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May 16, 2023

Prof. Miroslaw Staron
Editor-in-Chief
Information and Software Technology

Dear Prof. Miroslaw Staron,

We are pleased to submit our revised paper, “AGL: Incorporating Behavioral Aspects into Domain-Driven Design” (INFSOF-D-22-00490R1), for publication in Information and Software Technology. We appreciate the time and effort dedicated by the editorial staff and reviewers. The comments provided were valuable and helped us refine our paper. Below are our point-by-point responses to the reviewers’ comments.

Thank you very much!

Sincerely,

Duc-Hanh Dang

Response to Reviewers

General comments

The editor and the reviewers have examined the submission. Their general opinion is that after a revision addressing the reviewer's comments and after performing another round of peer evaluation, the manuscript could form a valuable contribution to the Journal.

1. Response to Reviewer #3

1.1. Summary

In this new version, the authors answered to most of my remarks.

- There are too many writing errors, making the paper unnecessarily hard to read.
- Sections 7 and 8 still need to improved, despite the changes.

1.2. Section 7

Q1. Section 7 is much better now, but it still lacks some technical details. Two of my questions remain unanswered:
- How annotations are inserted into Java or C# code?
- What is the input format?

Response: *We have made revisions to the paper in order to provide further clarity on the aspects related to the two questions. Firstly, we describe the specification of a unified domain model as the input of our method. This unified domain model, which is detailed in Section 7.2 (page 18), comprises a combination of the DCSL unified model and the AGL specification, both of which are encoded in Java. In our upcoming work, we intend to create transformations that allow us to derive the DCSL/AGL specifications from UML diagrams as input. Additionally, we acknowledge the need to improve these definitions for greater clarity: a unified class model (Definition 1, page 7), a DCSL unified model (Definition 2, page 8), and a unified domain model (Definition 7, page 15).*

Secondly, we elaborate in Section 7.2 (page 20, the last paragraph) on the implementation of AGL and its annotations in Java.

1.3. Section 8

Section 8 was also improved, I appreciate that the research questions are clearly stated. However, it is confusing at some points:
Q2. First, why do you separate the UML activity diagram from the UML class diagram? They represent the same model and are strongly connected to each other. Moreover, you say that "it lacks a mechanism to compose the behavioral diagrams with other structural diagrams", which is not true, since all UML diagrams are linked. Maybe I misunderstand the meaning of "mechanism to compose".

Response: *We concur with the reviewer's observation that there should be a connection and consistency between the UML Activity diagram and the UML Class diagram. It is important to note that all UML diagrams used to model the underlying system must be integrated and coherent. We have revised the underlying paragraph (page 22, line 8) to make it clear the point the reviewer mentioned: "Although the UML Activity diagram can be utilized to implement the final DDD pattern, it requires additional mechanisms such as fUML [34] and OCL [7] to obtain an integrated semantic model of the behavioral and structural diagrams (one of which represents the domain model)."*

Q3. Second, Table 3B should be better explained. For instance, you explain that ApacheIsis supports 4 out of 8 properties of the domain field pattern, but you do not explain these properties and neither why ApacheIsis cannot represent them. You should provide examples of each language to illustrate your claims.

Response: *We have revised the paper to provide a more detailed explanation of Table 3B. Specifically, as the reviewer's suggestion, we have listed the essential properties w.r.t. the meta-attributes DAttr and DAssoc in order to clarify the values presented in Table 3B. Due to the limited space of this paper, examples for each language to illustrate our claims, as well as a detailed explanation of the annotations of the languages ApacheIsis[1] and OpenXava[2] are provided in the accompanying technical report [27].*

1.4. Other remarks

In section 2.4, you explain that you need a mechanism "to maintain consistency between the two models". Which models?

Response: *We have revised the paragraph in question (page 6, line 7) to clarify the aforementioned point: "To create an executable version of the software, we need to integrate domain behavior with the essential domain model depicted in Figure 3. Currently, this domain*

[1] https://svn.apache.org/repos/infra/websites/production/isis/content/guides/rg.html
[2] https://www.openxava.org/OpenXavaDoc/docs/annotations_en.html

behavior is represented in UML, which requires us to adopt a mechanism for ensuring consistency between the behavioral model and the essential domain model, typically at the implementation level."

