Quality Characteristics for Software in HPC Environments: A Systematic Literature Review

deRSE25

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IT Center | RWTH AACHEN UNIVERSITY

Motivation

Why *quality characteristics*?

- FAIR criteria for research software translate to qualities

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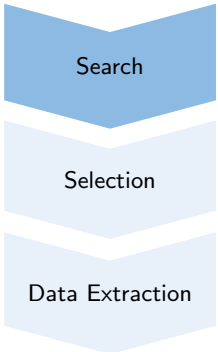
Why *software in HPC environments*?

- HPC system capabilities are needed by scientists across all domains
- Quality is important because of expensive runs
- Unique challenges like hardware heterogeneity

Goals

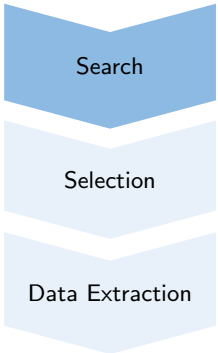
1. Investigate existing research on the topic
2. Find out which quality characteristics are important
3. Compare to quality characteristics from software in general

Systematic Literature Review - Search



[Kitchenham and Charters 2007]

Systematic Literature Review - Search



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- Executed in August, 2024

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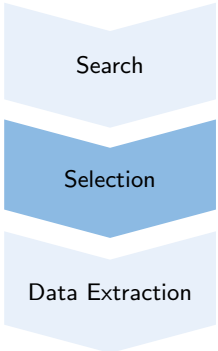
Systematic Literature Review - Selection



Inclusion criteria	Exclusion criteria
1. Quality refers to an application software	1. Not in English language
2. Software is intended to be executed in an HPC environment	2. Duplicate
3. Characteristics of software quality are defined and analyzed	3. Pre-print of an included publication
	4. Not in continuous full-text format
	5. Primarily about teaching the topics

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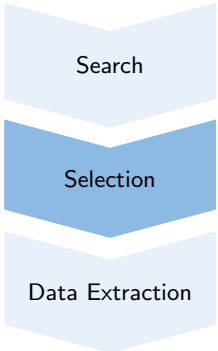

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- 29 included publications

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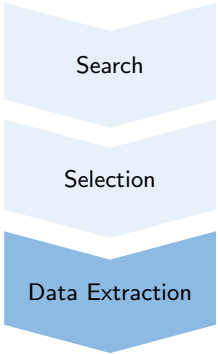

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- General data

  title, authors, publication venue, publication year, DOI, references, application domain

[Lummerzheim 2025b]

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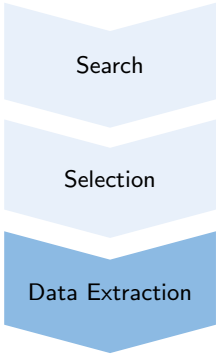

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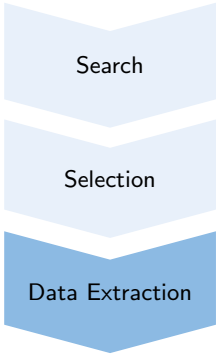

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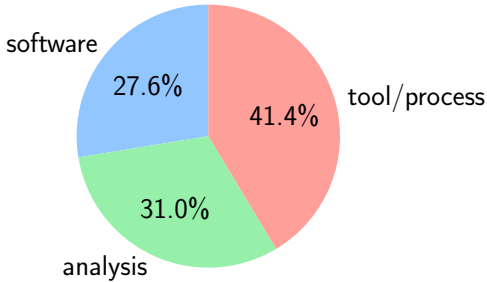
- General data
  title, authors, publication venue, publication year, DOI, references, application domain
- Quality characteristics and trade-offs between them
- Category
  - Tool and/or process
    to measure or improve software quality aspects
  - Software
    including a description of how software quality is approached
  - Analysis
    of software quality, for example, the current state

[Lummerzheim 2025b]

General Results



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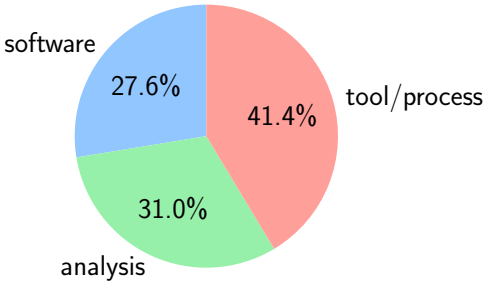

