

# Bib<sub>La</sub>T<sub>E</sub>X style extension for Software

Citation and References macros for Bib<sub>La</sub>T<sub>E</sub>X

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## Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>	<b>4</b>	<b>Examples</b>	<b>5</b>
1.1	About . . . . .	1	4.1	software and softwareversion	5
1.2	License . . . . .	2	4.2	softwaremodule . . . . .	6
1.3	History . . . . .	2	4.3	codefragment . . . . .	7
1.4	Acknowledgments . . . . .	2	<b>5</b>	<b>Use</b>	<b>8</b>
<b>2</b>	<b>Software entries</b>	<b>2</b>	5.1	Use as an <i>on the fly</i> extension	8
2.1	software . . . . .	2	5.2	Generate extended styles . . .	8
2.2	softwareversion . . . . .	2	5.3	Installation . . . . .	9
2.3	softwaremodule . . . . .	3	5.4	Package options . . . . .	9
2.4	codefragment . . . . .	3	5.5	Adding support for additional software identifiers . . . . .	10
<b>3</b>	<b>Field description</b>	<b>3</b>	<b>6</b>	<b>Details</b>	<b>10</b>
3.1	Data fields . . . . .	3	<b>7</b>	<b>Contributing</b>	<b>11</b>
3.2	Special fields . . . . .	5	<b>8</b>	<b>Revision history</b>	<b>11</b>

## 1 Introduction

### 1.1 About

Software plays a significant role in modern research, and it must be properly acknowledged and referenced in scholarly works. To this end, specific bibliographic entries for describing *software*, *software versions*, *software modules* and *code fragments* have been designed by a dedicated task force at Inria in 2020 that brought together researchers from Computer Science and Applied Mathematics to discuss best practices for archiving and referencing software source code [2].

This package is a Bib<sub>La</sub>T<sub>E</sub>X *style extension* that adds support for these four *software entry types* to any other Bib<sub>La</sub>T<sub>E</sub>X style used in documents typeset in LaTeX. It is made up of the following key components: a references section style (`software.bbx`), a data model extension (`software.dbx`) and string localisation files (`<language>-software.lbx`)<sup>1</sup>.

The distribution contains other material, for demonstration purposes, and for more advanced use.

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<sup>1</sup>String localisations are provided for some languages: localisations for other languages are welcome, feel free to contribute them on the official repository, see Section *Contributing* below.

## 1.2 License

Permission is granted to copy, distribute and/or modify this software under the terms of the LaTeX Project Public License, version 1.3c<sup>2</sup>. The current maintainer is Roberto Di Cosmo (© 2020).

## 1.3 History

When I decided to start the Software Heritage initiative in 2015, software in general and research software in particular was not yet a first class citizen in the scholarly world. The absence of support for properly citing software in a bibliography was just one of the many signs of this lack of recognition.

In order to properly reference a software project, and ensure that these references are stable enough to pass the test of time, it was necessary to build a *universal archive* for software source code, and to equip every software artifact with *intrinsic* identifiers.

Now that [Software Heritage](#) is providing the universal archive [1], with Software Heritage *intrinsic identifiers* (SWH-IDs) widely available [3], it is finally possible to propose proper bibliographic entries for software, at various levels of granularity, down to the line of code.

## 1.4 Acknowledgments

Thanks to the Inria working group members for their precious feedback and contribution to the desing of the software bibliography entries: Pierre Alliez, Benjamin Guedj, Alain Girault, Morane Gruenpeter, Mohand-Said Hacid, Arnaud Legrand, Xavier Leroy, Nicolas Rougier and Manuel Serrano.

# 2 Software entries

There are four entry types, corresponding to different granularities in the identification of the (part of) software artifacts that one wishes to cite. They are listed below in order of granularity.

## 2.1 software

Computer software.

*Required fields:* author / editor, title, url, year

*Optional fields:* abstract, date, doi, eprint, eprintclass, eprinttype, file, hal\_id, hal\_version, institution, license, month, note, organization, publisher, related, relatedtype, relatedstring, repository, swhid, urldate, version

## 2.2 softwareversion

A specific version of a software. Inherits values of missing fields from the entry mentioned in the `crossref` field.

*Required fields:* author / editor, title, url, version, year

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<sup>2</sup><http://www.latex-project.org/lppl.txt>

*Optional fields:* abstract, crossref, date, doi, eprint, eprintclass, eprinttype, file, hal\_id, hal\_version, institution, introducedin, license, month, note, organization, publisher, related, relatedtype, relatedstring, repository, swhid, subtitle, urldate

## 2.3 softwaremodule

A specific module of a larger software project. Inherits values of missing fields from the entry mentioned in the `crossref` field.

