ILLINOIS

Software Heritage and CRAN

Connect *The Great Library of Source Code* with the Comprehensive R Archive Network

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[1]University of Illinois [2]Université Paris Diderot [3]Inria [4]Software Heritage [5]Debian Project [6]R Project

Disclaimer

Quick Clarifications

- I (Dirk) am not affiliated with Software Heritage
- So whatever I say do not blame Software Heritage for it
- I have known about Software Heritage for years via Debian
- I meant to get involved for years too and ...
  ... am now informally helping within Google Summer of Code
- Big thanks to Software Heritage for what they do
- And for access to their collection of talks to bootstrap this one
- Most of what follows ended up coming from `https://www.softwareheritage.org/`

Software Heritage: Motivation

Motivation

```
4015  */
4016 static int do_sched_cfs_period_timer(struct cfs_bandwidth *cfs_b, int overrun)
4017 {
4018         u64 runtime, runtime_expires;
4019         int throttled;
4020
4021         /* no need to continue the timer with no bandwidth constraint */
4022         if (cfs_b->quota == RUNTIME_INF)
4023                 goto out_deactivate;
4024
4025         throttled = !list_empty(&cfs_b->throttled_cfs_rq);
4026         cfs_b->nr_periods += overrun;
4027
4028         /*
4029          * idle depends on !throttled (for the case of a large deficit), and if
4030          * we're going inactive then everything else can be deferred
4031          */
4032         if (cfs_b->idle && !throttled)
4033                 goto out_deactivate;
4034
4035         __refill_cfs_bandwidth_runtime(cfs_b);
4036
4037         if (!throttled) {
4038                 /* mark as potentially idle for the upcoming period */
4039                 cfs_b->idle = 1;
4040                 return 0;
4041         }
4042
4043         /* account preceding periods in which throttling occurred */
4044         cfs_b->nr_throttled += overrun;
4045
4046         runtime_expires = cfs_b->runtime_expires;
4047
4048         /*
4049          * This check is repeated as we are holding onto the new bandwidth while
4050          * we unthrottle. This can potentially race with an unthrottled group
4051          * trying to acquire new bandwidth from the global pool. This can
```

Software [is our] Heritage

Source: https://www.softwareheritage.org/

Motivation

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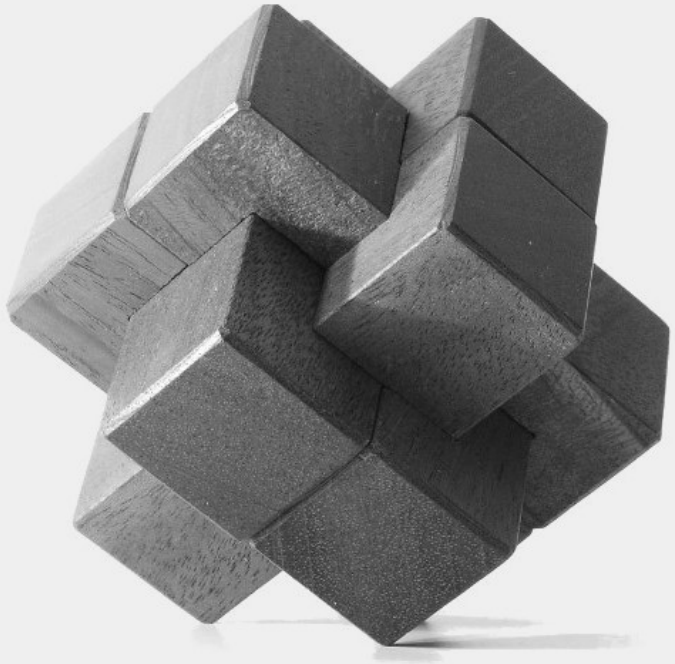
Motivation



Software is the key

to access information and
a fundamental part of
human heritage

Source: https://www.softwareheritage.org/

Motivation

Software Heritage

preserves software source code for
present and future generations

Source: https://www.softwareheritage.org/

The Software Heritage Project

We are building the universal software archive

Collect
Preserve
Share

We **collect** and **preserve** software in source code form, because software embodies our technical and scientific knowledge and humanity cannot afford the risk of losing it.

