Research Software Hackaton

Introduction and highlights

Roberto Di Cosmo

Online material: http://bit.ly/reswhack

October 15th, 2019

Software Heritage

THE GREAT LIBRARY OF SOURCE CODE

Outline

1. Introduction
2. Academia's evolving practice
3. Connecting communities
4. Challenges
5. Moving forward

Short Bio: Roberto Di Cosmo

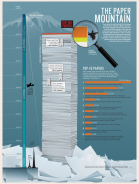
Computer Science professor in Paris, now working at INRIA

- *30 years* of research (Theor. CS, Programming, Software Engineering, Erdos #: 3)
- *20 years* of Free and Open Source Software
- *10 years* building and directing structures for the common good

1999	*DemoLinux* – first live GNU/Linux distro
2007	*Free Software Thematic Group* 150 members 40 projects 200Me
2008	*Mancoosi project* www.mancoosi.org
2010	*IRILL* www.irill.org
2015	*Software Heritage* at INRIA
2018	*National Committee for Open Science*, France

Why we are here

Software is everywhere in modern research



[...] software [...] essential in their fields.
Top 100 papers (Nature, 2014)

Sometimes, if you dont have the software, you dont have the data
Christine Borgman, Paris, 2018

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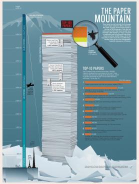

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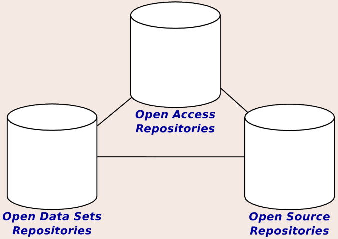
Open Science: three pillars



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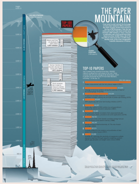

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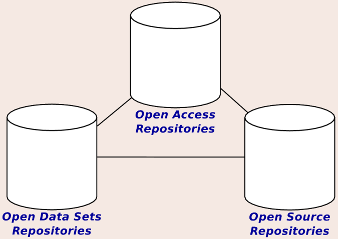

Nota bene

The links in the picture are essential

The knowledge is in the source code!

“The source code for a work means the preferred form of the work for making modifications to it."

GPL Licence

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Hello World

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> *GPL Licence*

Hello World

Program (excerpt of binary)

```
4004e6: 55
4004e7: 48 89 e5
4004ea: bf 84 05 40 00
4004ef: b8 00 00 00 00
4004f4: e8 c7 fe ff ff
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4004fa: 5d
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Program (source code)