In section 6.1, you talk about "UML activity graph requirements". Could you be more precise about this requirements? In this same section, you explain that "variable is an alternative to object flows". Could you explain?

Response: *We have addressed the reviewer's points by updating Section 6.1 (page 16). We have clarified that the term "UML activity graph requirements" refers specifically to the requirements for Activity as explained in [5, p. 373]. The revision is as follows:*

"We define the AGL's domain requirements by applying inclusion (I), exclusion (X), and restriction (R) clauses to the UML activity requirements as detailed in [5, p. 373]. Specifically, the following clauses apply:

- *(I1) a module action, as discussed in Section 4, is a special form of action [5, p. 441];*
- *(R1) each executable node [5, p. 403] performs a sequence of module actions;*
- *(X1) using a variable with activity [5, p. 377];*
- *(X2) using variable actions [5, p. 469].*

I1 and R1 are necessary to integrate the activity graph into MOSA. X1 and X2 exclude variable usage, which is an alternative to object flow, the primary means for moving data in UML activities [5, p. 377]. The AGL activity model captures current system state by directly referencing the unified class model, instead of using object flow."

Note that clauses X3 (which excluded guards from activity edges [5, p. 373]) and R2 (which restricted value specification [5, p. 374] to decision nodes) have been removed in this revised version of the paper. In the previous version, we had intended to apply these clauses so that the guard condition of a decision node could be checked by a method of a Java abstract class called "Decision". However, we have since found that this approach is not necessary, and have therefore removed these clauses.

== Minor remarks

- "work" is an uncountable noun, like "software" or "information".

=== Introduction

- "which both thoroughly captures" -> "which thoroughly captures"
- "Recent works in DDD [2, 3] proposed annotation-based"
  -> "Recent work in DDD [2, 3] propose annotation-based"
- "We aim to define an extension of domain model"
  -> "We aim to define an extension of the domain model"
- " the software at higher level" -> " the software at a higher level"

- "As a first step to get over this point is we define"
  -> "As a first step to get over this point, we define"
- "with a language support" -> "with language support"
- "behavior aspects" -> "behavioral aspects" (several times)

=== Section 2

- "Two main features of DDD is that (1)" -> "The two main features of DDD are: (1)"
- "that are expressed in a so-called the ubiquitous language"
  -> "that are expressed in a ubiquitous language"
- "Our previous works [8, 15] proposed a variant"
  -> "Our previous work [8, 15] propose a variant"
- "Meta-concept Associative Field represents Domain Field"
  -> "Meta-concept Associative Field represents the Domain Field"
- "Finally, meta-concept Domain Method is composed of Method and"
  -> "Finally, the meta-concept Domain Method is composed of a Method and"
- "to maintain a consistency between" -> "to maintain consistency between"
- "Figure 3 shows an essential domain model for CourseMan, that is represented by a UML class diagram"
  -> "Figure 3 shows an essential domain model for CourseMan, which is represented by a UML class diagram"

=== Section 3

- "First, we take as input domain requirements that are captured by" -> "First, we take as input domain requirements which are captured by"
- "We then aim to represent such input domain requirements as a composition of a DCSL model for a so-called unified model and an AGL model to represent domain behaviors."
  -> This sentence should be rephrased
- "For the latter one (the AGL model)," -> "For the AGL model,"
- "referred to as a so-called activity class" -> "referred to as an activity class"
- "(coordinating a collaboration among moudules)"
  -> "(coordinating collaboration among modules)"
- "Domain behaviors are specified using UML Activity diagram"
  -> "Domain behaviors are specified using the UML Activity diagram"

=== Section 4

- "characterised" -> "characterized"
- "This ASE consists in a sequence" -> " This ASE consists of a sequence"
- "so that interested listeners of this event can handle"
  -> "so that interested listeners of this event can handle it"

=== Section 5

- "that could be captured at a high-level description using an UML activity diagram together with domain-model based statements"

-> "that could be captured at a high-level description using a UML activity diagram together with domain-model based statements"

