Research Software Engineering Master Curriculum

Research Software RSE Master Curriculum Project

- software-based research plays an increasingly central role
- qualified research software engineers (RSEs) are rare (mostly Quereinsteiger)
- delineation of the emerging field is challenging

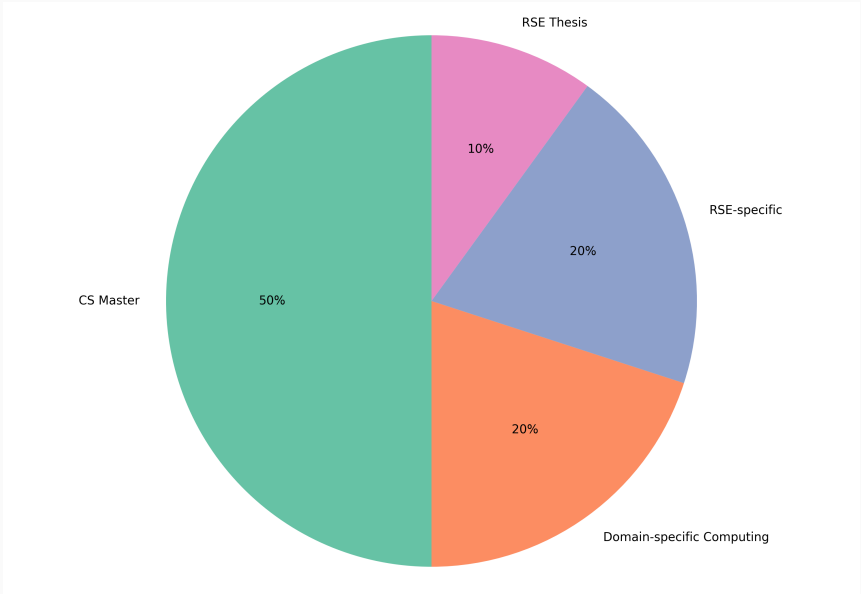
First Issues and Current Answers

1. Is RSE a CS study program? Yes, but not only
2. What is the BA requirement (audience)? CS or MNT depending on profile
3. Is RSE a recomposition of existing lectures? yes, but only partially
4. What is the intended job profile (if any)? Academia and research institutes primarily
5. Is the Curriculum one idea or a set of ideas? At least two ideas are dominating

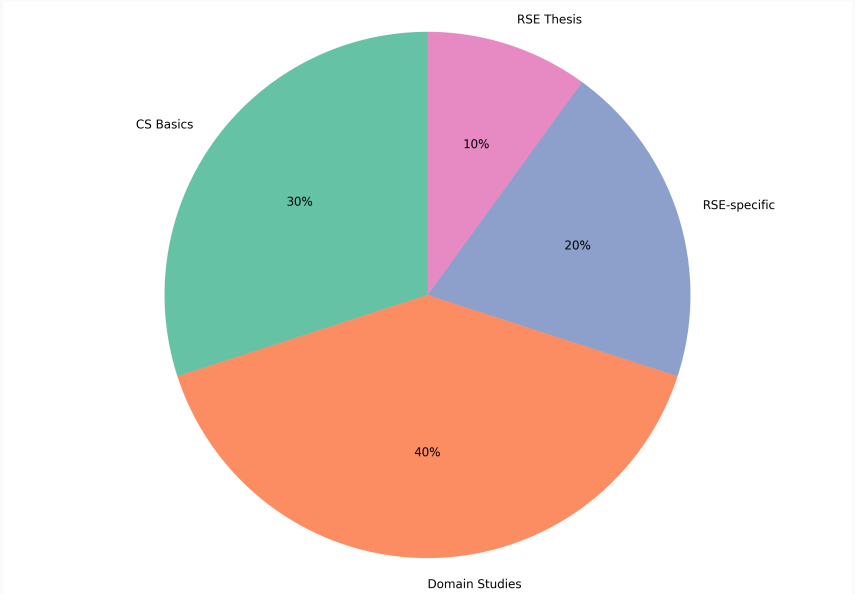
Why profiles?