*Required fields:* author, subtitle, url, year

*Optional fields:* abstract, crossref, date, doi, eprint, eprintclass, eprinttype, editor, file, hal\_id, hal\_version, institution, introducedin, license, month, note, organization, publisher, related, relatedtype, relatedstring, repository, swhid, title, urldate, version

## 2.4 codefragment

A code fragment (e.g. a specific algorithm in a program or library). Inherits values of missing fields from the entry mentioned in the `crossref` field.

*Required fields:* url

*Optional fields:* author, abstract, crossref, date, doi, eprint, eprintclass, eprinttype, file, hal\_id, hal\_version, institution, introducedin, license, month, note, organization, publisher, related, relatedtype, relatedstring, repository, swhid, subtitle, title, urldate, version, year

The **softwareversion**, **softwaremodule** and **codefragment** entries can inherit the missing fields from another entry designated by the *crossref* field, which is expected to be higher in the granularity hierarchy: **softwareversion** may inherit from a **software** entry, **softwaremodule** may inherit from a **softwareversion** or a **software** entry, and **codefragment** may inherit from all other entries.

## 3 Field description

The field description is based on the [bibtex documentation](#)

### 3.1 Data fields

**abstract** field (literal). This field is intended for recording abstracts in a bib file, to be printed by a special bibliography style. It is not used by all standard bibliography styles.

**author** list (name). The authors of the title.

**date [bibtex only]** field (date). The date of creation or release in ISO format.

**editor** list (name). The coordinator(s) of large modular software projects.

**file** field (verbatim). A link to download a copy of the work.

**doi** field (verbatim). The Digital Object Identifier of the work.

**eprint [biblatex only]** field (verbatim). An electronic identifier of the work. This field can be used to accommodate electronic identifiers different from the ones that have a dedicated field in this style.

**eprinttype [biblatex only]** field (verbatim). The type of eprint identifier, e. g., the name of the archive, repository, service, or system the eprint field refers to. Will be typeset by default as a prefix of the content of the eprint field.

**eprintclass [biblatex only]** field (verbatim). Additional information related to the resource indicated by the eprinttype field. This could be a section of an archive, a path indicating a service, a classification of some sort.

**hal\_id [not in biblatex standard styles]** field (verbatim). A digital identifier for the software record including its description and metadata on HAL.

**hal\_version [not in biblatex standard styles]** field (verbatim). The version of the HAL software record designated by `hal_id`.

**license [not in biblatex standard styles]** list (literal). The license/s of the title in SPDX format.

**month** field (literal). The month of creation or release. In BibLaTeX, this must be an integer, not an ordinal or a string. For compatibility with BibTeX, one can also use the three letter abbreviations *jan, feb, mar, apr, may, jun, jul, aug, sep, oct, nov, dec*, which must be given without any braces or quotes.

**note** field (literal). Release note of the cited version.

**institution** list (literal). The institution(s) that took part in the software project.

**introducedin [not in biblatex standard styles]** field (literal). If this is a software module or fragment, the version of the containing project where it has been first introduced.

**organization** list (literal). The organization(s) that took part in the software project.

**publisher** list (literal). The name(s) of the publisher(s) of the *qualified* software record.

**related [biblatex only]** field (separated values). Citation keys of other entries which have a relationship to this entry.

**relatedtype [biblatex only]** field (identifier).

**relatedstring [biblatex only]** field (literal).

**repository [not in biblatex standard styles]** field (uri). The url of the code repository (e.g. on GitHub, GitLab).

**swhid [not in biblatex standard styles]** field (verbatim). The identifier of the digital object (a.k.a the software artifact itself). The intrinsic identifier of the item is an swh-id (swh:cnt for a content, swh:dir for a directory, swh:rev for a revision, swh:rel for a release, etc.). See [the SWH-ID specification](#).

**subtitle** field (literal). The title of a component of the software artifact.

**title** field (literal). The title of the software artifact.

**url** field (uri). The url of a reference resource (e.g the project's official webpage).

**urldate** field (date). The access date of the address specified in the url field.

**version** field (literal). The revision number of a piece of software, a manual, etc.

**year** field (literal). The year of creation or release.

### 3.2 Special fields

**crossref** field (entry key). This field holds an entry key for the cross-referencing feature. Child entries with a crossref field inherit data from the parent entry specified in the crossref field.

