

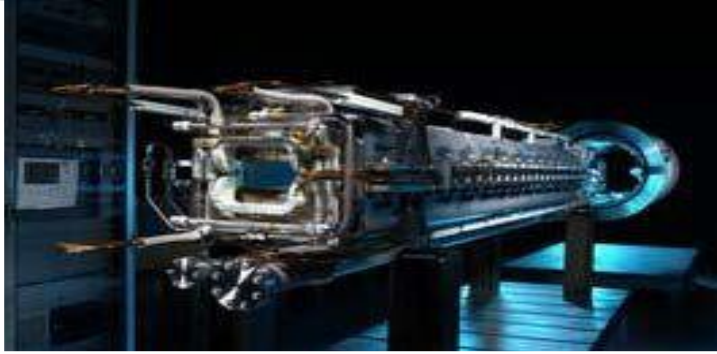

Common GSI/FAIR Software Development Guideline

– a C++ developers point-of view

- “The Only Unbreakable Law”: https://indico.gsi.de/event/16522/
- “Where Does Bad Code Come From?”: https://indico.gsi.de/event/16533/
- Initial Guideline Proposal: https://indico.gsi.de/event/18737/
- Initial Guideline Proposal – contd.: https://indico.gsi.de/event/18737/

Ralph J. Steinhagen

C++ User-Group Meeting

June 11th, 2025

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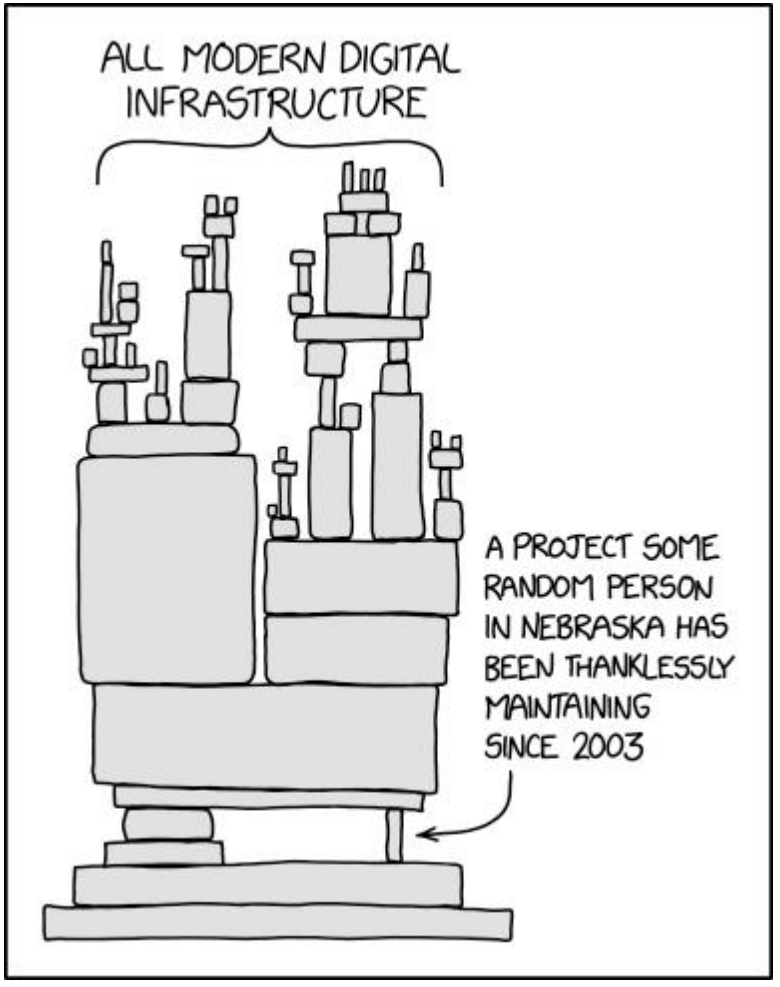
Finland France Germany India Poland Romania Russia Slovenia Sweden UK

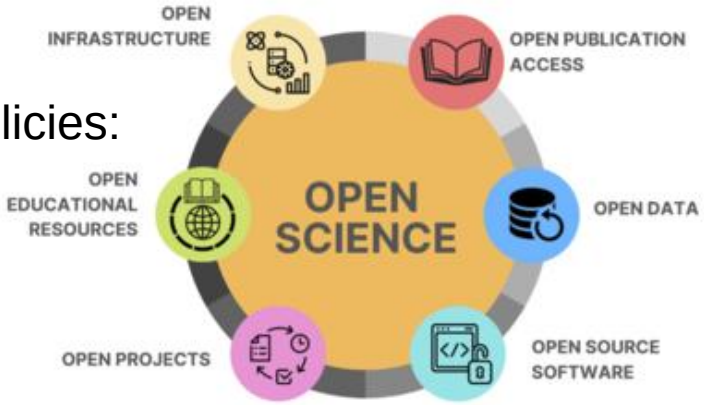
GSI HELMHOLTZ ASSOCIATION FAIR

Why a Software Development Guideline?



