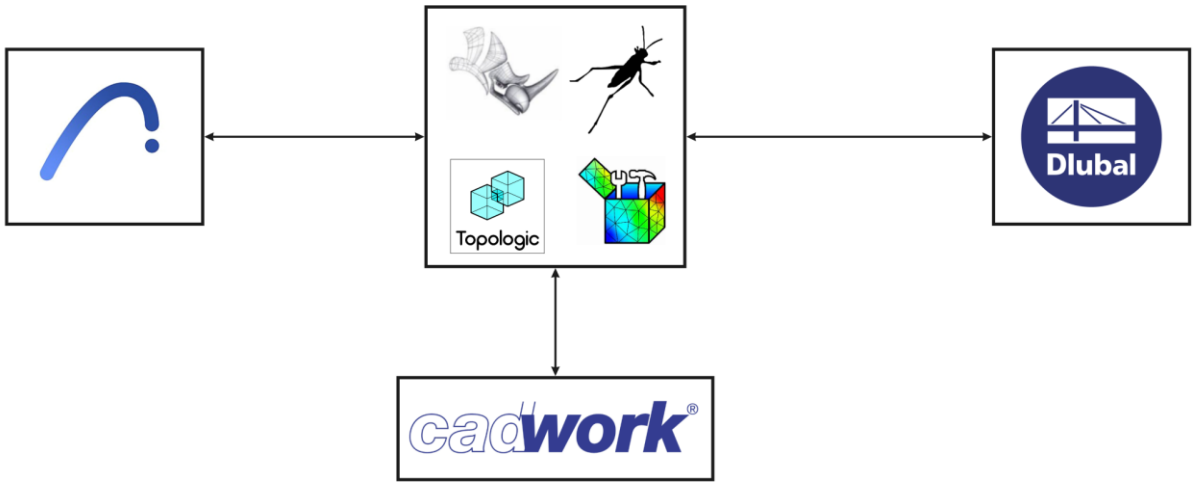


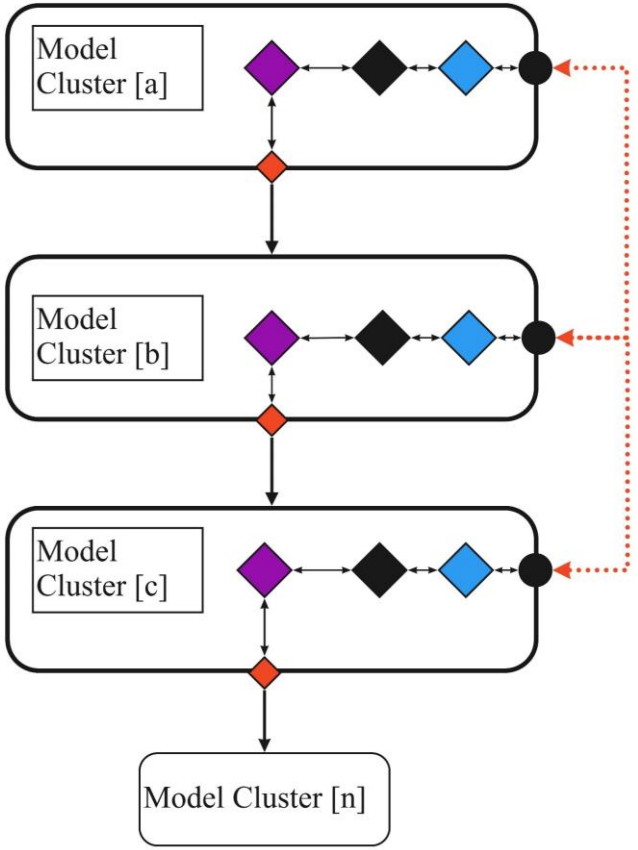
System thinking «cascade effect»

Multi-model cluster

System thinking «cascade effect»