- at least CS-specialization idea and domain-RSE (i.e. computational social scientist) are competing
- universities offer different existing modules: easier adaptability
- the curriculum can be adapted to other educational systems
- the curriculum can be adapted to other institutions such as universities of applied sciences

Example Curriculum Composition 1 - CS Profile



Example Curriculum Composition 2 - Domain Profile



Why modularized generation?

- reuse components for more than one profile
- division of labor on expert topics
- doing the RSE curriculum RSE-style (open source, collaboratively. . .)
- allows for automated input in future

Reference Example: Programming module

A general module that teaches programming for RSE

- contains a general description and optional partial description files
- consist of several planned lectures
- contains a set of competences that can be acquired
- contains a set of educational sources
  - mappings to existing modules
  - mappings to existing reference standards
  - mapping to existing programs

Contribute here: https://github.com/the-teachingRSE-project/RSE-Masters/tree/main/components/gen_programming

Example: meta.yml

```yaml
meta:
  id: gen_prog
  profiles:
    - science
    - rse
    - up
  level: master
  name: Basics of Programming
  depends_on: []
```

Example: lectures.yml

```yaml
entries:
  - name: "Basic Programming"
    description: ""
    type: "Lecture"
    sws: 2
    ects: 1
    group: 1
    quarto_filename: "basics_programming.qmd"
    optional: True
  - name: "Basic Programming Exercise"
    description: ""
    type: "Exercise"
    sws: 4
    ects: 4
```

Example: sources.yml

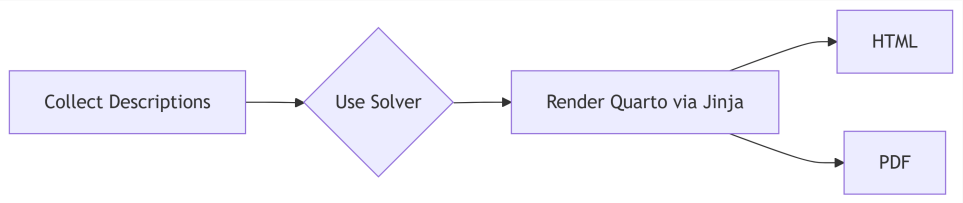
```yaml
sources:
  curricula:
    - name: Computing Curricula 2020
      link: https://dl.acm.org/doi/book/10.1145/3467967
  courses:
    - name: UP Grundlagen der Programmierung
      link: "https://puls.uni-potsdam.de/qisserver/pages/cs/sys/p
    - name: UP Praxis der Programmierung
      link: "https://puls.uni-potsdam.de/qisserver/pages/cs/sys/p
  programs:
    - name: UP Computational Science Master
      link: "https://www.uni-potsdam.de/de/studium/konkret/rechts
```

Example: competences.yml

```yaml
competences:
  - id: ex_programming_mod1_1
    description: "Use an imperative-procedural programming langua
    disciplines: "Computer Science"
    prerequisites: ""
    evidence: "Submit working programs in both languages demonstr
    author: "University of Potsdam"
    source: "https://puls.uni-potsdam.de/qisserver/pages/cs/sys/p

  - id: ex_programming_mod1_2
    description: "Implement basic data structures and algorithms"
    disciplines: "Computer Science"
    prerequisites: "ex_programming_mod1_1"
    evidence: "Submit a project with implemented algorithms and d
```

Technical Pipeline: Process



Technical Pipeline: Solver

Current Brute Force Solution

- solve for enough ECTS
- solve for lecture and component dependencies
- ....

Future Tech Work

- explainable AI and constraint programming
- generate component using NLP and web crawling / APIs from universities

Next Steps: Workshops for component x

x is in [“RSE Management and Communication”, “Advanced Software Engineering for Research”, . . .]

- discuss experiences teaching and learning in the RSE area x
- discuss what competences are needed for an RSE component x
- discuss how many lectures might be needed and what kind of lecturer
- discuss necessity and map to profiles is possible
- best case: form a focus group for lecture series x