

Guidelines on Research Software

Development, use and dissemination

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I. Introduction

At the GFZ, software for scientific work is developed and used in all Sections. The spectrum ranges from small tools and scripts to complex software systems (**software**) that are available as source code or executable programs. Software in the sense of these guidelines do not include data processed with the software or software that is purchased and made available via IT Services and Operations, for example.

The development processes for software are manifold: (i) There is software that is developed and used by individual employees or purely internally in teams or only for GFZ's own purposes. (ii) In addition, there is software that is developed in cooperation with third parties or in the context of a scientific community and also passed on to third parties or commissioned or used as third-party development.

Uniform standards must be ensured at the GFZ already during software development under the aspects of sustainability and subsequent use of software as well as traceability and reproducibility of research results that have been generated by the use of (partly) self-developed software.

When software is passed on and made available to third parties, the interests of the GFZ must be safeguarded, as the rights to software developed by GFZ employees with a thematic connection to their GFZ-work are held by the GFZ. This also applies to software developments commissioned by the GFZ within the scope of projects. For the dissemination and licensing of software, and thus, also for the protection of employees, a mandatory approval and consultation process must be followed, which automatically involves, among others, the respective Section Head, the Legal Department and the Department for Technology Transfer and Innovation.

In order to ensure a uniform practice at the GFZ, these guidelines summarize what has to be considered when developing and disseminating software and, where applicable, who must be involved.

Further central information on the topic of research software at the GFZ can be found:

- on the GFZ intranet under "For researchers", "software at GFZ"
- in the GitLab area of the GFZ network of RSE Ambassadors
- in the "*GFZ Policy on Use and Licensing of Research Software*¹".
- in the on-line form for the approval process for licensing and redistribution of software
- in the flowchart for licensing research software, see Attachment 1
- in the information sheet on copyright protection of software, see Attachment 2

¹ <https://doi.org/10.48440/gfz.5.2.2023.002>

II. Process at GFZ, definitions

With respect to the development, use and dissemination of software, specific obligations and specifications must be taken into account at the GFZ:

- For the **development**, the obligations mentioned under **Clause 1** must always be observed.

Development of software is understood to be the creation as well as the editing of software by natural persons. **Editing** includes, for example, extensions of the source code, development of new program versions, a merger of existing software or the translation of existing software into another programming language.

- For **use at the GFZ**, the specifications recorded under **Clause 2** apply.

Use includes the usage of the software e.g. for purposes of data processing or visualization by executing the software.

Insofar as the use also includes editing of the software, the obligations set forth under Clause 1 shall additionally apply to this development activity.

- If **dissemination or provision of the software** is planned, the requirements under **Clause 3** must also be complied with.

Dissemination and provision of software includes all forms of transfer, distribution, transmission, lending, sale, rental or other online or offline provision of software or reproductions of software as well as making essential functions of software accessible to or for third parties.

If software is passed on to the public, this constitutes a **publication**. For this purpose, it is already sufficient that a large number of third parties can theoretically access the software without this actually having to take place; this is the case, for example, when software is posted in a software repository, such as GitHub, BitBucket or GitLab, or on a publication platform, such as GFZ DataServices or Zenodo, which can be viewed publicly or to which third parties have access.

Third parties in the sense of these guidelines are all those who are not employed at the GFZ (employment or service relationship), e.g. students, PhD students, visiting scientists, project partners, contractors, freelancers, former fellow students, fellows. It should be noted that scientists working on site at the GFZ do not have to be employed at the GFZ, but are e.g. doctoral students or visiting scientists working on site at the GFZ, but have an employment contract with another employer.

- In the case of development, use or dissemination of software or software with program parts **created by third parties**, the instructions given for **obtaining rights of use in Section 4** must be observed.

1. General obligations in the development of software

When creating software, rules and technical specifications must be adhered to. Establishing institution-wide standards through **best practices** enables, among other things, quality, traceability, deployment options, maintenance, further development, and subsequent use for software. This includes:

- a) the application and implementation of proven software engineering methods and practices, so-called best practices.

Best practices should be defined and established by those responsible within a section, a department, or for joint software development projects, depending on the applicable rules of the respective programming language, the technological software environment, and other aspects. For this purpose, regularly updated best practices are recommended as a suggestion by the software developing colleagues at the GFZ (see Intranet).