```
/* Hello World program */

#include<stdio.h>

void main()
{
    printf("Hello World");
}
```

Source code is *special*

Executable and *human readable* knowledge — copyright law

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

Harold Abelson

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Software *evolves* over time

- projects may last decades
- the *development history* is key to its *understanding*

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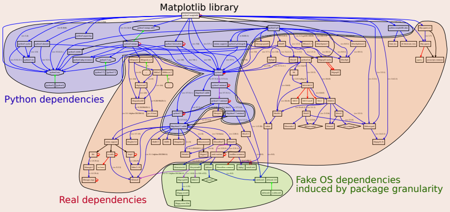
Complexity

- *millions* of lines of code
- large *web of dependencies*
  - easy to break, difficult to maintain
- sophisticated *developer communities*



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Pressure to make the source code available is raising

Why

Necessary to

- *reproduce* and verify,
- *modify* and *evolve*, building new experiments from old ones

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When and where

- debate started end of first 2000 decade (biology, statistics, medicine, etc.)
- growing in Computer Science since the ESEC/FSE 2011 Artifact Evaluation context (winner: Vouillon and Di Cosmo)

What is at stake

in increasing order of difficulty

Archival

Research software artifacts must be properly archived

make it sure we can *retrieve* them (*reproducibility*)

What is at stake — in increasing order of difficulty

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Identification

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Metadata

Research software artifacts must be properly described

make it easy to *discover* them (*visibility*)

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Metadata

Research software artifacts must be properly described

make it easy to *discover* them (*visibility*)

Citation

Research software artifacts must be properly cited *(not the same as referenced!)*

to give *credit* to authors (*evaluation*!)

Where we stand

Lack of recognition

not (yet) a first class citizen

- in the EOSC plan
- in the scholarly world

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Lack of consensus on how to

- *archive* software
- *choose* a license
- *cite* a software project

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Lack of consensus on how to

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… but a wealth of initiatives!

- Policies: ACM Artifact Review and Badging, AEC, …
- Working groups: FORCE11, RDA, SPSO, …
- Journals: IPOL, ReScience, InsightJournal, JOSS, eLife, ACM DL, …
- Repositories: FigShare, Zenodo, …
- Common infrastructures: Software Heritage

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FORCE Software Citation Implementation WG

Spawned from the Software Citation WG (2/2016)

led by Daniel Katz, Kyle Niemeyer and Arfon Smith

Co-chairs

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. . .

Neil tells us more. . .

RDA Software Source Code Interest Group

Co-chairs

Roberto Di Cosmo, Neil Chue Hong, Mingfang Wu, Julia Collins

Objectives

a forum for discussing *software* inside RDA

Chronology

RDA 10, Montreal 9/2017 motivations, survey of ontologies, metadata use cases

RDA 11, Berlin 3/2018 identification of gaps in metadata

RDA 13, Philadelphia 4/2019 FAIR for Software Source Code

Web page

https://www.rd-alliance.org/groups/software-source-code-ig

RDA WG on Software Source Code Identification

Joint RDA & FORCE11 WG which spawned from

RDA's Software Source Code IG & FORCE11's SCIWG

Co-chairs

Roberto Di Cosmo, Daniel Katz, Martin Fenner

Objectives

- bring together people involved/interested in *software identification*
- produce concrete recommendations for the academic community

`https://www.rd-alliance.org/groups/software-source-code-identification-wg`

Inria's Software Citation Working Group

Members

task force of Inria's scientific council

Mission

- map the landscape
- collect best practices
- identify potential Inria contributions
- make recommendations

First outcome

Position paper available from
https://hal.archives-ouvertes.fr/hal-02135891

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Much more complex than it seems

Software is complex

Structure	monolithic/composite; self-contained/external dependencies
Lifetime	one-shot/long term
Community	one man/one team/distributed community
Authorship	complex set of roles
Authority	institutions/organizations/communities/single person

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Various granularities

Exact status of the source code for reproducibility, e.g.

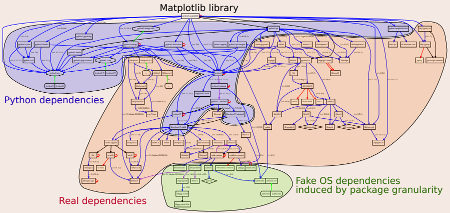
“you can find at swh:1:cnt:cdf19c4487c43c76f3612557d4dc61f9131790a4;lines=146-187 the core algorithm used in this article”

(Major) release *“This functionality is available in OCaml version 4”*

Project *“Inria has created OCaml and Scikit-Learn”.*

We are not alone

Research Software does not exist in isolation



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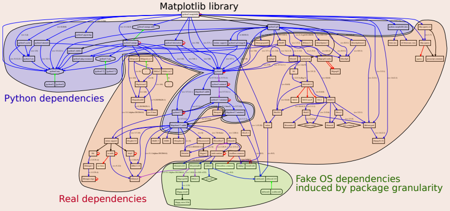

large *web of dependencies* on non-research software

Industry and developers have been here

- NSRL (NIST)
- SPDX (Linux Foundation)
- SWH-ID (Software Heritage)
- SWID (ISO Standard)
- Wikidata Software Properties

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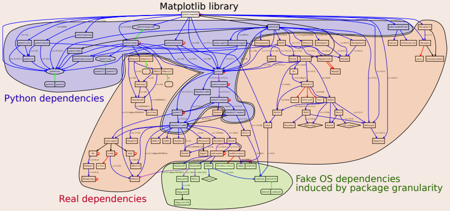

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We must

- accept the complexity
- avoid reinventing the wheel
- connect with existing communities of practice

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Our goals today

Make progress

- Share and collect knowledge
- Improve state of the art
- Other tangible outputs, as detailed in the agenda

Thanks, and good work!