https://xkcd.com/2347/

Why a Software Development Guideline?



not fundamentally ‘new’ – existing GSI/FAIR Open Science policies:

- since 2021: Open Source Guidelines
  - GPLv3 → LGPLv3 → Apache 2.0 & CERN OHW
    especially for public-public & public-private collaborations
  - proprietary licenses/development
    require documented evaluation of total-cost-of-ownership & risk for the organisation

- since 2023: Open-Science WG Initiative
  GSI/FAIR supporting ‘Public Money? Public Code!’ Campaign
  - new directorate policy:
    favour open-source and document risks related to developments and procurements of new software systems

- 2023/2024: Open-Science WG charged by directorate to draft RSE Guidelines for GSI/FAIR (lead: Andrew Mistry)
  - refine definition for Open-Hardware/Software policies
  - update licenses (N.B. new AI-regulations and CE certification)

FAIR GSI

RSE Guidelines – Why care? What's in for me?

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Guideline for everyone who:
develops, maintains, or publishes software at GSI/FAIR
regardless of job title or background.

- Explicitly:

  Core-Goal №1:
  Ensure software is fit-for-purpose and adaptable to evolving organisational needs.

  Core-Goal №2:
  Cultivate a supportive and collaborative environment for developers at all experience levels.

  Core-Goal №3:
  Follow quality software standards that adhere to best practices, minimising organisational risk.

  Core-Goal №4:
  Ensure that, whenever possible, software owned/in part be made available as Open Source.

- Provides: orientation, contact points, checklists, and reduces risk around:
  licensing, **IP**, **quality-assurance**, **publication**

What's New / Important?

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- **replaces the previous GSI/FAIR Open Source Licence Guideline** (see earlier version)
- **applicable across all departments**
  – including external contributors to GSI/FAIR projects (unless stated otherwise).
- **four application classes**
  define graded requirements depending on usage, risk, and project scope.
- **Clear licence recommendations**: (L)GPLv3 → Apache 2.0 → MIT
  with legal clarifications, third-party libs, publication, embargoes, and export control.
- New: **Consideration of Total-Cost-of-Ownership (TCO)**, scientific citation, version maintenance, and Open Science / F.A.I.R. principles.
- Includes practical **checklists**, **guidance on legal framework**, as well as annexes on: licence selection, application examples, glossary, recognition of software work, …

Classification according to ‘Application Classes’