- b) the management of software using the central infrastructure provided by the GFZ for version control, backup, collaboration, and software project management purposes.
- c) the use of uniform coding styles and naming, testing and continuous integration.
- d) the documentation of the software for different addressees, such as software developers, IT administrators, users and scientists.
- e) compliance with the requirements for good scientific practice, among other things to ensure the verifiability and reproducibility of research results.
- f) the recording of all persons involved in a software development, be it colleagues from the GFZ or partners from other organizations, as co-authors (at the appropriate places in the software).
- g) obtaining rights of use and rights for further editing, insofar as it concerns software created by third parties and now adopted and further developed by GFZ employees (see Clause 4).
- h) a regulated off-boarding process in the event of the departure or resignation of persons involved in software development, so that, among other things, documentation of previously internally or individually developed software is ensured. The online-form for the dissemination of software (see II, Clause 3) is to be used to secure work results created at the GFZ if it is planned that the software will be used elsewhere after leaving the GFZ or if third parties were involved in the development.

- ➔ The respective Section itself determines the measures required for the software to fulfill the listed general obligations.
- ➔ New employees are made aware of these guidelines and the underlying policy by Section Heads and Working Group Leaders. Introductory offers are offered regularly and announced via the GFZ mailing list.

2. Use and development of software at the GFZ

Clause 2 regulates the **exclusively GFZ-internal** use and editing of software. This includes the use of software that is located on the GFZ infrastructure or on a software repository accessible only to GFZ employees and that is used and edited only by GFZ employees.

Important: The distribution or provision of the software to third parties (persons without a GFZ employment contract) for use or editing, both outside and within the GFZ, is not considered internal use. Even the transfer within a project to colleagues who are not employed at the GFZ, e.g. to doctoral students of universities working on site, is classified as external use. In this case, the process described in Clause 3 must be followed!

The following must be observed for the use and editing of software at the GFZ:

- a) For use at the GFZ, all rights for the planned specific use must be obtained. These rights of use must at least cover that the software can be used, stored and reproduced for the specific purposes by the GFZ and the corresponding number of employees.
- b) This also applies if GFZ employees bring in software for their work at the GFZ that was developed outside the GFZ, e.g. as part of a previous employment relationship with another employer, as part of a funded project, or as part of their dissertation. The Section must ensure that all necessary rights are granted for the use and, if necessary, further development of this contributed software at and by the GFZ, see Section 4.
- c) If further editing is to take place, the license for the GFZ must also include the rights to change, further develop, translate and modify the software, among other things. This can be done by obtaining the corresponding rights of use (licenses) (see Clause 4). For the development activity itself, the specifications made under Clause 1 apply.
- d) Restrictions in the scope of use resulting from the license conditions of the software, e.g. in terms of content, location or time, are to be deposited with the software and made accessible to all who are to work with the software. In case of doubt, the software must be stored on a separate GFZ repository that is only accessible to selected employees.
- e) Access for non GFZ employees is not granted. If this is to be done, a separate repository must be selected for this purpose and made available to non-GFZ employees. In addition, a release via the process according to Clause 3 is required.
- f) If a later use or dissemination outside the GFZ is considered, further legal requirements must be met (e.g. for distribution, making available, sublicensing, transfer, etc.). These are initiated via the process under Clause 3.

- The respective Section itself determines the measures required for the software, but in compliance with the general obligations listed under II. 1. and 2.
- The rights of use for the GFZ must be obtained and documented by the Section in accordance with the instructions in Clause 4.
- If persons without a GFZ employment contract are to be given access to the software, e.g. doctoral students from universities working on site, the process described in Clause 3 must be followed!

3. Dissemination and provision of software outside the GFZ

The **dissemination** of software outside the GFZ covers all cases in which software that was (co-)developed at the GFZ is to be made available outside the GFZ for use by third parties.

Provision includes all forms of passing on the source code, publishing the source code or making the software accessible, even without passing on the source code, e.g. as an executable program or cloud service. It is irrelevant here whether the software as a whole or only essential functions are to be made available. A possible commercial dissemination of the software is also irrelevant. However, the possibility of commercial dissemination and a possible establishment of market maturity will be examined as part of the approval process before the software is distributed or made available to the public.

Typical use cases are for example:

- a) software that is to be published as part of a publication and published via scientific journals or library repositories with a DOI or other PIDs. In addition to the requirements for this case, the publication guidelines of the GFZ must be observed.
- b) the planned provision of already developed software under a Free and Open Source Software (FOSS) license to the general public, e.g. publicly available on GitHub.
- c) proprietary software that has been developed entirely in-house or parts of which have been made available by third parties without restrictions on use or dissemination, and which is to be passed on to individual third parties outside the GFZ, e.g. by selling rights of use (license agreement).
- d) software was developed within the framework of contract research by the GFZ for an external client, e.g. a company, and is now to be handed over.
- e) software is to be passed on to a clearly definable, numerically and personally limited group of "third parties" ("**closed user group**") or is to be further developed together with them without being publicly accessible; e.g. as part of a collaborative project.

