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Abstract Graph-based version control of BIM models in an event-driven collaboration environment

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Interdisciplinary collaboration and communication are two essential aspects of Building 9 Information Modeling (BIM). Current practice and international standards rely on exchanging entire domain models, which are managed as separated files and coordinated 11 in a primarily manual fashion. The concept lacks version control, as the granularity of 12 change tracking remains on the level of complete monolithic files. Hence, high manual 13 effort is necessary to coordinate model modifications across the domains involved in a project. 15

To overcome the limitations addressed, the keynote presents a novel approach that ena-16 bles modification tracking on object level instead of tracking monolithic model files. As 17 BIM models contain not only objects but also various dependencies forming a complex 18 network structure, formalisms of graph theory and graph transformation are applied to 19 identify and deploy model changes in a vendor- and schema-neutral fashion. The com-20 munication among project partners is ultimately implemented using event-driven net-21 work architectures, which provide a flexible means to realize scalable asynchronous col-22 laboration. Once an authoring party reaches a new shareable state of its discipline model, 23 an update event is raised and deployed through a central project hub. Each event contains 24 a set of transformation rules and additional information relevant to project management 25 purposes. Applying the transformations to an outdated model copy, concurrency among 26 all existing replicas of a particular discipline model is obtained again. As a key advantage, 27 the updates are much smaller compared to repeatedly exchanging entire BIM models. 28 Furthermore, the approach provides a responsive and scalable system where each design 29 unit can subscribe to specific events like modifications of specific object types or models 30 of a particular discipline. Finally, the approach fits into existing standards of model-based 31 collaboration such as ISO 19650 or the concept of Information Containers for linked Doc-32 ument Delivery (ICDD) defined in ISO 21597. 33

The application of the proposed collaboration environment is demonstrated using BIM 34 models implementing the Industry Foundation Classes (IFC) as their underlying data 35 model. 36

References

Esser, S., Vilgertshofer, S., & Borrmann, A. (2021). Graph-based version control for asyn-
chronous BIM level 3 collaboration. EG-ICE 2021 Workshop on Intelligent Computing in
Engineering, 98–107. https://doi.org/10.14279/depositonce-120213840

Esser, S., Abualdenien, J., Vilgertshofer, S., & Borrmann, A. (2022). Requirements for41event-driven architectures in open BIM collaboration. 29th International Workshop on In-42telligent Computing in Engineering.43

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