Multi-model cluster

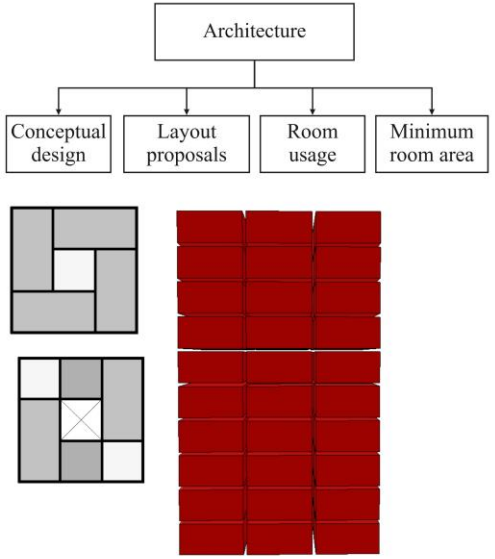


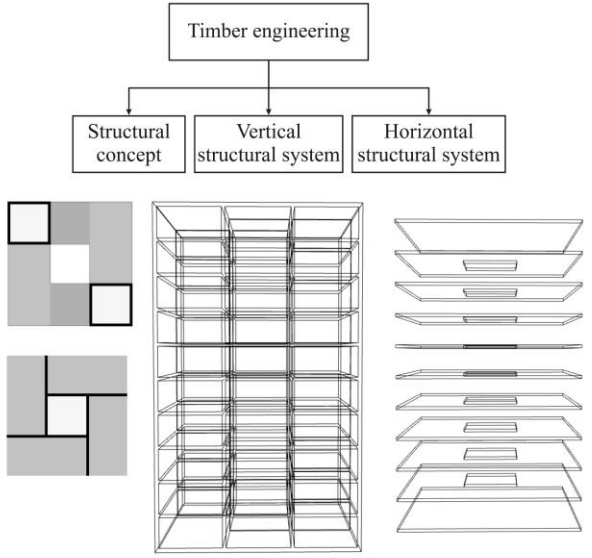


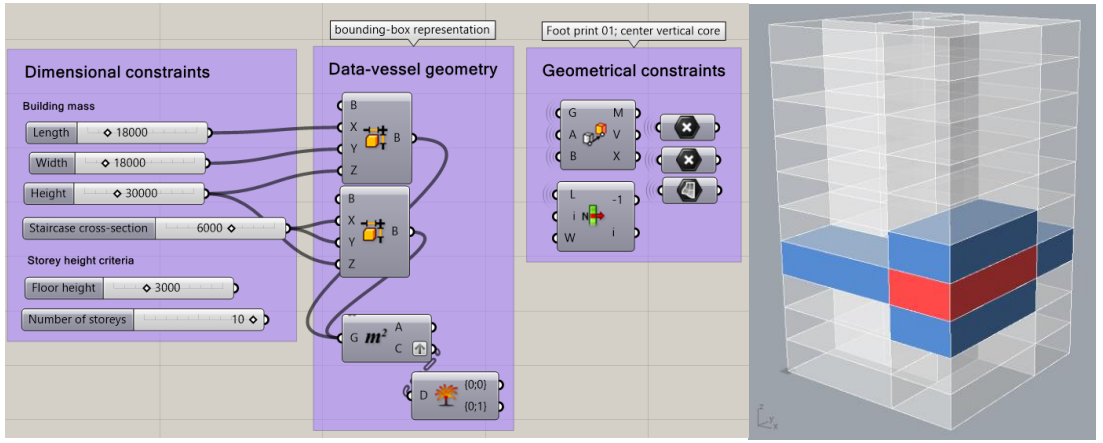
System thinking «cascade effect»

