Towards a Software Pillar for Open Science

challenges and opportunities

Roberto Di Cosmo

Director, Software Heritage
Inria and Université de Paris Cité

June 2nd 2022
PNRIA

Software Heritage

THE GREAT LIBRARY OF SOURCE CODE

Outline

Open Science: the what and the why

Open Science (Second National Plan for Open Science, France, 2021)

Unhindered dissemination of results, methods and products from scientific research.
It draws on *the opportunity provided by recent digital progress* to develop *open access* to *publications* and – as much as possible – *data*, *source code* and *research methods*.

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Yuval Noah Harari (on COVID 19)

"The real antidote [to epidemic] is scientific knowledge *and* global cooperation."

Open Source

Free Software, AKA: *Open Source*, FOSS, FLOSS,...

Software that offers to *its users* the freedom to:

- use the software
- study and adapt the software
- distribute software copies
- distribute modified copies

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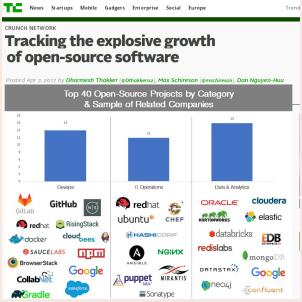
From the ripple in the early days (~1980's) to a tidal wave



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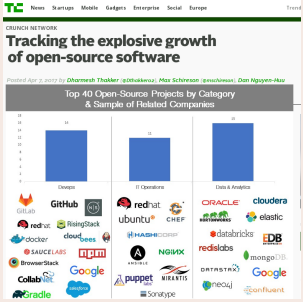

Free Software has changed the way software (even proprietary!) is

- developed
- tested
- deployed
- maintained
- marketed
- sold
- designed
- taught
- …

Software *Source Code* is Precious Knowledge

Harold Abelson, Structure and Interpretation of Computer Programs (1st ed.) 1985

"Programs must be written for people to read, and only incidentally for machines to execute."

