The MULTI Collaborative Comparison Challenge

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***Abstract*—The Collaborative Comparison Challenge aims at fostering communication and collaboration between researchers within the community, with a potential view to homogenizing multi-level modeling. The challenge invites researchers working on different multi-level modeling approaches to contrast their respective approaches with each other by writing a joint paper that applies their approaches on the same domain example. The joint work should focus on elaborating the commonalities and differences between the approaches' foundational concepts rather than realization details.**

I. Introduction

Multi-level modeling addresses the modeling of subject domains that benefit from an explicit recognition of multiple levels of domain representation, such as software development, process modeling, capturing organizational roles, biological taxonomies, product hierarchies, and so on. Over the span of two decades many approaches for multi-level modeling have been proposed, all sharing the goal of extending traditional two-level approaches with constructs and concepts that naturally support multiple levels of domain representation, with the goal to increase model expressiveness while simultaneously reducing model complexity.

Numerous advances in multi-level modeling approaches and tools have, however, lead to a proliferation of available approaches, thus displaying a lack of consensus on what kinds of constructs and concepts provide the best support for multi-level modeling. In part, differences are owed to different application targets or different prioritizations of desirable model properties, yet not all existing differences can necessarily be motivated in this manner. Some differences at both foundational and realization levels may be perfectly justifiable while others may be reconcilable without diminishing effects. One of the most fundamental differences between various multi-level modeling approaches concerns the conceptualisation of levels. For instance, level-adjuvant approaches significantly differ in the way they utilise levels compared to level-blind approaches, and multi-level modelling approaches even differ regarding the abstraction principle used to separate levels from each other.

The respective lack of a common basis for multi-level modeling principles makes it challenging to compare and integrate models constructed using different approaches. While plurality undoubtedly has undisputed advantages, and should be welcomed in general, it can also lead to an unnecessary fragmentation of efforts, contribute to the confusion of interested parties, and thus become an obstacle to the advancement of multi-level modeling.

The Collaborative Comparison Challenge aims towards increasing communication between multi-level modeling researchers by encouraging collaborations which may justify and thus clarify the need for existing differences, or, alternatively, lead towards homogenizing multi-level modeling. Previous MULTI challenges (the 2017 Bicycle Challenge [1] and the 2019 Process Challenge [2]) already invited researchers to demonstrate their approaches by addressing a set of requirements in a given domain and thus represented essential first steps towards the benchmarking of various approaches.

However, since these challenges only focused on a single approach respectively and did not specifically encourage the contrasting of approaches beyond regular related work discussions, their value in contrasting approaches and fostering a dialogue between researchers was limited. For this reason, the Collaborative Comparison Challenge specifically requires the application of two or more approaches to one domain example and mandates the discussion of commonalities and differences between the approaches in a joint paper authored by proponents of different multi-level modeling approaches.

Commonalities and differences should be discussed as they manifest themselves in the treatment of the domain example but also at a more general level. Respective discussion subjects which authors may choose to elaborate on include, but are not limited to, fundamental concepts such as the nature of levels, cross-level relationships, classification vs generalization, deep characterization, the treatment of attributes and operations, and the use of structural and behavioral constraints.

Discussions should seek to explore justifications for, and/or potential reconciliations of, fundamental differences rather than surface-level realization choices. An optional avenue towards contributing to the clarification of differences is the formalization of foundational concepts, thereby possibly discovering open questions and/or potential for unification.

II. Case description

The domain example to be tackled in the Collaborative Comparison Challenge requires the representation of companies, their factories, and devices produced by these factories. Companies own both factories and (intellectual rights to) device models. A factory supports a list of device models, and can only produce devices that conforms to (are of) a device model they support. More specifically, a mobile phone factory produces mobile phones, and mobile phones only. A mobile phone is a device, it has an IMEI number (string)

and conforms to a mobile phone model (which itself is a device model). Mobile phone models allow specific RAM size options (e.g. 2GB or 4GB). Huawei mobile phone factories are owned by the company Huawei. These factories only produce mobile phones conforming to mobile phone models owned by Huawei. The IMEI number of such phones always starts with '001'. Moreover, for purposes of quality assurance, Huawei factories keep track of devices produced by them. Factory124 is a Huawei factory that supports producing model S400 and model S500 devices which are models owned by Huawei. Devices of the S400 model either have 4GB or 8GB of RAM. So far, the factory has only produced two devices: mobile phone S400_0001 and mobile phone S400_0002. Both phones conform to the S400 mobile model. S400_0001 has 4GBs of RAM, its IMEI is '001468723648726', while S400_0002 has 8GBs of RAM, and its IMEI is '0018768768475638'.

The following glossary summarizes the case description and provides hierarchical labels which challenge respondents are encouraged to refer to, when discussing the fulfillment of requirements.

1) A company
   a) has a name
   b) owns factories
   c) owns device models
2) Huawei
   a) is a company
   b) owns Factory124
   c) owns the mobile phone models S400 and S500
3) A factory
   a) produces devices
   b) supports a list of device models
   c) can only produce devices that conform to (are of) supported device models
4) A device
   a) conforms to a device model
5) A device model
   a) captures what is universal about the devices it describes
6) A mobile phone model
   a) allows specific RAM size options
   b) is a device model
7) A mobile phone device
   a) conforms to a mobile phone model
   b) has an IMEI
   c) has a RAM size
8) A mobile phone factory
   a) supports mobile phone models only
9) A Huawei mobile factory
   a) supports Huawei mobile phone models only
   b) keeps track of mobile phone devices it produced
   c) constrains the IMEI of the mobile phone devices produced by the factory to start with '001'
10) Factory124
    a) is a factory
    b) supports Huawei S400 and S500 mobile phone models
    c) produced two S400 devices (S400_0001, S400_0002)
11) S400
    a) is a mobile phone model
    b) has either 4GB or 8GB of RAM
12) S400_0001
    a) is a mobile phone device
    b) conforms to the S400 model
    c) has 4GBs of RAM
    d) has '001468723648726' as its IMEI
13) S400_0002
    a) is a mobile phone device
    b) conforms to the S400 model
    c) has 8GBs of RAM
    d) has '0018768768475638' as its IMEI

III. Presentation requirements

Papers should be submitted with the subtitle: "A contribution to the MULTI 2021 collaboration challenge". The paper contents should comprise:

1) a short characterization of the approaches.
2) solutions of the domain challenge, one for each approach respectively
3) an analysis of commonalities and differences between the approaches, focusing on fundamental concerns.
4) conclusions that could elaborate on the discovery of necessary differences and/or reconciliation potential.

The focus should not be on modeling the domain example, but rather on utilizing the domain example to contrast the approaches with each other. Therefore, although recommended, it is not mandatory to cover all requirements of the modeling challenge. The main acceptance criterion will be whether the submission furthers the clarification of necessary differences and/or highlights opportunities for homogenization.

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References

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