Software Heritage

The universal source code archive

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July 11th, 2018

Software Heritage
THE GREAT LIBRARY OF SOURCE CODE

Outline

Software Heritage in a nutshell

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THE GREAT LIBRARY OF SOURCE CODE

Collect, preserve and share the *source code* of *all the software*

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

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Universal archive

preserve all the source code

Research infrastructure

enable analysis of all the source code

Our principles

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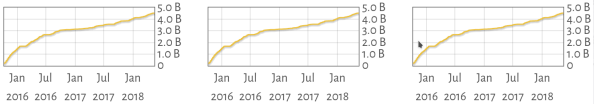
Cultural Heritage | **Industry** | **Research** | **Education**

Software Heritage

Source files	Commits	Projects
4,536,067,027	1,024,675,748	83,801,775



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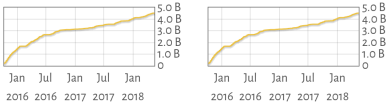

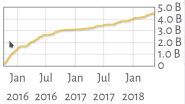

Open approach

- open source
- transparency

In for the long haul

- non profit, mirrors
- intrinsic identifiers

Exhaustive

- all software
- open to all communities

Growing Support

Raising awareness: landmark agreement, 3/4/2017; grand opening, 7/6/2018

Inria — INVENTEURS DU MONDE NUMÉRIQUE

UNESCO

Sharing the vision

The Software Heritage · GitLab · ENGINEERING · eclipse · OW2 · fsfe · nlnet FOUNDATION · SIGSOFT · Liberté • Égalité • Fraternité RÉPUBLIQUE FRANÇAISE · INAP · THE LINUX FOUNDATION · ADULLACT · INFORMATICS EUROPE · Computer History Museum · software freedom conservancy · Software Freedom Law Center · AdaCore · gandi.net · TDF · FREE SOFTWARE FOUNDATION · creative commons · SIF · open source initiative · openinventionnetwork

Sponsoring our work

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Microsoft · intel · SOCIETE GENERALE · HUAWEI · Google · DANS · NOKIA Bell Labs · GitHub · UQÀM · FOSSID

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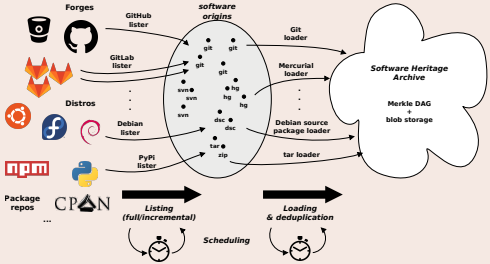
Zoom on the collection phase

Much more than an archive!



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- WIP: Bitbucket, FusionForge, GitLab.com
- *add your own plugins!*

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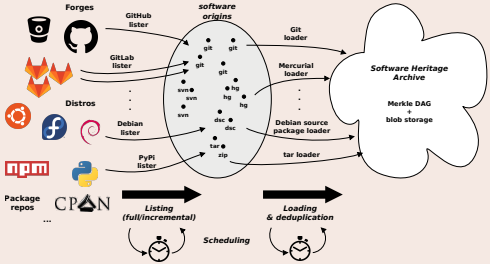

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- mission: exhaustive and up to date collection of source code, *specifically*
- strategy: automatic harvesting + *deposit* from *selected* sources

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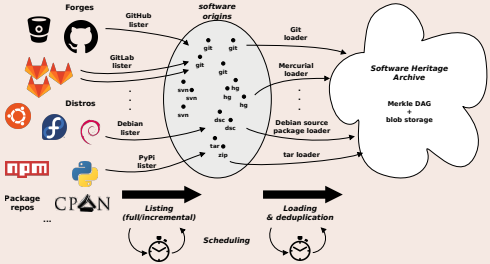

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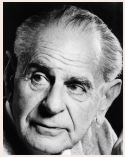
The *richest* source code archive already, … and growing daily!

