PhD Committee Meeting #4

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Overview

1. Research Recap
2. Current Progress
3. Results to date
4. Next Steps.

Research Topic Recap

Motivation

- Too much duplication!

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- Inter-/intra-artifact consistency issues

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Research Topic Recap

KBSE & The Drasil Framework

A Knowledge-Based Software Engineering Approach

- Too much duplication!
- Inter-/intra-artifact consistency issues
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Research Topic Recap

KBSE & The Drasil Framework

A Knowledge-Based Software Engineering Approach

- Single knowledge-base
- Inter-/intra-artifact consistency issues
- Design for change
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- Easy to mix and match
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Research Topic Recap

KBSE & The Drasil Framework

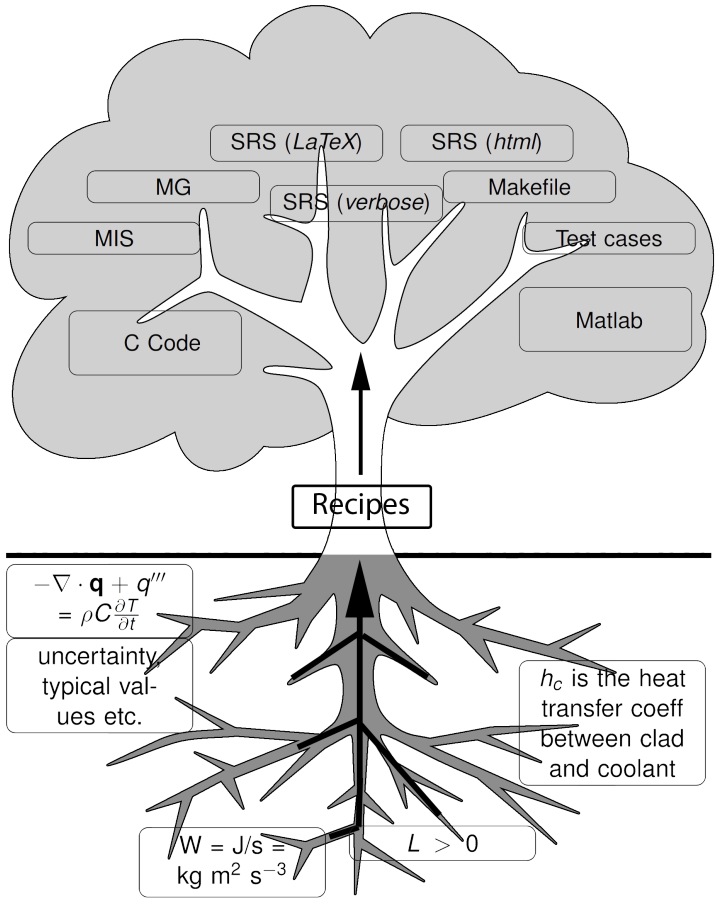
A Knowledge-Based Software Engineering Approach

- Single knowledge-base
- Guaranteed consistency
- Easy to mix and match
- Reusable across projects
- Generate artifacts

Research Topic Recap

KBSE & The Drasil Framework

Drasil – Towards generating Software Families



Research Topic Recap

KBSE & The Drasil Framework

Drasil – Towards generating Software Families

- One “source”, multiple views
- Full traceability
- Consistent-by-construction artifacts

Research Topic Recap

KBSE & The Drasil Framework

Drasil composed of many Domain-Specific Languages (DSLs) including, but not limited to:

- Knowledge Capture
- Recipes (Document generation)
- Code Generation

Current Program Progress

A brief overview

- Completed all necessary graduate courses & comprehensive examinations
- Currently Writing:
  - Journal paper for ACM TOSEM
  - Thesis

Current Program Progress

A brief overview continued

Research Project: Drasil proof-of-concept “complete”

- Scoped-down due to nature of project
- Generating SRS for six case studies & code for one
- Still improving with the help of summer students