- The online form for a review and approval of the planned distribution and provision of software is to be used. This initiates an internal GFZ approval and consultation process.
- The form must be completed in good time before the planned distribution or publication.
- The provision of GFZ software to third parties must be subject to a grant of rights of use (licensing). This must clearly stipulate that the rights lie with the GFZ –as far as possible– and which rights of use are granted to the third party. A recommendation for a choice of license is made as part of the approval and consultation process.

When the completed form is sent, the responsible Section Head and other GFZ stakeholders such as the Legal Department and Technology Transfer are involved for review and approval. The following aspects are taken into account during the review, consultation, issuing of recommendations and approval:

- Only development on software repository with version control allowed
- Consideration of the specifications and agreements from consortia or other contracts set up by third-party funding bodies
- Contributor License Agreement from all external developers and, if applicable, their employers
- Clarify and observe licenses of embedded third-party code; if necessary, clarify with development team at GFZ whether it should be used.
- Observe licensing requirements from the *Policy on Use and Licensing of Research Software*¹
- Observe project specifications as to which OSS code contributions may not be used (e.g. exclusion of copyleft)

- ➔ Before publication: License check via online form
 - For simple software: approval by Section Head
 - For complex or innovative software: obtain approval from Section Head, Legal Department and Technology Transfer (Team Transfer & Innovation - TI). TI examines dissemination options, also for Open Source Software.
- ➔ Application of the license with the templates provided on the intranet, if necessary, a proprietary software license provided by the Legal Department and tuned for the purpose.

4. Obtaining rights of use

Rights of use for the use and editing and, if applicable, dissemination of software at the GFZ must be obtained in the following cases:

- if external developers who are not employed at the GFZ are involved in software development at the GFZ (see Clause 1). If these developers are employed by other institutes or companies, etc., the consent of the respective employer must also be obtained.
- if GFZ employees bring software for their work at the GFZ that was developed outside the GFZ, e.g. in the context of a previous employment relationship with another employer, in the context of a funded project, or in the context of their dissertation (see Clause 2);
- if software has been developed by third parties without the involvement of the GFZ, but the GFZ wishes to use it for its own purposes.

The **granting of the right of use to** the GFZ can take different forms:

- a) Individual contract for commissioned development: Developers work on behalf of the GFZ and grant the GFZ all rights to the results of their work;
- b) Cooperation agreement: The software development is carried out within the framework of a cooperation by various partners or their employees. The cooperation agreement regulates the rights to the work results and must provide for a grant of rights to the GFZ at least for use and editing for the GFZ's own scientific purposes, even beyond the project. The individual developers then no longer have to make separate grants of rights.
- c) If several developers jointly develop software as an open community or as a closed user group (limited in number and personally), the rights to the contributions for use and further development at the GFZ must be obtained from the individual developers via so-called Individual Contributor License Agreements (ICLA). The granting of rights by their employers takes place through a CCLA (Corporate Contributor License Agreements), which must also be obtained. Templates for ICLA and CCLA are available on the intranet. For small code contributions, it is sufficient to obtain the Developer Certificate of Origin (DCO).

For subsequent use of the development outside the GFZ, Clause 3 of the Guidelines must be observed. In this respect, when obtaining the developers' consent, it is already necessary to consider which subsequent uses outside the GFZ already should be covered.

- d) A special case of the above is the public development of new software which development status shall be made available in a publicly accessible software repository (e.g. GitHub) from the first line of source code (Open by Default). If all developers agree that the software should be created under a FOSS license, this FOSS license represents the necessary granting of rights. The GFZ generally recommends the use of the open-source license EUPL, see *Policy on Use and Licensing of Research Software*¹.