## 4 Examples

Here are a few example of use of the proposed entries.

### 4.1 software and softwareversion

This is an example description of a software release using a single @softwareversion entry.

```
@softwareversion {delebecque:hal-02090402-condensed,
  title = {Scilab},
  author = {Delebecque, Fran{\c c}ois and Gomez, Claude and Goursat, Maurice
    and Nikoukhah, Ramine and Steer, Serge and Chancelier, Jean-Philippe},
  url = {https://www.scilab.org/},
  date = {1994-01},
  file = {https://hal.inria.fr/hal-02090402/file/scilab-1.1.tar.gz},
  institution = {Inria},
  license = {Scilab license},
  hal_id = {hal-02090402},
  hal_version = {v1},
  swhid = {swh:1:dir:1ba0b67b5d0c8f10961d878d91ae9d6e499d746a;
    origin=https://hal.archives-ouvertes.fr/hal-02090402},
  version = {1.1},
  note = {First Scilab version. It was distributed by anonymous ftp.},
  repository= {https://github.com/scilab/scilab},
  abstract = {Software for Numerical Computation freely distributed.}
}
```

The same information can also be represented using a @software / @softwareversion pair that factors out the general information in the @software entry, so for other versions only the changes need to be added in a new @softwareversion entry:

```

@software {delebecque:hal-02090402,
  title = {Scilab},
  author = {Delebecque, Fran{\c c}ois and Gomez, Claude and Goursat, Maurice
    and Nikoukhah, Ramine and Steer, Serge and Chancelier, Jean-Philippe},
  date = {1994},
  institution = {Inria},
  license = {Scilab license},
  hal_id = {hal-02090402},
  hal_version = {v1},
  url = {https://www.scilab.org/},
  abstract = {Software for Numerical Computation freely distributed.},
  repository= {https://github.com/scilab/scilab},
}

```

```

@softwareversion {delebecque:hal-02090402v1,
  version = {1.1},
  date = {1994-01},
  file = {https://hal.inria.fr/hal-02090402/file/scilab-1.1.tar.gz},
  swhid = {swh:1:dir:1ba0b67b5d0c8f10961d878d91ae9d6e499d746a;
    origin=https://hal.archives-ouvertes.fr/hal-02090402},
  note = {First Scilab version. It was distributed by anonymous ftp.},
  crossref = {delebecque:hal-02090402}
}

```

## 4.2 softwaremodule

For highly modular software projects, like CGAL, one may need to reference specifically a particular module, that has distinguished authors, and may have been introduced in the project at a later time.

The following example uses [the informations in the existing BibTeX entries for CGAL](#) that currently refer to the user manual, to create the corresponding software entries.

```

@software {cgal,
  title = {The Computational Geometry Algorithms Library},
  author = {{The CGAL Project}},
  editor = {{CGAL Editorial Board}},
  date = {1996},
  url = {https://cgal.org/}
}

@softwareversion{cgal:5-0-2,
  crossref = {cgal},
  version = {{5.0.2}},
  url = {https://docs.cgal.org/5.02},
  date = {2020},
  swhid = {swh:1:rel:636541bbf6c77863908eae744610a3d91fa58855;
    origin=https://github.com/CGAL/cgal/}
}

```

```
}
```

```
@softwaremodule{cgal:lp-gi-20a,  
  crossref = {cgal:5-0-2},  
  author = {Menelaos Karavelas},  
  subtitle = {{2D} Voronoi Diagram Adaptor},  
  license = {GPL},  
  introducedin = {cgal:3-1},  
  url = {https://doc.cgal.org/5.0.2/Manual/packages.html#PkgVoronoiDiagram2},  
}
```

Of course, it is always possible to use only one entry to get an equivalent result; here one would use just `@softwaremodule` with all the needed data fields as follows:

```
@softwaremodule{cgal:lp-gi-20a-condensed,  
  title = {The Computational Geometry Algorithms Library},  
  subtitle = {{2D} Voronoi Diagram Adaptor},  
  author = {Menelaos Karavelas},  
  editor = {{CGAL Editorial Board}},  
  license = {GPL},  
  version = {{5.0.2}},  
  introducedin = {cgal:3-1},  
  date = {2020},  
  swhid = {swh:1:rel:636541bbf6c77863908eae744610a3d91fa58855;  
  origin=https://github.com/CGAL/cgal/},  
  url = {https://doc.cgal.org/5.0.2/Manual/packages.html#PkgVoronoiDiagram2},  
}
```