- "The first catalog of domain behavior patterns is defined corresponding to"
  -> "The first catalog of domain behavior patterns is defined as corresponding to"
- "For brevity, we will omit" -> "For brevity, we omit"
- "We would illustrate each pattern" -> "We illustrate each pattern"
- "The third and fourth ANodes represent the two decision cases: the first results in creating a new C1 object for the specified Cd object, the second,"
  -> "The third and fourth ANodes represent the two decision cases: the first results in creating a new C1 object for the specified Cd object, and the second,"
- "It uses two variables k and kout, both are dependent on Ck. "
  -> ". It uses two variables k and kout, which are both dependent on Ck. "
- “To obtain a concrete AGL specification when applying a domain behavior pattern, basically, we proceed three main steps as follows:”
  -> “To obtain a concrete AGL specification when applying a domain behavior pattern, we follow three main steps:”
- "The reference from ANodes to domain classes (expressed with the keywords refCls and outCles) provide"
  -> "The reference from ANodes to domain classes (expressed with the keywords refCls and outCles) provides"
- "keywork" -> "keyword"
- "of an activity of the domain" -> "of a domain activity"

=== Section 6

- "This section briefly specify" -> "This section briefly specifies"
- "(R2) value specification [5, p. 374]) is only applied to decision node;"
  -> "(R2) value specification [5, p. 374]) is only applied to decision nodes;"
- "(X1) using variable with activity ([5, p. 417]); (X2) variable action [5, p. 467]; (X3) activity edge [5, p. 373] is without guards."
  -> Please rephrase using articles
- "According to the UML specification, variable is an alternative to using object flow."
  -> "According to the UML specification, a variable is an alternative to using object flow. "
- "In this figure the entire AGL specification" -> "In this figure, the entire AGL specification"
- "Attribute label realizes the node label." -> "Attribute label represents the node label."

=== Section 7

- "with a focus on explaining main design" -> "with a focus on explaining the main design"
- "In order to obtain an OrderMan software" -> "To obtain the OrderMan software "
- "jdomainapp" -> "Jdomainapp"
- "java" -> "Java"
- "organising" -> "organizing"

=== Section 8

- "as a domain-specifying language" -> "as a domain-specific language"
- "expressiveness: the extend" -> "expressiveness: the extent"
- "constructiability: the extend" -> "constructibility: the extent"
- "in an piecewise" -> "in a piecewise"
- "perform on representing" -> "perform in representing" (2x)
- "How much effort is required to define unified domain model in AGL+ for generating a DDD software?"
  -> "How much effort is required to define a unified domain model in AGL+ for generating DDD software?" (2x)
- "based on UML Class diagram" -> "based on the UML Class diagram"
- "The last pattern could be realized by UML Activity diagram"
  -> "The last pattern could be represented in the UML Activity diagram"
- "AGL's RCL" -> did you mean "RLC" ?

=== Section 9

- "that were discussed in Section 11" -> "that is discussed in Section 11"
- "specifciation" -> "specification"

Response: *Thank you for your suggestions. We have updated the paper with the suggestions. (Specifically, for the "AGL's RCL" we fix it with "RCL" for "Required Coding Level".)*

2. Response to Reviewer #4

2.1. Summary

The authors have greatly improved their paper compared to the initial version. I am satisfied with the changes and recommend accepting the paper.

2.2. Comment

The only relevant issue is that I could not access the accompanying technical report at https://tinyurl.com/AGLTechnical, the authors should make sure that the provided URL is correct. A final proofreading is also recommended to fix the (few) remaining language issues.

Response: *We have fixed the issue so that the accompanying technical report is accessible with the provided URL. We have also carefully revised the paper to fix the remaining language issues.*

2.3. Other remarks

- Page 2: to get over this point is we ---- to get over this point, we
- In Figure 2, attribute Student.name is assigned optional=false, but the text mentions that this attribute is optional. It is a bit confusing.
- Page 8: an unified ---- a unified
- Page 20: the extend ---- the extent
- Page 20: constructiability ---- constructability
- Page 20: an piecewise ---- a piecewise
- In the first paragraph of Section 9, do not mention reliability, as it is not discussed in the subsequent subsections.
- Page 24: lead to unsatisfactory. ---- lead to an unsatisfactory model.
- Page 24: allowing combined the class model ---- allowing combining the class model
- Page 24: specification ---- specification
- Page 26: to incorporates ---- to incorporate

Response: *Thank you for your suggestions. We have updated the paper with the suggestions.*