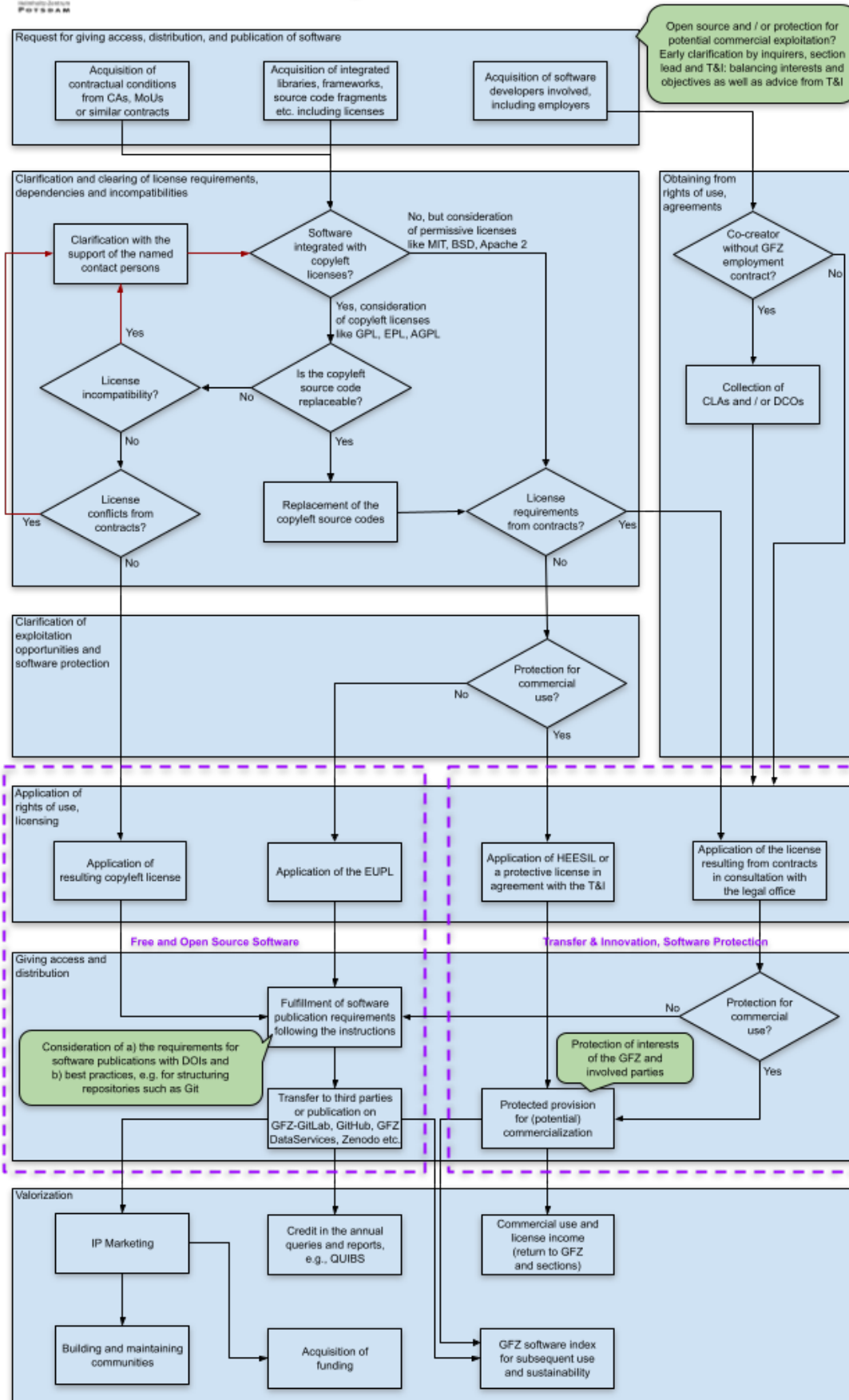
- The Sections shall obtain all necessary rights for the use and, if necessary, further development at the GFZ regarding software developed and contributed to GFZ by third parties.
- The aspects of a possible later commercial dissemination are to be considered at an early stage already when obtaining the rights of use.
- The Section is also responsible for appropriate, legally compliant documentation.

Questions as well as requests for advice and assistance in obtaining rights of use should be directed to software-legal@gfz-potsdam.de.

Attachment 1 – Flowchart for licensing research software



Procedure for licensing and valorisation of research software



This overview explains the copyright background of software developments.