### 4.3 codefragment

Finally, if one wants to have a particular code fragment appear in the bibliography, we can do this as follows:

```
@software {parmap,  
  title = {The Parmap library},  
  author = {Di Cosmo, Roberto and Marco Danelutto},  
  date = {2020},  
  version = {1.1.1},  
  institution = {{Inria} and {University of Paris} and {University of Pisa}},  
  license = {LGPL-2.0},  
  url = {https://rdicosmo.github.io/parmap/},  
  repository= {https://github.com/rdicosmo/parmap},  
}
```

```
@codefragment {simplemapper,  
  subtitle = {Core mapping routine},  
  swhid = {swh:1:cnt:43a6b232768017b03da934ba22d9cc3f2726a6c5;  
  lines=192-228;
```

```

    origin=https://github.com/rdicosmo/parmap},
  crossref = {parmap}
}

```

## 5 Use

This package can be used as a standalone on the fly extension, or to produce full bibliographic styles that extend pre-existing styles.

### 5.1 Use as an *on the fly* extension

The simplest way to use this package is to follow the example given in the `sample-use-sty.tex` that shows how one can *extend on the fly* any existing Bib<sub>TEX</sub> style by just doing the following:

- pass the `datamodel=software` option to the `biblatex` package as in

```
\usepackage[datamodel=software]{biblatex}
```

- load the software `biblatex` style using

```
\usepackage{software-biblatex}
```

- set software specific bibliography options using the macro `\ExecuteBibliographyOptions`; the options with their default values are as in

```

\ExecuteBibliographyOptions{
  halid=true,
  swhid=true,
  swlabels=true,
  vcs=true,
  license=true}

```

This is quite handy to add support for software entries in a single article, as it is enough to add `software.dbx`, `software.bbx`, `<language>-software.lbx` and `software-biblatex.sty` to make it work.

### 5.2 Generate extended styles

When a more systematic use is foreseen, as for institution-wide reports, or conference and journal proceedings, it is more appropriate to generate a new `biblatex` style that includes support for the software entries right away.

The following simple mechanism is provided for this use case:

- add to the `stublist` file the names of all the existing styles that must be extended
- run `make biblatex-styles` to produce new style files, with an added `+sw` suffix, for each of the existing style

- install the newly generated files in the standard path where Bib<sub>TEX</sub> files are found

The stock `stublist` file contains the names of all the standard Bib<sub>TEX</sub> styles. If this approach is followed, then one can load directly the extended file, and the software specific bibliography options become available when loading the Bib<sub>TEX</sub> package directly. See the `sample.tex` file for a working example.

### 5.3 Installation

This package may become available in standard distributions like T<sub>EX</sub>Live as `biblatex-software`. To install manually, you can download it from CTAN and then, put the relevant files in your `texmf` tree, usually:

```
<texmf>/tex/latex/biblatex-software/software-biblatex.sty
<texmf>/tex/latex/biblatex-software/software.bbx
<texmf>/tex/latex/biblatex-software/software.dbx
<texmf>/tex/latex/biblatex-software/<language>-software.lbx
```

### 5.4 Package options

The following options are available to control the typesetting of software related entries.

```
swlabels=true|false
```

Software is a special research output, distinct from publications, hence software entries in a bibliography are distinguished by a special label by default. This behaviour can be disabled by setting this option to `false`.

```
license=true|false
```

This option controls whether license information for the software entry is typeset. The default is `true`.

```
halid=true|false
```

This option controls the inclusion of the identifier on the HAL repository of the metadata record for the software described in the entry. The default is `true`.

```
swhid=true|false
```

This option controls the inclusion of the identifier on the Software Heritage archive of the source code of the software described in the entry. The default is `true`.

```
vcs=true|false
```

This option controls the inclusion of the url of the code hosting platform where the software described in the entry is developed. The default is `true`.

## 5.5 Adding support for additional software identifiers

It would not be reasonable to have a dedicated field for each of the many software related identifiers that exist. If you want to create bibliographic records that use identifiers not natively supported by this package, you can use the standard Bib<sub>La</sub>T<sub>E</sub>X mechanism that uses the `eprint`, `eprinttype` and `eprintclass` fields.

The default formatting of these fields may be what you want, but if it's not the case, you can define your own format, as explained in the official Bib<sub>La</sub>T<sub>E</sub>X documentation.