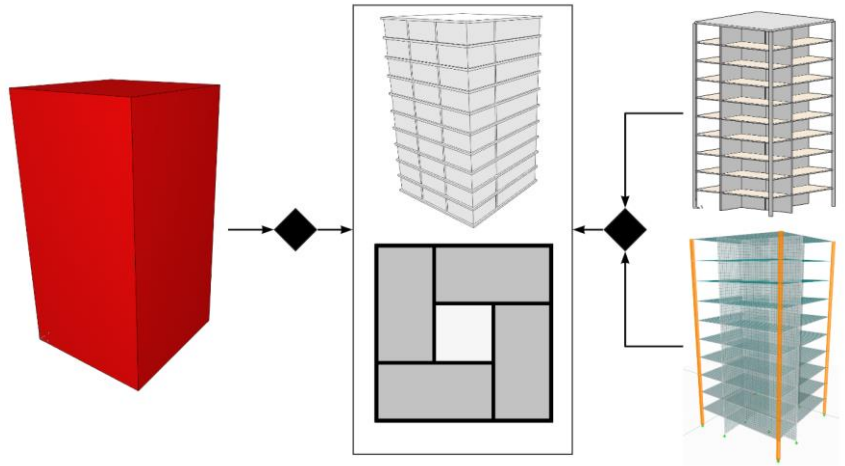
Multi-model cluster

- Input-output criteria for the expected results
- Technical development to achieve the planned milestone
- Abstract IFC classes coexist with concrete IFC classes