Software is a precious part of our cultural heritage. We curate and make accessible all the software we collect, because only by **sharing** it we can guarantee its preservation in the very long term.

Discover our mission

Source: https://www.softwareheritage.org/

Software Heritage: Who and How

People

Executives

Roberto Di Cosmo (Founder, CEO)

After teaching for almost a decade at Ecole Normale Supérieure in Paris, Roberto Di Cosmo became full professor in Computer Science at University Paris Diderot. He is currently on leave at Inria to lead the Software Heritage project.

His research interests span a wide spectrum from foundational aspects of logical systems to functional programming, parallel and distributed programming. He created and directed the european reseach project Mancoosi to improve the quality of large collections of software quality, and is investigating now the scientific problems posed by the general adoption of Free Software, with a particular focus on static analysis of large software collections.

A long term Free Software advocate, contributing to its adoption since 1998, he has created the Free Software thematic group of Systematic in October 2007, which has helped fund over 40 research and development projects, and he is now director of IRILL, a research structure dedicated to Free and Open Source Software quality.

- Email: roberto@softwareheritage.org
- Twitter: @rdicosmo

Stefano Zacchiroli (Founder, CTO)

Stefano Zacchiroli holds a PhD in Computer Science from the University of Bologna, Italy, and is Associate Professor of Computer Science at University Paris Diderot, France. He is currently on leave at INRIA and a research fellow at IRILL, a research institute dedicated to the study of Free/Open Source Software (FOSS).

His research interests span formal methods, their applications to improve software quality and packages upgrades, as well as Free Software evolution.

He has been an official member of the Debian Project since 2001, where he worked on many tasks, from package maintenance to distribution-wide Quality Assurance. He has been elected to serve as Debian Project Leader (DPL) for 3 terms in a row, during the period 2010-2013. He is a Board Director of the Open Source Initiative (OSI) and a recipient of the 2015 O'Reilly Open Source Award.