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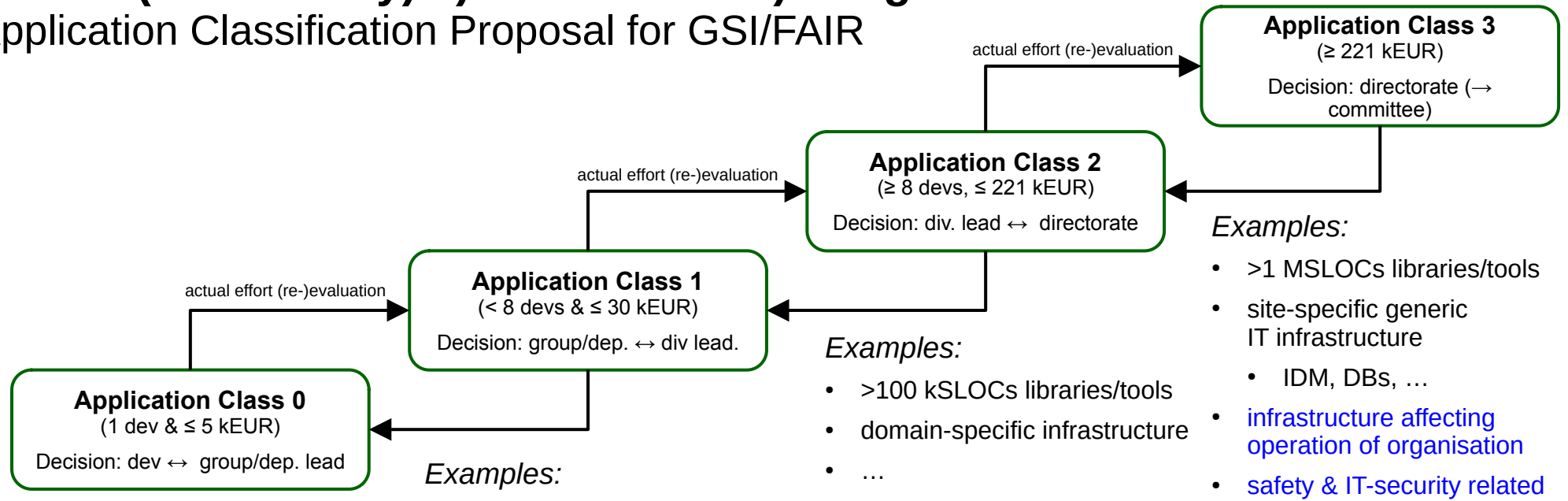
Application Class	0	1	2	3
Development	GSI/FAIR	GSI/FAIR	GSI/FAIR or with third Parties	GSI/FAIR or with third Parties
Utilisation	Individual use or specific to a particular study	Used within GSI/FAIR	Developed as part of a third party funded project for long-term use or planned as a product	Product-scale software for services, or critical infrastructure use
Requirements	Compliance with legal aspects. Version Control. Open Source licensing recommended	Version control. Open Source licensing. Further development by non-GSI-affiliated parties possible	Version control. Open Source licensing. Maintenance and long-term usability ensured. Rights of use remain with GSI/FAIR.	Long-term management ensured. Testing automation, release management, maintenance, and usability ensured. Rights of use remain with GSI/FAIR.
Distribution	Not planned. Recorded in a suitable repository if needed	Recorded in a suitable repository and possibly onboarded to a software directory	Onboarded to a community software directory (if licence allows)	Onboarded to a community software directory (If licence allows)
Examples	Small codes, functions, simple scripts	Software used by a group (e.g. experiment analysis code)	Software used on a broader scale in collaboration with partners (e.g. SMASH [https://doi.org/10.5281/zenodo.14922777], larger analysis codes)	Software developed as part of a large open-source project (e.g., FairRoot [https://doi.org/10.5281/zenodo.11210174]) or software for commercial exploitation.

HowTo (realistically) a) assess and b) mitigate Risks related to RSE

Application Classification Proposal for GSI/FAIR



Examples:

- < 2 kSLOCs analysis scripts
- spread-sheet macros
- …
- reproducible within days

Examples:

- < 100 kSLOCs libraries/tools
- …
- reproducible within few engineering months

Examples:

- >100 kSLOCs libraries/tools
- domain-specific infrastructure
- …
- reproducible within few FTEs

Examples:

- >1 MSLOCs libraries/tools
- site-specific generic IT infrastructure
  - IDM, DBs, …
- infrastructure affecting operation of organisation
- safety & IT-security related
- non-open-source
- …

greater scrutiny with greater risks

employee

organisation

Application Class Requirements

to be reviewed/open for comments

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Application Class	0	1	2	3
Licensing and Open-Source Release				
Licence and Copyright	✓	✓	✓	✓
Group leader/Collaboration agreement	✓	✓	✓	✓
Transfer approval process	✘	✘	✓	✓
Management				
Code Repository/Version Control (Git)	✓	✓	✓	✓
Software Tests	✘	✘	✓	✓
Test Automation	✘	✘	✘	✓
Maintenance and Troubleshooting	✘	✘	✘	✓
Documentation				
Readme/Installation Instructions	✓	✓	✓	✓
Documentation and contribution guide/authors	✘	✓	✓	✓
Citation and machine readable Metadata	(✓)	(✓)	✓	✓
Documentation of Processes, Standards, and Tools	✘	✓	✓	✓
Release Strategy	✘	✓	✓	✓
Developer guide	✘	✘	✓	✓
Version Publishing				
Persistent Identifiers (including Machine readable metadata)	(✓)	✓	✓	✓
Onboarding to Community (e.g. OSSR)	✘	✘	(✓)	(✓)

What's next?

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- Timeline – Targets:
  - user- and departmental-Feedback **by July 2025**
  - final draft presented to WTR *(N.B. RED on board)*
  - ratification as official guideline by our directorates in Q3/2025

- Please send feedback:
  - e-mail, informal notes, hallway chats are all OK
  - point-of-contact:
    - Andrew Mistry (lead),
    - Matthias Kretz, or
    - Ralph J. Steinhagen