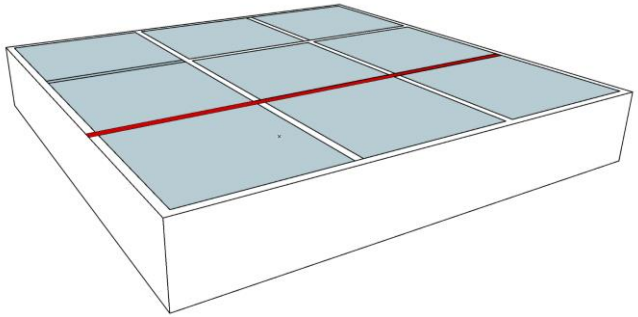


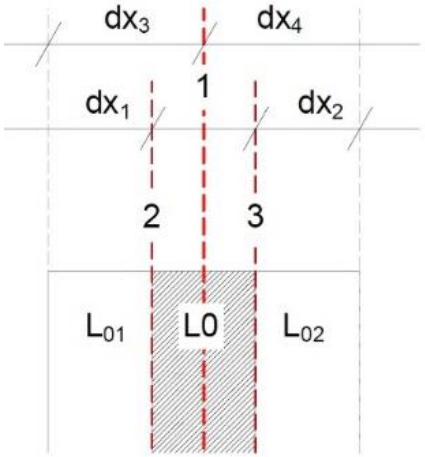


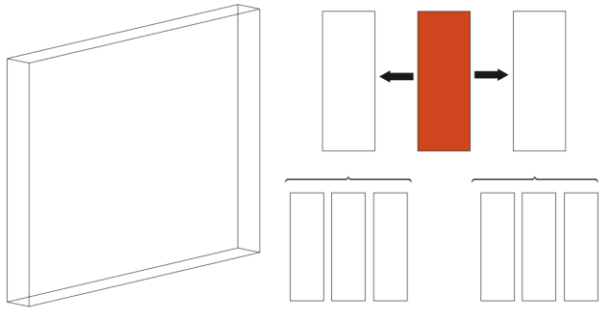


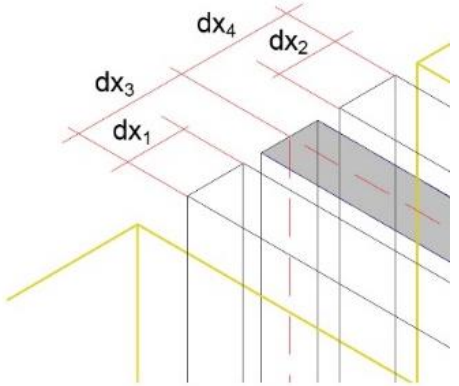
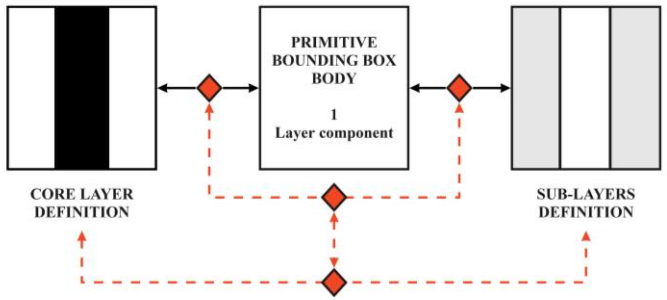
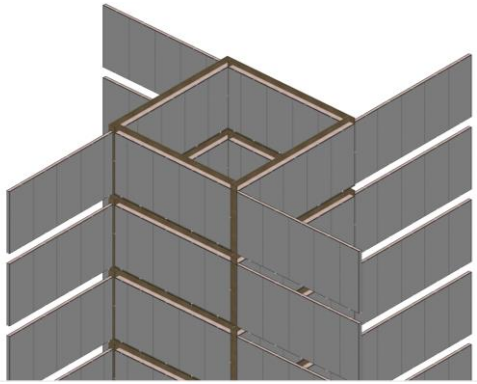
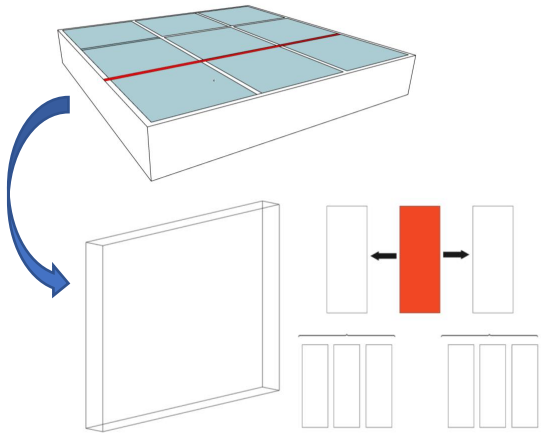
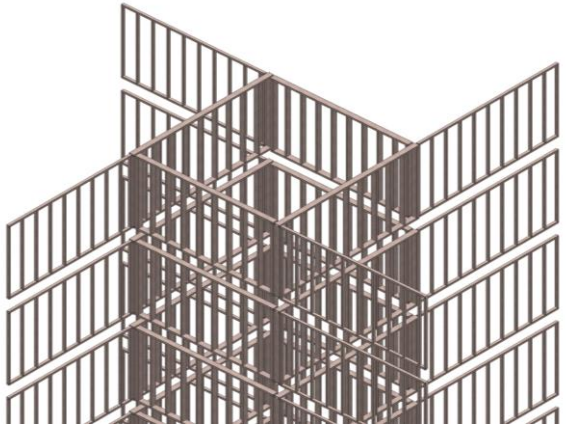
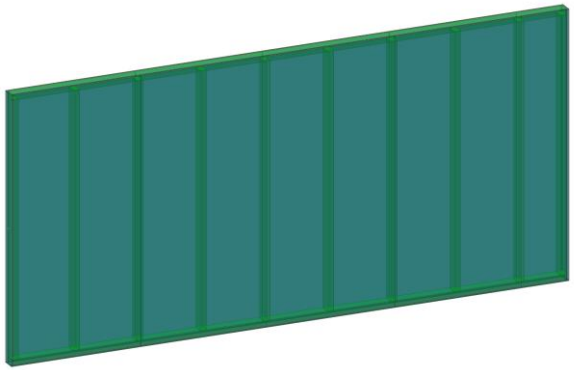
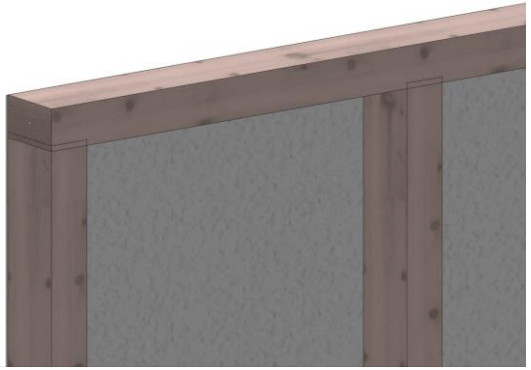
Conclusions

1. Reference and anchoring elementes by data vessels
2. Precision and accuracy achieved by ranges
3. Expansion of the IFC schema by algorithmic modelling









Modularisation in the planning of systems