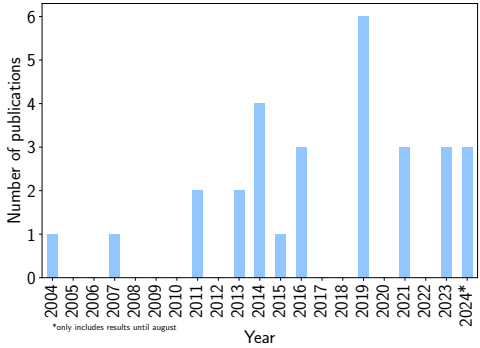

Connections

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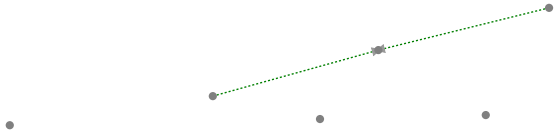

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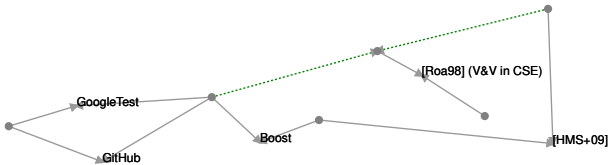

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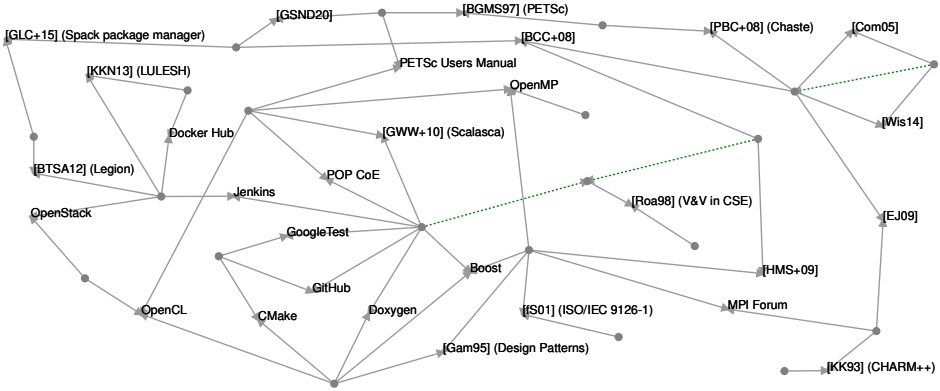
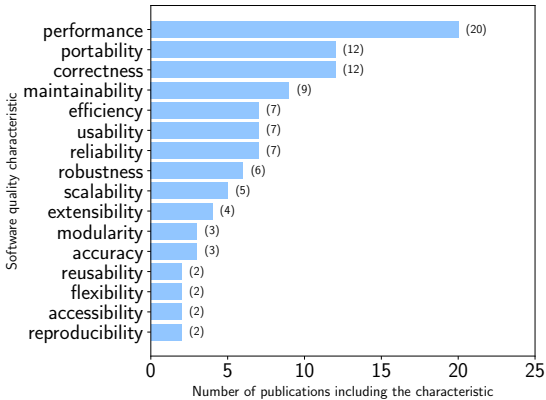


[Lummerzheim 2025a] interactive version: https://slr-hpc-software-quality-794fea.pages.git.nrw/

Quality Characteristics



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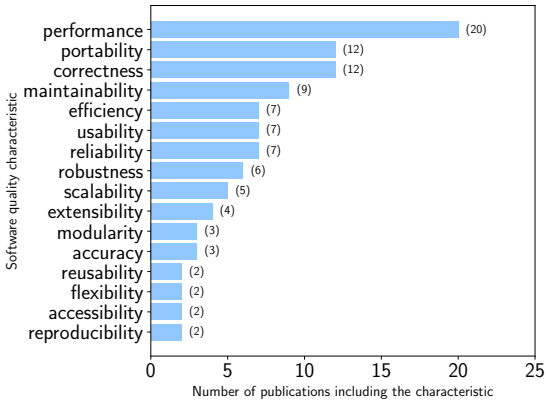

- Trade-offs mainly between performance-related and other characteristics

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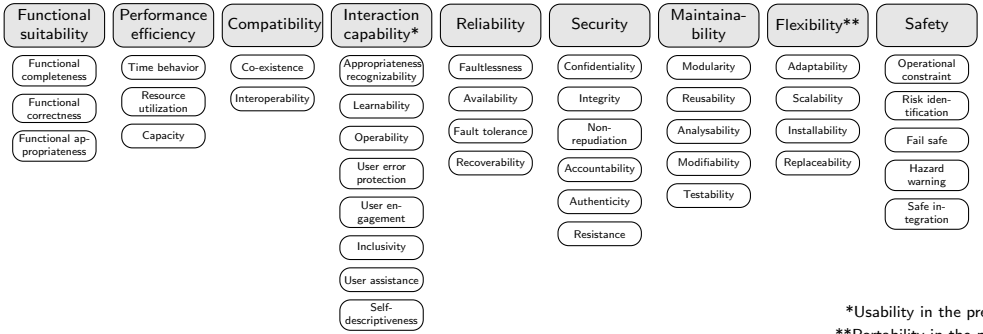
Comparison to SQuaRE (ISO/IEC 25010:2023) [International Organization for Standardization 2023]