- Email: zack@softwareheritage.org
- Twitter: @zacchiro

Source: https://www.softwareheritage.org/people

Accoloades

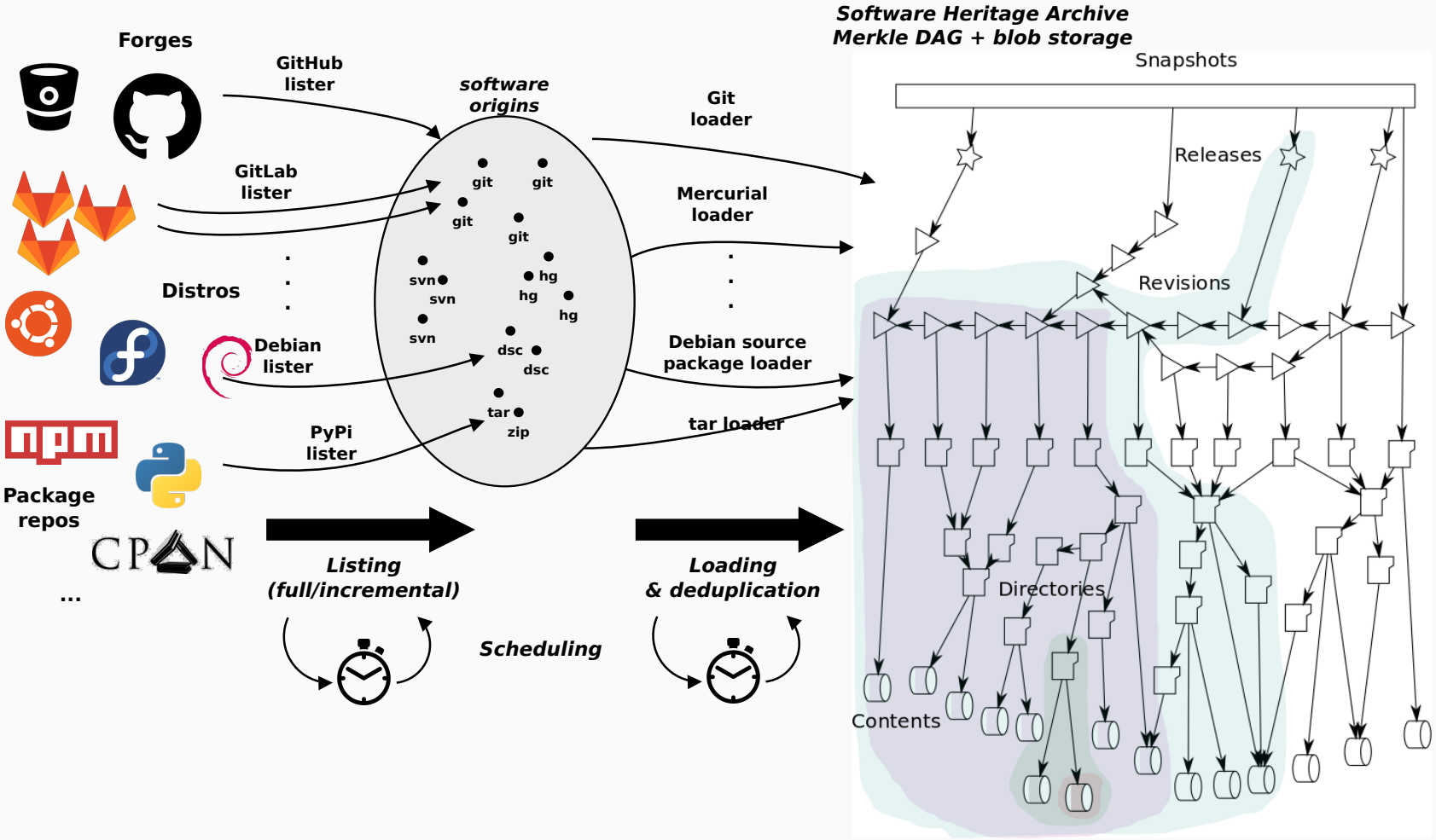
UNESCO

Software source code represents unique knowledge of humanity's recent history. It is therefore crucial to work together collectively so that the knowledge embedded in software source code is properly preserved, valued and shared with all. This lies at the core of UNESCO's cooperation with Inria to support the creation of Software Heritage, the global archive of software source code.

—Moez Chakchouk, Assistant Director-General for Communication and Information, UNESCO

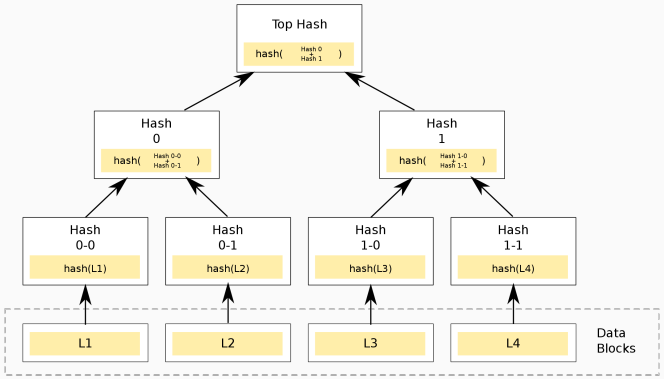
Source: https://www.softwareheritage.org/support/testimonials/
https://www.softwareheritage.org/2019/06/24/unesco/

Data Flow into DAG



Source: Software Heritage, with permission

Merkle Trees



Source: Software Heritage, with permission

- Combination of
  - tree
  - hash function
- Classical cryptographic construction
  - fast, parallel signature of large data structures
  - widely used (e.g., Git, blockchains, IPFS, …)
  - built-in deduplication

Archive Coverage

Overview

The long term goal of the Software Heritage initiative is to **collect** all publicly available software in source code form together with its development history, replicate it massively to ensure its **preservation**, and **share** it with everyone who needs it. The Software Heritage archive is growing over time as we crawl new source code from software projects and development forges. We will incrementally release archive search and browse functionalities — as of now you can check whether source code you care about is already present in the archive or not.