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Apollo 11 source code (excerpt)

```
P63SPOT3        CA      BIT6            # IS THE LR ANTENNA IN POSITION 1 YET
                EXTEND
                RAND    CHAN33
                EXTEND
                BZF     P63SPOT4        # BRANCH IF ANTENNA ALREADY IN POSITION 1

                CAF     CODE500         # ASTRONAUT:    PLEASE CRANK THE
                TC      BANKCALL        #               SILLY THING AROUND
                CADR    GOPERF1
                TCF     GOTOPOOH        # TERMINATE
                TCF     P63SPOT3        # PROCEED       SEE IF HE'S LYING

P63SPOT4        TC      BANKCALL        # ENTER         INITIALIZE LANDING RADAR
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Quake III source code (excerpt)

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float Q_rsqrt( float number )
{
    long i;
    float x2, y;
    const float threehalfs = 1.5F;

    x2 = number * 0.5F;
    y = number;
    i = * ( long * ) &y; // evil floating point bit level hacking
    i = 0x5f3759df - ( i >> 1 ); // what the fuck?
    y = * ( float * ) &i;
    y = y * ( threehalfs - ( x2 * y * y ) ); // 1st iteration
// y = y * ( threehalfs - ( x2 * y * y ) ); // 2nd iteration, this
can be removed

    return y;
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Len Shustek, Computer History Museum 2006

"Source code provides a view into the mind of the designer."

The Paris Call on Software Source code (2019, UNESCO)

Experts call for greater recognition of software source code as heritage for sustainable development

.6 November 2018

UNESCO, Inria, Software Heritage invite
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"[We call to] promote software development as a valuable research activity, and research software as a key enabler for Open Science/Open Research, sharing good practices and recognising in the careers of academics their contributions to high quality software development, in all their forms"
https://en.unesco.org/foss/paris-call-software-source-code

Outline

A plurality of needs

Researchers

- archive and reference software used in articles
- find useful software
- get credit for developed software
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Research Organization

know its software assets

- technology transfer
- impact metrics
- funding strategy
- career evaluation

What is at stake

ARDC

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- Reference for identification (*reproducibility*)
- Describe for discovery and reuse
- Cite/Credit for credit and evaluation

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- Development practices and tools (VCS, build system, test suites, CI, …)
- Opening up towards a community (documentation, organization, communication)

Need training, best practices

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Beyond ARDC

- Policies (dissemination, reuse, careers!)
- Sustainability (legal, economic etc.)
- Technology transfer
- Advanced technologies and tools (quality, traceability, etc.)

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Forges are *not* archives!

2015: the first big bad news

Google Code and Gitorious.org shutdown: ~1M endangered repositories

- broken links in the web of knowledge (my papers too)

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we need a universal archive of software source code:

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we need a universal archive of software source code: now we have one!

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Preserving our heritage, enabling better software and better science for all

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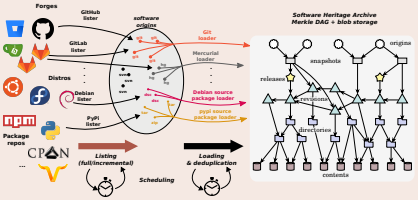
Research infrastructure

enable analysis of all software source code

Addressing the four ARDC needs (see ICMS 2020 for details)

Archive (12B+ files, 170M+ projects)



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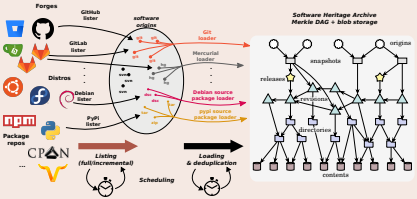

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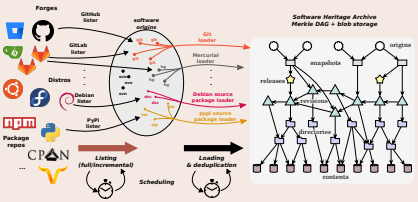

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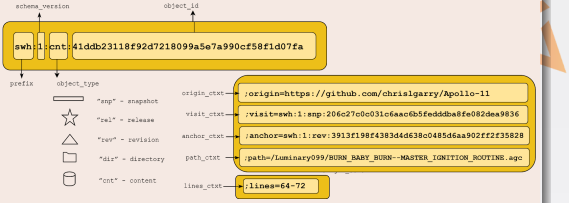

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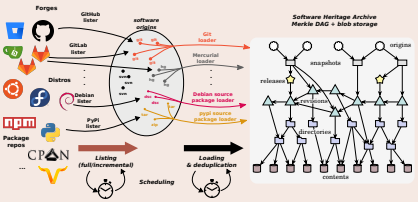

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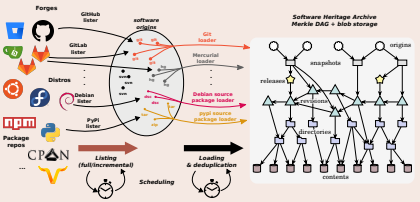

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Cite/Credit

- Contributed *software citation* style biblatex-software, v 1.2-2 now on CTAN

Outline

A walkthrough

- Browse the archive
- Trigger archival of your preferred software in a breeze
- Get and use SWHIDs (full specification available online)
- Cite software with the biblatex-software style from CTAN
- Example use in a research article: extensive use of SWHIDs in a replication experiment
- Example in a journal: an article from IPOL
- Curated deposit in SWH via HAL, see for example: LinBox, SLALOM, Givaro, NS2DDV, SumGra, Coq proof, …
- Extracting all the software products for Inria, for CNRS, for LIRMM or for Rémi Gribonval using HalTools

Call to action on ARDC: let's foster adoption!

Train students and colleagues to archive and reference relevant source code

- full details in the ICMS 2020 article
- short operational HOWTO online

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Engage conferences, journals, learned societies to use Software Heritage and SWHIDs

APIs for save code now and deposit are available to integrate with

- Research Articles
- Artifact Evaluation Committees
- Badging initiatives

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Help grow and structure the community

- Promote the ambassador program
- Encourage our institutions to
  - include Software Heritage in their Open Science policy
  - become member/sponsor
  - build a Software Heritage mirror (see ENEA)

Outline

French National plan for Open Science, 2021-2024

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2nd National Plan for Open Science (6/7/2021)

Open and promote research software source code

- actions (selection)
  - charter for research software policy
  - recognize software development (see announcement of the 2021 prize)
  - coordinate communities of practice
  - connected ecosystem of research outputs
- recommendations (selection)
  - archive in Software Heritage
  - standardise and use SWHID
  - build a national catalog of research software
  - leverage ADAC network

See official announcement

Breaking news: the Software Chapter of the CoSO is live!

Software Chapter in the CoSO

Five action lines

- Identifying and highlighting research software production
- Technical and social tools and best practices
- Valorization and sustainability
- Liaison and animation at national, European, and international levels
- Recognition and careers

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- Collaboration with DINUM, Eclipse Foundation, OW2, …

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The Open Science award for Open Source research software

See the official page at MESRI

Software Chapter in the CoSO, cont'd

Twenty-four active members

Chairs: Roberto Di Cosmo and François Pellegrini

- Florent CHUFFART (Univ Grenoble Alpe)
- Mélanie CLÉMENT-FONTAINE (Univ Paris-Saclay - Versailles Saint-Quentin)
- Laurent COSTA (UMR 7041 ArScAn)
- Ludovic COURTÈS (Inria)
- Sébastien GÉRARD (Univ Paris-Saclay, CEA, List)
- Mathieu GIRAUD (CNRS, Univ Lille)
- Timothée GIRAUD (CNRS)
- Jean-Yves JEANNAS (Univ Lille, AFUL)
- Nicolas JULLIEN (IMT Atlantique)
- Daniel LE BERRE (Univ Artois, CNRS)
- Violaine LOUVET (CNRS / GRICAD - Univ Grenoble Alpes)
- Camille MAUMET (Inria, Univ Rennes, CNRS, Inserm)
- Clémentine MAURICE (CNRS)
- Grégory MIURA (Univ Bordeaux Montaigne)
- Raphaël MONAT (LIP6, Sorbonne Université)
- Patrick MOREAU (CNRS)
- Sophie RENAUDIN (AP-HP)
- Nicolas ROUGIER (Inria, Univ Bordeaux, CNRS)
- Filippo RUSCONI (CNRS-Univ Paris-Saclay)
- François SABOT (IRD)
- Sylvie TONDA-GOLDSTEIN (Inria)
- Samuel THIBAULT (Univ Bordeaux) (Univ Paris-Saclay)

it's a long road, but together we can make it

Questions?

References


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