As an example, this style already contains a specific formatting definition for the Astrophysics Source Code Library (ASCL) software records, via the following declaration in the `software.bbx` file:

```
\DeclareFieldFormat{eprint:ascl}{%
  \mkbibacro{ASCL}\addcolon\addspace%
  \ifhyperref
    {\href{https://ascl.net/#1}{%
      \(\langle\)\ascl\addcolon\nolinkurl{#1}\(\rangle\)%
      \iffieldundef{eprintclass}
      {}
      {\addspace\texttt{\mkbibbrackets{\thefield{eprintclass}}}}}
    {\(\langle\)\ascl\addcolon\nolinkurl{#1}\(\rangle\)%
      \iffieldundef{eprintclass}
      {}
      {\addspace\texttt{\mkbibbrackets{\thefield{eprintclass}}}}}
}
```

If you want to adapt this very example to an identifier `foo` with resolver prefix `https://myfoo.org/`, just replace in the <sub>La</sub>T<sub>E</sub>X code above `https://ascl.net/` with `https://myfoo.org/`, `ascl` with `foo` and `ASCL` with `F00`.

## 6 Details

The detailed information for this style is contained in the example document and accompanying `.bib` files:

`software-biblatex.tex` This document.

`biblio.bib` An example bibliography showcasing all the software entries.

`sample-use-sty.tex`<sup>3</sup> This document exercises most useful feature of this style extension, using the `biblio.bib` entries.

`sample.tex` This document produces the same output as `sample-use-sty.tex`, but instead of extending on the fly and existing style, it assumes that an extended bibliographic style `numeric+sw` has been created starting from the standard `numeric` style.

---

<sup>3</sup>`sample-use-sty.pdf` is also provided and is the typeset version of this <sub>La</sub>T<sub>E</sub>X source file.

`software.bbx` The biblatex-software references style.

`software.dbx` The biblatex-software data model additions.

`*.lbx` The biblatex-software localisation files.

`software-biblatex.sty` The software-biblatex  $\LaTeX$  package for extending on the fly any preloaded Bib  $\LaTeX$  style.

## 7 Contributing

This style extension is currently developed on a git-based repository at <https://gitlab.inria.fr/gt-sw-citation/bibtex-sw-entry/>. Contributions and bug reports are very welcome. In particular, translation of the localization strings for other languages are needed.

## 8 Revision history

### **bltx-v1.2-2 2020-06-27**

Fix handling of related field; use date instead of year/month in examples; add swMATH definition

### **bltx-v1.2-1 2020-06-01**

Fix mishandling of SWHIDs and HALids when hyperref is not loaded. Fix wrong origins in some SWHIDs in the examples. Improve ASCL example.

### **bltx-v1.2 2020-05-29**

Bump version to 1.2 with clean support of multiline SWHIDs

### **bltx-v1.1 2020-04-29**

Add support for the institution, organization, eprint, eprinttype and eprintclass fields Force urls output when they are the only reference available Updates to the documentation

### **bltx-v1.0 2020-04-25**

First public release

### **bltx-v0.9 2020-04-25**

Preparing for public release: Licence, Readme, update documentation, handle suggestions from the Working Group

### **bltx-v0.8 2020-04-09**

Make the style usable as an extension, and keep possibility of generating extended styles

### **bltx-v0.7 2020-04-09**

Move to diff model approach to be more portable

#### **bltx-v0.6 2020-04-08**

Standardise file names, make softwarebib.tex self contained, separate out sample.tex, update Makefile, use printdate macro

#### **bltx-v0.5 2020-04-08**

Added standard list format for licenses

#### **bltx-v0.4 2020-04-07**

Added repository and licence field

#### **bltx-v0.3 2020-04-05**

Biblatex style with first complete example

#### **bltx-v0.2 2020-04-02**

Biblatex style sent for review

#### **bltx-v0.1 2020-04-02**

First version of the biblatex style

## **References**

- [1] J.-F. Abramatic, R. Di Cosmo, and S. Zacchiroli. Building the universal archive of source code. *Commun. ACM*, 61(10):29–31, Sept. 2018.
- [2] P. Alliez, R. Di Cosmo, B. Guedj, A. Girault, M.-S. Hacid, A. Legrand, and N. Rougier. Attributing and referencing (research) software: Best practices and outlook from inria. *Computing in Science and Engineering*, 22(1):39–52, Jan 2020. Available from <https://hal.archives-ouvertes.fr/hal-02135891>.
- [3] R. Di Cosmo, M. Gruenpeter, and S. Zacchiroli. Referencing source code artifacts: a separate concern in software citation. *Computing in Science and Engineering*, 22(2):33–43, 2020.