How we built our scientific knowledge

Reproducibility is the key

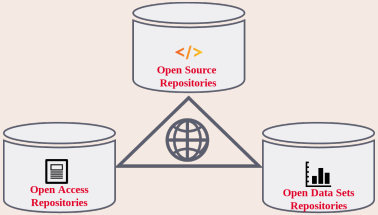


non-reproducible single occurrences are of no significance to science

Karl Popper, The Logic of Scientific Discovery, 1934

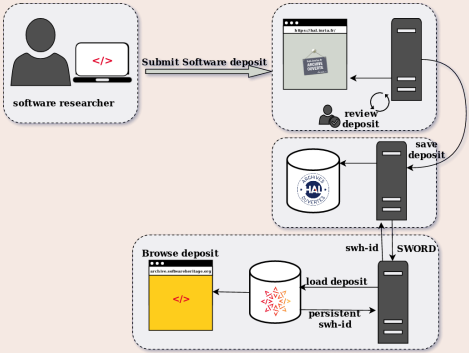
the *software source code* is special

- It embodies the logic of the data transformation.
- It must be included in strategies for *scientific knowledge preservation.*
- knowing the exact version of the software used is essential for reproducibility.



The research software (deposit) use case

Deposit software in HAL http://hal.inria.fr/hal-01738741



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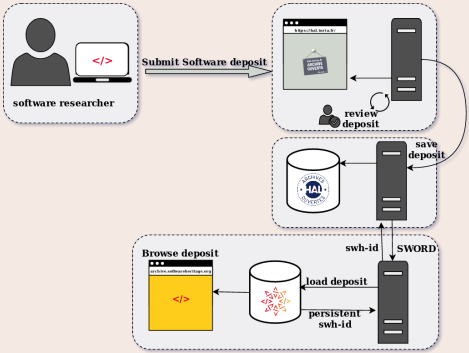

Generic mechanism:

- SWORD based
- review process
- versioning

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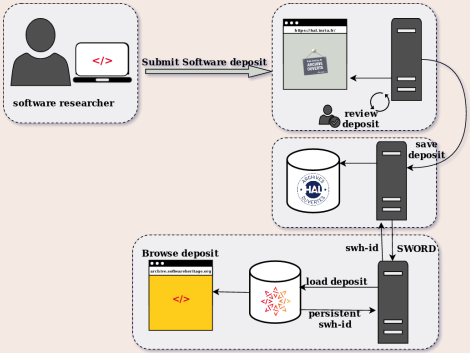

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How to do it:

- today: deposit .zip or .tar.gz file (*guide*)
- tomorrow:
  - provide *SWH id* and metadata
  - include *metadata file* for automatic metadata extraction
  - ...

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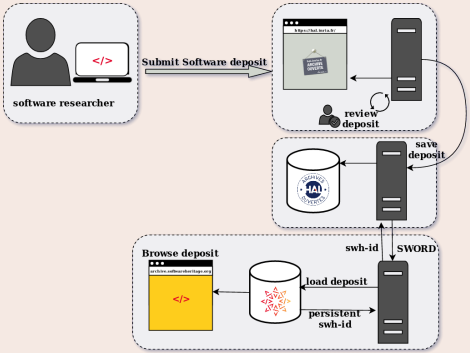

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September 2018: open to all on https://hal.archives-ouvertes.fr/

Identifying and retrieving source code

Intrinsic identifiers (spec: `http://bit.ly/swhpids`)

- provide integrity guarantees
- all software and VCS (not just git or GitHub)
- use for identifying a precise version of source code
- learn more in the forthcoming iPres 2018 paper

e.g: swh:1:cnt:41ddb23118f92d7218099a5e7a990cf58f1d07fa

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"Wayback-machine-style" identifiers

- point to software origins
- expose the SWH crawling history

use when no precise version is known

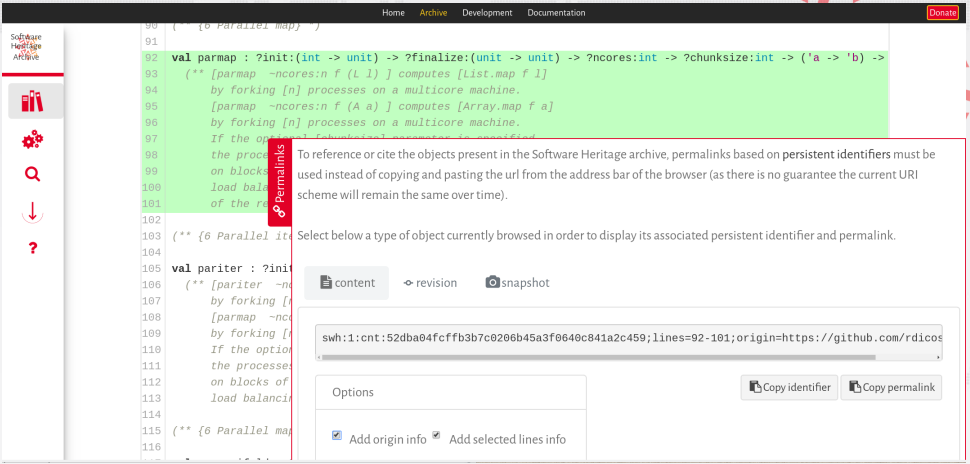
Demo Time!