Since Last Time

General

Summer 2017: Supervised 5 research students

- Cleaned up case studies
- Helped improve Drasil

Submitted to SE-CoDeSE'17 – Rejected
Began a paper for FASE 2018 – Scrapped
Met with OPG – Positive feedback
Co-supervising 3 research students
Writing

Since Last Time

Drasil-Specific

Total of 372 issues closed on the Drasil github

- Haddock
- Chunk and referencing databases
- Improved the Drasil class hierarchy
- Finished creating Document Language (Cont'd)
- Continuous Integration & automated tests
- General source clean-up and refactoring

Currently $\sim$130 open issues guiding development

Results

Document Language

Introduction of new Document Language led to:

- De-embedding English
- More readable source
- Improved sanity checking

Results

Old

```
1  glassBR_srs :: Document
2  glassBR_srs = Document ((srs ^. defn) +:+ S "for" +:+ (gLassBR ^. defn))
       srs_authors
3    [s1,s2,s3,s4,s5,s6,s7,s8,s9,s10,s11]
4
5  s1 = Section(S "Reference Material") [Con s1_intro, Sub s1_1, Sub s1_2,
6    Sub s1_3]
7
8  s1_intro = Paragraph (S "This section records information for easy reference.")
9
10 s1_1 = table_of_units this_si
11
12 s1_2 = table_of_symbols ((map qs glassBRSymbols) ++
13   (map qs glassBRUnitless)) (^.term)
14
15 s1_3 = table_of_abb_and_acronyms acronyms
16
17 s2 = Section(S "Introduction") [Con s2_intro, Sub s2_1, Sub s2_2, Sub s2_3]
18
19 s2_intro = Paragraph $
20   S "Software is helpful to efficiently and correctly predict the blast" +:+
21   S "risk involved with the" +:+. (sMap (map toLower) (glaSlab ^. term)) +:+
22   S "The" +:+ (sMap (map toLower) (blast ^. term)) +:+ S "under" +:+
23   S "consideration is" +:+. (sMap (map toLower) (blast ^. defn)) +:+
24   S "The software, herein called" +:+ (gLassBR ^. defn) +:+ S "aims to" +:+
25   S "predict the blast risk involved with the" +:+
26   (sMap (map toLower) (glaSlab ^. term)) +:+ S "using an intuitive" +:+
27   S "interface. The following section provides an overview of the" +:+
28   (srs ^. defn) +:+ sParen (srs ^. term) +:+ S "for" +:+. (gLassBR ^. defn) +:+
29   S "This section explains the purpose of the" +:+
```

Results

New

```
glassBR_srs :: Document
glassBR_srs = mkDoc mkSRS (for'' titleize phrase) glassSystInfo

mkSRS :: DocDesc
mkSRS = RefSec (RefProg intro [TUnits, tsymb [TSPurpose, SymbOrder], TAandA]) :
 IntroSec (
  IntroProg (startIntro software blstRsklnvWGlassSlab gLassBR) (short gLassBR)
   [IPurpose (purpose_intro_p1 document gLassBR glaSlab),
   IScope incScoR endScoR,
   IChar (rdrKnldgbleIn glBreakage blastRisk) undIR appStanddIR,
   IOrgSec intendedReaderIntro dataDefn SRS.dataDefn intendedReaderIntro_end]):
 StkhldrSec (StkhldrProg2 [Client gLassBR (S "a" +:+ phrase company +:+
     S "named Entuitive. It is developed by Dr." +:+ (S $ name mCampidelli)),
   Cstmr gLassBR]) :
 GSDSec (GSDProg2
   [UsrChars [user_chars_bullets endUser gLassBR secondYear undergradDegree
    civilEng structuralEng glBreakage blastRisk], SystCons [] []]) :
 ScpOfProjSec (ScpOfProjProg (short gLassBR) (prod_use_case_table)
          (indiv_prod_use_case (glaSlab) (capacity) (demandq) (probability)))
      :
 SSDSec (SSDProg [SSDProblem (
   PDProg start gLassBR ending [terms_defs, phys_sys_desc, goals])],
   [ SSDSolChSpec (
      SCSProg
       [ Assumptions
       , TMs ([Label] ++ stdFields) [t1IsSafe]
       , GDs [] [] HideDerivation -- No Gen Defs for GlassBR
       , DDs ([Label, Symbol, Units] ++ stdFields) dataDefns ShowDerivation
       , IMs ([Label, Input, Output, InConstraints, OutConstraints] ++
```