1. Copyright protection of software

- a) Software that is created by an individual person and which is not machine-generated is protected by copyright. According to German copyright law, it is a personal intellectual creation of the developer. Only trivial, routine work that any programmer would complete in a similar way is not covered by this protection.
- b) Copyright protection arises automatically when developing the software. The © sign is not of relevance to the creation of a copyright protection, as it is intended only to show the owner of the usage rights. Unlike trademarks and patents, there is also no public register in which the author can or must register his legal claims.
- c) The copyright protection of software programmes is comprehensive and is independent of whether the software exists as an object or source code, or is integrated in the hardware. The documentation and accompanying material are also covered by this protection. However, in all cases, the software is only protected in its respective, specific form or embodiment.
- d) Copyright, however, does not protect the know-how underlying software and its interfaces: ideas, methods, algorithms and other abstract functions and scientific principles. Unlike “embodied” software, this know-how has not yet been written down as a specific programme code or recorded in any other form. Therefore, copyright does not hinder offering competitor software that is compatible with the formats and interfaces of an item of protected software, and which is suitable for replacing this software with regard to its functions. For this reason, a check should always be made whether a confidentiality agreement should be concluded before forwarding or publishing ideas to third parties, in order to protect this know-how from further dissemination - and, thus, from a “devaluation” for the actual owner of the ideas. Please contact the legal department if you have any further questions in this regard.
- e) Websites without dynamic components are not computer programmes, since only texts and graphics are made visible by the code. Their copyright protection can however consist of a linguistic or artistic work. An exception applies when the websites contain Flash, Java-Applets, JavaScript or similar, since these are expirable/interpretable control commands.

2. Distinction from patent protection

A computer programme (the specific programme code) by itself is not patentable under German law and is only subject to copyright protection. However, so-called computer-implemented inventions are patentable, i.e. abstractly formulated technical principles. These must be based on technical innovations and solve a technical problem. A patent is not protected until it is registered with the Patent and Trademark Office. One requirement for patent protection is the “novelty” of the invention. As soon as an invention has been published, it is no longer regarded as being new; for this reason, a check should be made beforehand every time inventions (and the computer programmes that are associated with them) are published as to whether these are in general eligible for patent protection. Here, the Department for Technology Transfer and Innovation is available as a contact person.

3. Authorship/co-authorship

- a) The author is any individual person who has him- or herself made a direct contribution to the software. If several persons are involved in the development, they are jointly classified as the co-authors of the work.

- b) Protection is given to all co-authors, regardless of whether the individual contribution can only be used in connection with the contributions made by the others, or whether - on a purely objective basis - a separate use of the contribution is also possible. The size or quality of the individual contribution for the entire software programme is not important either.

4. Software development within an employment relationship

- a) Overall, in summary, the employees of the GFZ already obligate themselves by their employment contract to make available to the GFZ all work results achieved in connection with their tasks and during their activity at the GFZ. This also includes the software developed by the staff - regardless of whether this has been developed during working hours, at the place of work or elsewhere in their leisure time. The decisive factor is the relevance of the developed software to the activity of the member of staff at the GFZ. Unless otherwise regulated by additional agreements or contracts, the rights to developed software with a topical relevance to the member of staff's work therefore lie with the GFZ.
- b) The respective employee may remain the author, but only the employer may determine how the software is used and exploited. Accordingly, the rights of the GFZ must be upheld when disseminating the software or rendering it accessible. Employees need the approval of the GFZ each time they use a created work, if it is not within GFZ or purely of a private nature.
- c) If there are several developers who are co-authors, this also means that - when the respective developers are employed at different institutions during the phase of software development, - different institutions are authorised to exert the rights to the software. Important: New staff members must, therefore, clarify with their former employers whether and under what circumstances they may also use software at the GFZ that they have developed during their previous employments, and if appropriate, whether they may forward it to GFZ-colleagues.
- d) For colleagues who are not employed at the GFZ and who work without supervision and independently (doctoral students working on their doctoral thesis, students working on their diploma thesis), the decisive factor is what has been agreed with them in each individual case. In principle, scientific freedom applies here, so that the research assistants can retain the usage rights to their works, although these can be waived by means of contractual agreements in favour of the employer institutes or funding research partners.
- e) For projects financed by third-party funds, the funders of the third-party funded project may also have rights to the software. This is regulated in the respective funding conditions.

5. Rights to software, usage rights and licences

- a) As a result of copyright protection covering the software, the developer, or usually, as described above, his or her employer, has the right to decide whether and how this software should be used, processed, reproduced, disseminated, published or rendered publicly accessible.
- b) The right owner can grant these usage and exploitation rights to another entity. Without such granting of rights, no third party may use software developed by someone else and which is protected by copyright.
- c) In most cases, these rights are granted in such a way that when software is disseminated or published, conditions of use ("licences") are agreed. The licences can be designed as special licence agreements with individual users or as general terms and conditions for a large number of users. In the *Policy on Use and Licensing of Research Software*¹, the GFZ provides guidelines and recommendations for licensing.