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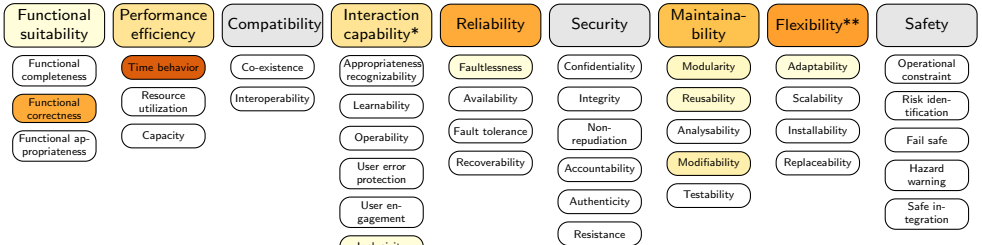

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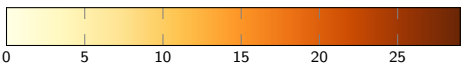
Frequency of characteristic:



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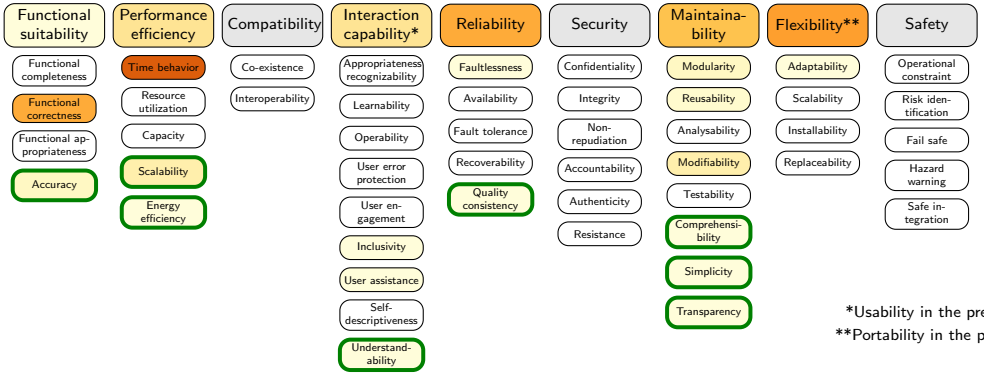

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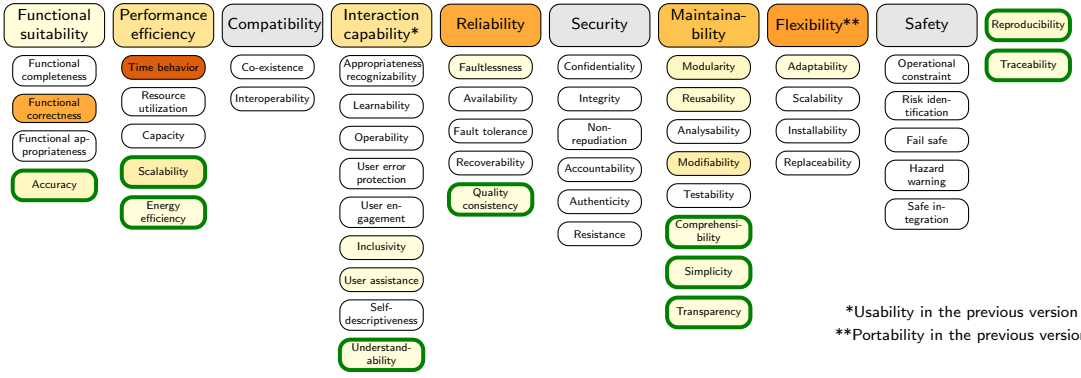

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Questions?

Contact
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Thank you for your attention.

References

- Barker, Michelle et al. (Oct. 2022). "Introducing the FAIR Principles for research software". In: *Scientific Data* 9.1. DOI: 10.1038/s41597-022-01710-x.
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- — (2025b). *Data for "Quality Characteristics for Software in HPC Environments: A Systematic Literature Review"*. en. DOI: 10.5281/ZENODO.14898873.