- example deposits in HAL
- example use of `https://archive.softwareheritage.org`

Access using intrinsic IDs

Click on the links in the paper and view the source code!

"Our Parmap.parmap and Parmap.parfold functions may be used to seamlessly ..."



Selected unique benefits there are more!

All features of Software Heritage *for free*

- intrinsic IDs (integrity, not dependent on resolvers!)
  - specification: `http://bit.ly/swhpids`
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- browse, download (now)
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Sustainability

... doors are open!

one infrastructure *independent* non profit foundation *worldwide* mirrors

Breaking news

Operational adoption

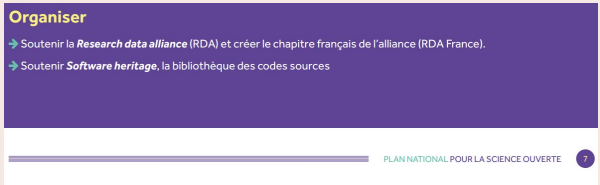
June 7th swMath.org points into SWH for the source code see "Code" link in, e.g. `http://swmath.org/software/7116`

ongoing OpenAire detects source code links in articles, resolves them to SWH

September HAL opens the software deposit doors on all portals

Institutional adoption

July 4th Software Heritage is part of the french National Plan for Open Science



Come in, we're open! (research software focus)

Adopt and reuse

deposit/reference research software in SWH	morane.gg@gmail.com
become a SWH mirror	roberto@dicosmo.org

Standardise

metadata	RDA source code IG
identifiers	RDA source code identification WG

Support

sponsoring / partnership	sponsorship.softwareheritage.org
donations	softwareheritage.org/donate
our own code	forge.softwareheritage.org

Outline

Our challenge in the PID arena

Long term

Identifiers must be there for the long term

No middle man

Identifiers must be meaningful even if resolvers go away

Integrity, not just naming

Identifier must ensure that the retrieved object is the intended one

Uniqueness by design

one name identifies a single object, and each object has only one name

Exploring the PID landscape

A lot of options out there...

URL, URI, PURL, URN, ARK, DOI, ...

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- articles
- data
- even software artefacts!

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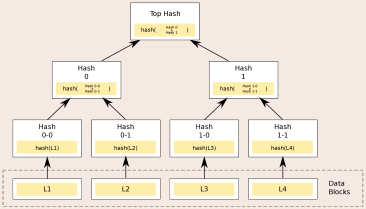
we adopted something radically different

Intrinsic identifiers in Software Heritage

Merkle tree (R. C. Merkle, Crypto 1979)



Combination of

- tree
- hash function

Classical cryptographic construction

fast, parallel signature of large data structures, built-in deduplication

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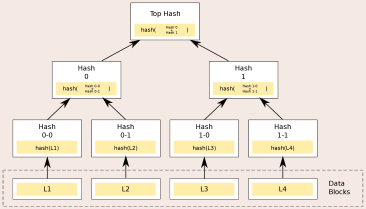

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fast, parallel signature of large data structures, built-in deduplication

- satisfies all three criteria
- widely used in industry (e.g., Git, nix, blockchains, IPFS, ...)

Back to basics: DIOs vs. IDOs

DIO (digital identifier of an object)

- digital identifiers for traditional (non digital) objects
  - epistemic complications (manifestations, versions, locations, etc.)
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Working together

Example: links to *software source code* in an article

Leveraging the Software Heritage universal archive:

set of files `swh:1:dir:06741c8c37c5a384083082b99f4c5ad94cd0cd1f`
id of directory object listing all the files in a project (at a given time)

revision `swh:1:rev:7598fb94d59178d65bd8d2892c19356290f5d4e3`
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Full specification available online:
`https://docs.softwareheritage.org/devel/swh-model/persistent-identifiers.html`

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metadata this *will* involve some form of DIO