Results

Equivalent to 140 “Old” lines

```
1  glassBR_srs :: Document
2  glassBR_srs = mkDoc mkSRS (for'' titleize phrase) glassSystInfo
3
4  mkSRS :: DocDesc
5  mkSRS = RefSec (RefProg intro [TUnits, tsymb [TSPurpose, SymbOrder], TAandA]) :
6   IntroSec (
7    IntroProg (startIntro software blstRskInvWGlassSlab gLassBR) (short gLassBR)
8     [IPurpose (purpose_intro_p1 document gLassBR glaSlab),
9     IScope incScoR endScoR,
10    IChar (rdrKnldgbleIn glBreakage blastRisk) undIR appStanddIR,
11    IOrgSec intendedReaderIntro dataDefn SRS.dataDefn intendedReaderIntro_end]):
12  StkhldrSec (StkhldrProg2 [Client gLassBR (S "a" +:+ phrase company +:+
13      S "named Entuitive. It is developed by Dr." +:+ (S $ name mCampidelli)),
14    Cstmr gLassBR]) :
15  GSDSec (GSDProg2
16    [UsrChars [user_chars_bullets endUser gLassBR secondYear undergradDegree
17     civilEng structuralEng glBreakage blastRisk], SystCons [] []]) :
18  ScpOfProjSec (ScpOfProjProg (short gLassBR) (prod_use_case_table)
19            (indiv_prod_use_case (glaSlab) (capacity) (demandq) (probability)))
        :
20  SSDSec (SSDProg [SSDProblem (
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24        [ Assumptions
25        , TMs ([Label] ++ stdFields) [t1IsSafe]
26        , GDs [] [] HideDerivation -- No Gen Defs for GlassBR
27        , DDs ([Label, Symbol, Units] ++ stdFields) dataDefns ShowDerivation
28        , IMs ([Label, Input, Output, InConstraints, OutConstraints] ++
```

Results

Sanity Checking

SSP Example (Issue #348)

$$S_i = \frac{P_i}{FS} \qquad (1) \qquad\qquad FS = \frac{S_i}{\tau_i} \qquad (2)$$

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Sanity Checking

SSP Example (Issue #348)

$$S_i = \frac{P_i}{FS} \qquad (1) \qquad\qquad FS = \frac{S_i}{\tau_i} \qquad (2)$$

Where did τ_i come from?

Were S_i and P_i swapped?

Results

Sanity Checking

SSP Example (Issue #348)

$$S_i = \frac{P_i}{FS} \quad (1) \qquad FS = \frac{S_i}{\tau_i} \quad (2)$$

Where did τ_i come from?

Were S_i and P_i swapped?

- τ_i was not defined anywhere in the documents
- Found with Drasil – undefined symbols throw errors
- Equation based on concepts – symbols automatically retrieved

Results

Conceptual Inconsistencies in Software Artifacts

Manually created artifacts are human-readable.
Problems arise when explaining things to a machine.

- What do our artifacts *mean*?
- What is each section contributing?
- Why do we organize things a given way?
- Are models/definitions different? How?

Need to be more rigorous!

Next Steps

Broad Strokes

What next?

- Finish writing paper for ACM TOSEM
- Complete Thesis writing
- Continue improving Drasil

Summary

Problem:

- Duplication
- Inconsistency
- Design for change
- Promote re-usability
- Re-certification

Solution:

Capture fine-grained knowledge & generate ALL artifacts