Content

A significant amount of source code has already been ingested in the Software Heritage archive. It currently includes:

Size

As of today the archive already contains and keeps safe for you the following amount of objects:

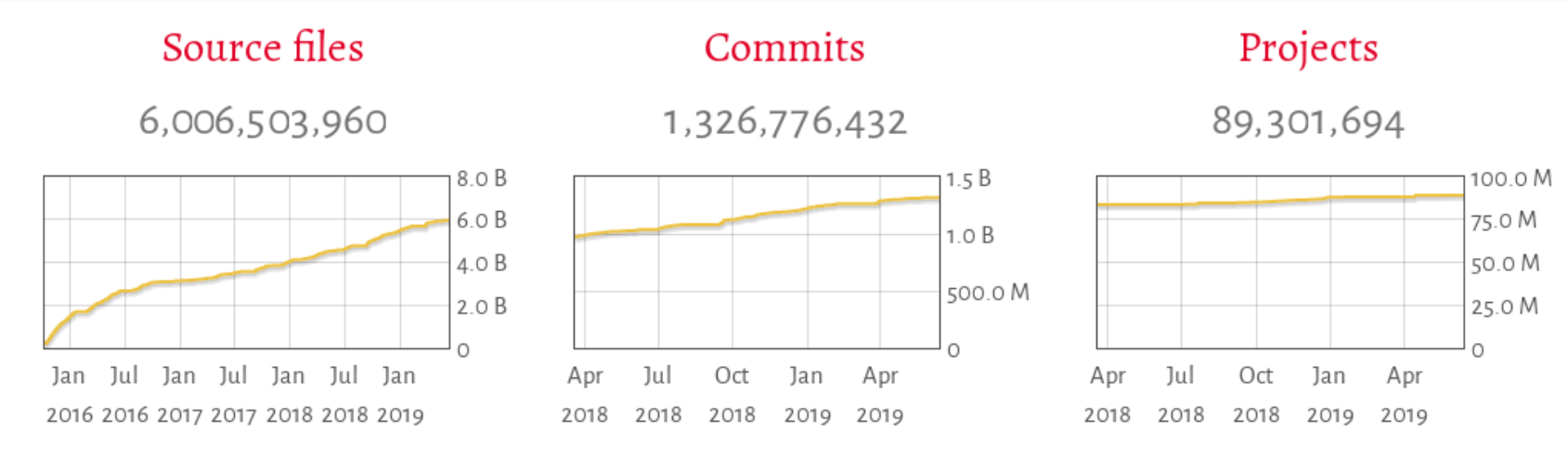
Source files	Directories	Commits	Authors	Projects	Releases
6,028,249,303	5,241,278,479	1,339,869,315	24,883,628	89,387,814	11,442,050

Source: https://archive.softwareheritage.org/ (as of June 29, 2019)