- and we get all the complications back

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Our role : handle *all* the *software source code*

At the end of the process

Explicit deposit, coordinated with the publisher

- store the *final* source code (no garbage)
- store only public source code
- N.B.: no embargo or access control (yet)

During the review

Access to the largest available source code base

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- metrics (for long standing projects)

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Later on

- Support embargo/access control

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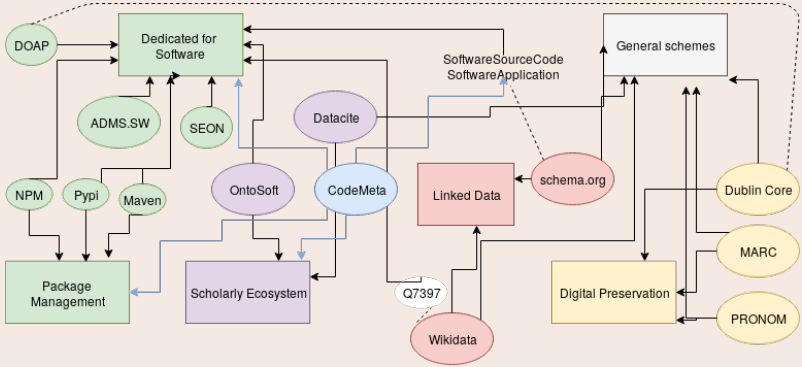
Collecting metadata for 60+ million projects

Landscape of Software Ontologies



It's the real world!

reconcile metadata from different origins, handle conflicts, synthesise missing information, classify (automatically) the projects, etc.

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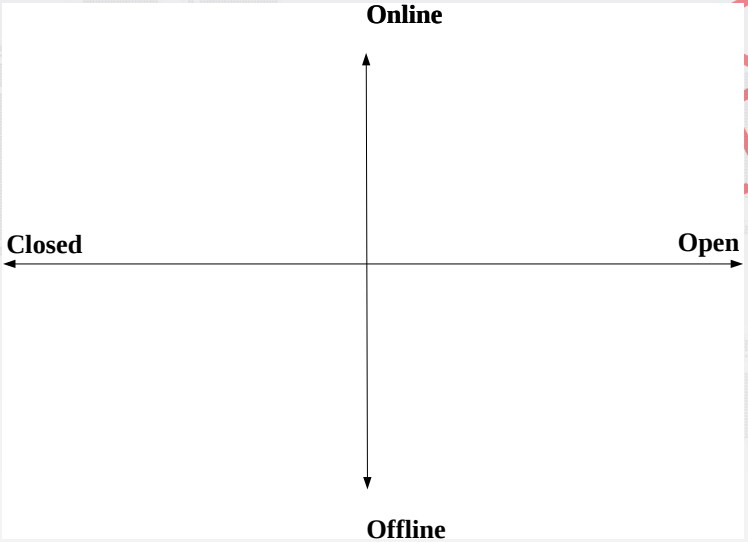
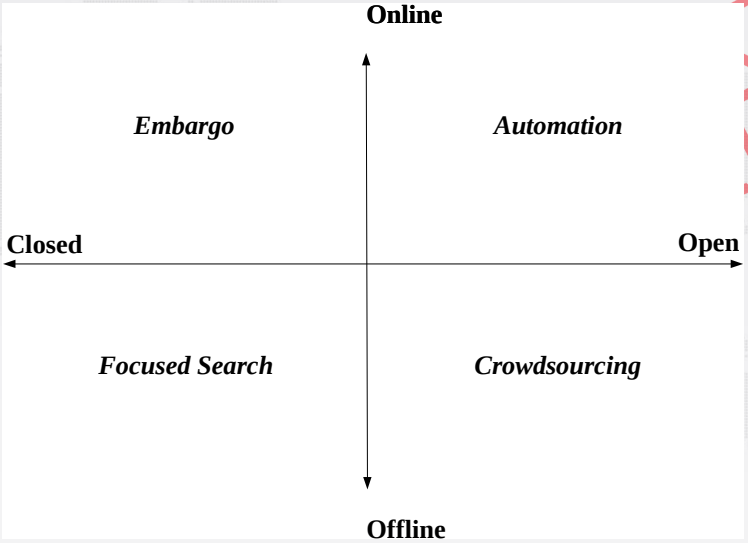


All the source code, strategies



Online, open source code: automation overview