BIM-Based Generation of Multi-Model Views

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I. Motivation - Why

II. Methodology – Who, When and How

III. Technological Approach – In What Way (Demo)

IV. Conclusions
Motivation: Why BIM-based Multi-Model Views

Architectural BIM (Coordination View)

Design cooperation
Further needed data are mainly document based
Motivation: Why BIM-based Multi-Model Views

Structural View

Further needed data: loads, environment ...
Filtered Structural View
(shear walls for lateral stiffness)
- suitable for FE Analysis -
Motivation: Why BIM-based Multi-Model Views

Filtered Building Envelope (facades) View

Further needed data: Environment, Climate, Data from sensors and actuators (Building Automation)
Motivation: Why BIM-based Multi-Model Views

Fluid dynamics model

Further needed data:
Wind model data,
Detailed material/finishing data
Motivation: Why BIM-based Multi-Model Views

Fluid dynamics model

etc. etc. ... ...
Motivation: Why BIM-based Multi-Model Views

Individual design/construction domains require their own view of BIM

Such views are typically subsets of the full BIM, but augmented with domain-specific model data

People use BIM with different tools and in different ways

In order to support their work, these tools need to be adapted to the specific user requirements and "speak" the specific user language

However, unlike large CAD vendors, specialized AEC software developers often find it too difficult to work with the full IFC model

Key: Multi-Model Views
Methodology: The "classical" IDM/MVD Approach

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1. Exchange Requirement
2. Definition in IDM
3. Model View Definition (MVD)
4. Software implementation and certification
5. Validation & Use in Projects
**Problems:**

IDM / MVD answers quite well the question of "Why" and "How" but it does not completely resolve "Who", "When" and "in what way" should define, implement and use BIM views.

It also doesn’t give answer to questions related to multi-model views.
Support Tools on three levels

I. Modelers
   Subschema generator

II. S/W Developers
   Stand-alone or embedded multi-model view generator

III. Developers & Users
   Web-based or embedded object selection service

Exchange Requirement Definition in IDM
Model View Definition (MVD)
Interface implementation and certification
Extended BIM-related application capabilities
BIM View Validation
Use in Projects
View Edit
- Subschema / View Generation
- Language: Java
- Authors: TU Dresden, Germany & AEC3 Ltd. UK
- Intended users: Modelers

OpenIfcTools (www.openifctools.org)
- IfcViewer, inspector & library for IFC data manipulation in memory
- Language: Java (Eclipse platform)
- Authors: University of Weimar & Hochtief AG, Germany

Multi-Model Framework
- Multi-model view generation and refinement, Multi-model querying and data selection, Flexible addition of filtering mechanisms via plug-ins
- Authors: TU Dresden, Germany
- Intended users: Software developers (SMEs), End users
Case Example

Scenario:
Integrating BIM with data from temperature and humidity sensors for room climate calculations
Technological Approach

Level 1: BIM View Definition
Level 1: BIM View Definition

GMSD Spec: (EXPRESS)
Level 1: BIM View Definition

GMSD Spec: (EXPRESS)

- PartialModelFilter
- QuerySetSelect
- SetOperation
- ObjectSelector
- FeatureUsageTypeEnum
- SelectTypeSelect
- SelectInstances
- SelectInstancesOf
- SelectReferencedEntities
- SelectHasReferenceTo
- Matches $S[1:?]$
Level 1: BIM View Definition

GMSD
Use: ViewEdit
Technological Approach

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Level 1: BIM View Definition
Level 1: BIM View Definition

Defining a subview with the help of **ViewEdit**: Rooms, Walls, Openings, Windows with *some* properties

**Basis**: GMSD Schema
Level 2: Adding Class Level Constraints

Additional view adaptation based on attribute type/value constraints

**Basis:** GMSD Selection Capabilities integrated in the target application or defined externally in advance. 

Uses the already processed View Definition.
Level 3: Object Level Multi-Model Filtering

Load add-on domain models and optionally filter their data

Create a Link Model (BIM - Domain model(s))

Define additional (ad-hoc) filters to query specific multi-model properties or prepare input for a specialised application

Basis: Link Model, Engineering Query Language
Conclusions

- Multi-model view definition is an important prerequisite for the efficient implementation and use of BIM in practice
- The suggested methodology and tools help to better structure and further enhance the model view definition process
- GMSD and ViewEdit can support and accelerate modelers’ work
- OpenIfcTools and our new Multi Model Framework can help developers to implement, validate and put to market specialized BIM-based software faster
- Further refinements needed in several detail issues regarding
  - Performance
  - Functionality
  - Flexibility
  - User interface
  - …
Thank You!