Archive Coverage: Scale and Growth

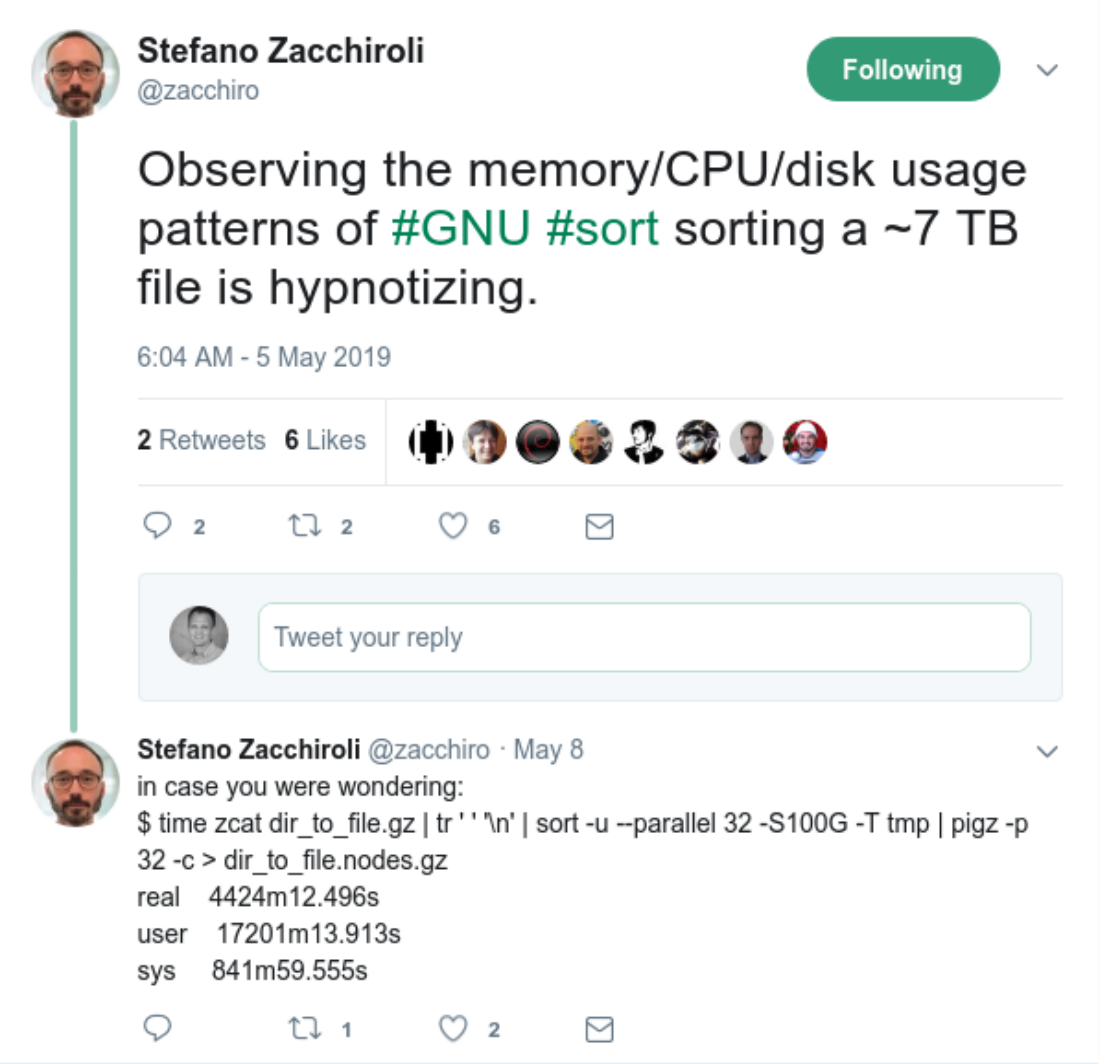
Scale

- 200 TB (compressed) blobs
- 6 TB database (as a graph: 10 B nodes + 100 B edges)
- The *richest* public source code archive, … and growing daily!



Source: Software Heritage, with permission

Archive Coverage

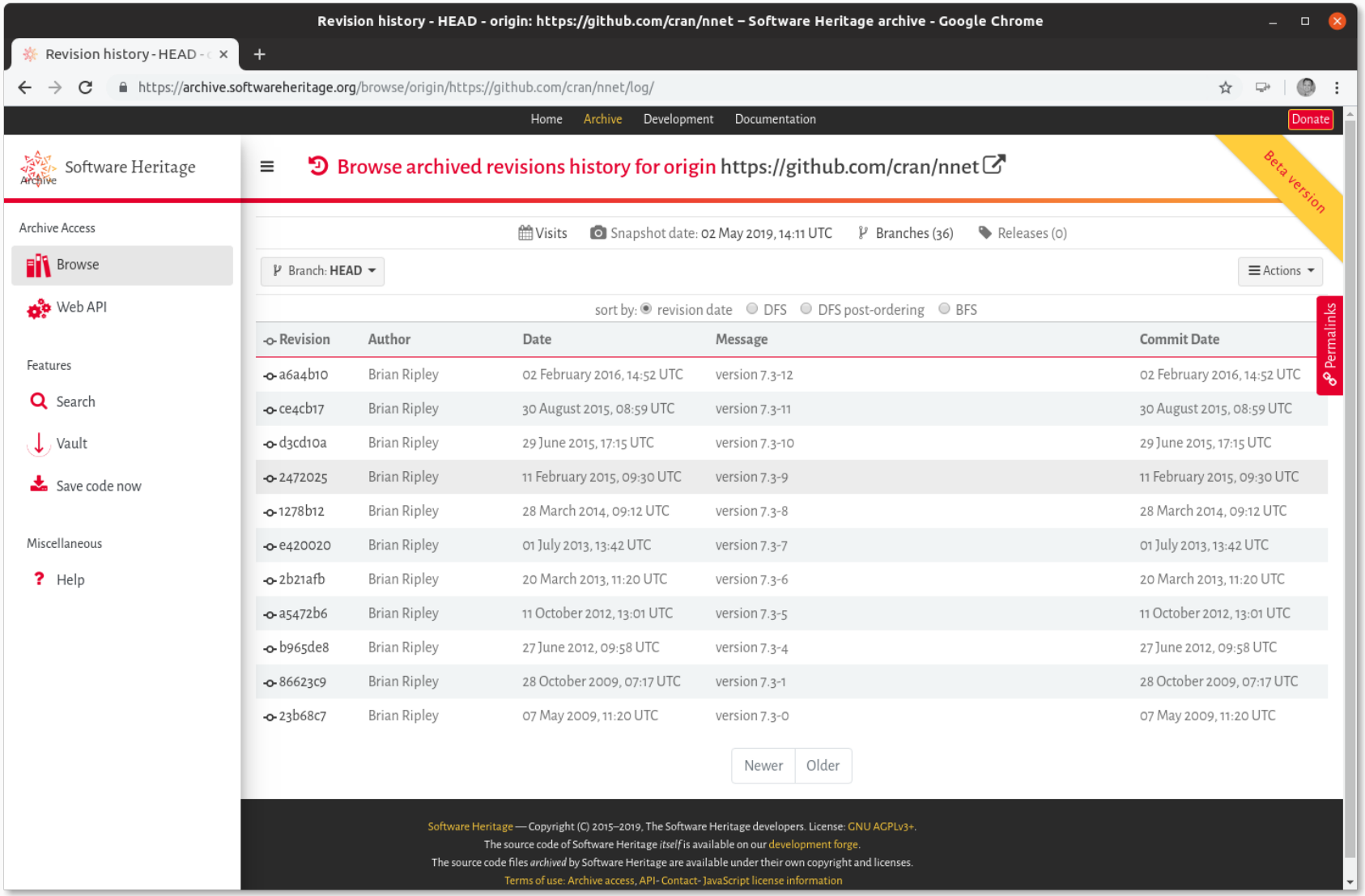


putting the big

back into big data

Software Heritage: Adding R

Significant Parts Already Available via GitHub



With thanks to Gábor Csárdi for the CRAN mirror at GitHub!

This Year

One of the Google Summer of Code Projects

- Archit Agrawal works on “Increasing Archive Coverage”
- This includes R / CRAN ingestion (among others)
- Use CRAN metadata for ‘state’ and change from last saved state
- Download, parse, index, … tarballs off CRAN
- Seed with CRAN archive section, then update live as CRAN grows
- Will start “any day now”

Get Involved

Softare Heritage: Get Involved

Main Website

- https://www.softwareheritage.org/

Archive

- https://archive.softwareheritage.org/browse/search/
- https://archive.softwareheritage.org/api/

Development

- https://forge.softwareheritage.org/
- https://docs.softwareheritage.org/devel/

Thanks

Thank You

Thanks

- To the *useR! 2019* organizers for giving us a last-minute slot
- To everybody
  - writing,
  - releasing, and
  - maintaining software worth archiving
- To everybody hosting: GitHub, CRAN, ...