Software Heritage

Une Archive Mondiale du Logiciel Libre, Inspirée de Git

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Meetup Git
Paris, France

Software Heritage

Outline

Software is Pervasive

At the heart of *our society*

- communication, entertainment
- administration, finance
- health, energy, transportation
- education, research, politics
- ...

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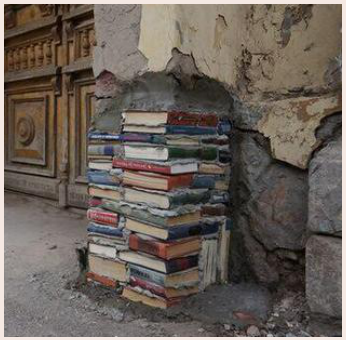
At the heart of *technology*

- house appliances ≈ 10M SLOC
- phones ≈ 20M SLOC, *cars* ≈ 100M SLOC
- Internet of things, …

Software is Knowledge

Key mediator for accessing *all* information (c) Banksy



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> *Absent an ability to correctly interpret digital information, we are left with […] "rotting bits" […] of no value.*
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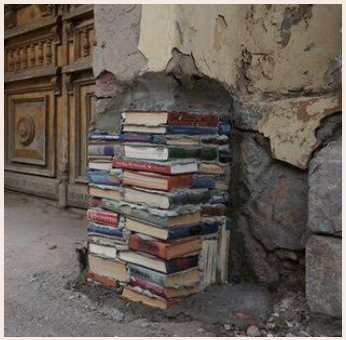

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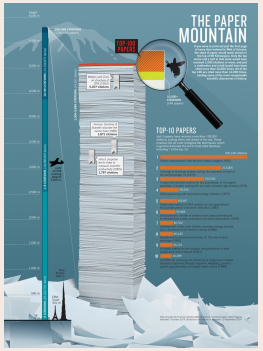
Software is *an essential component* of modern scientific research

> *[…] the vast majority describe experimental methods or software that have become essential in their fields.*

Top 100 papers (Nature, October 2014)



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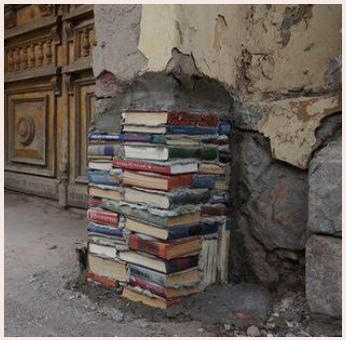

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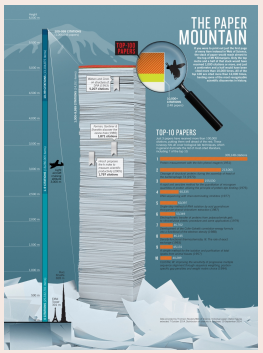

Bottomline: Software embodies our *Knowledge* and *Cultural Heritage*

It *must* be *collected*, *preserved*, *referenced* and made *accessible*!

Software is Fragile

Bits rot, hosters shut down

- Have you tested your backups recently? How about git fsck?
- Gitorious
- Google Code

Software is scattered all around

GitHub, GitLab, BitBucket, SourceForge, alioth, …

… *your personal home page*, …

No uniformity or stability whatsoever

Software migrates from hosters to hosters, URIs aren't perennial

Outline

Software Heritage

Collect, *organise*, *preserve* and *share all the software source code* that lies at the heart of our culture and our society.

`https://www.softwareheritage.org/`

Software Source Code is *different*

"Programs must be written for people to read, and only incidentally for machines to execute." Harold Abelson, Structure and Interpretation of Computer Programs

Distinguishing features

- *executable* and *human readable* knowledge (an *all time new*)
  - even hardware is… software! (VHDL, FPGA, …)
  - *text files are forever*
- naturally *evolves* over time
  - the *development history* is key to its *understanding*
- complex: large *web of dependencies*, millions of SLOCs

In a word

- software *is not just another* sequence of bits
- a software archive *is not just another* digital archive

Current status

Ingest all the software

- all (non-fork) GitHub repositories
- all Debian package uploads from snapshot.debian.org
- the GNU project FTP archive

Preserve all the software

- Google Code
- Gitorious

Roadmap

Features

- *lookup* by hashes for contents (done)
- *browse*: wayback machine for software source code
- *download*: git clone from Software Heritage
- *provenance* information for all the content
- *full text search*: dive into the Software Heritage archive

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… and much more than one could imagine

- license information (for code reuse)
- source code autocomplete in your IDE
- FOSS history/archeology
- the world's software devel history in a single Merkle DAG!

Outline

The structure of the archive

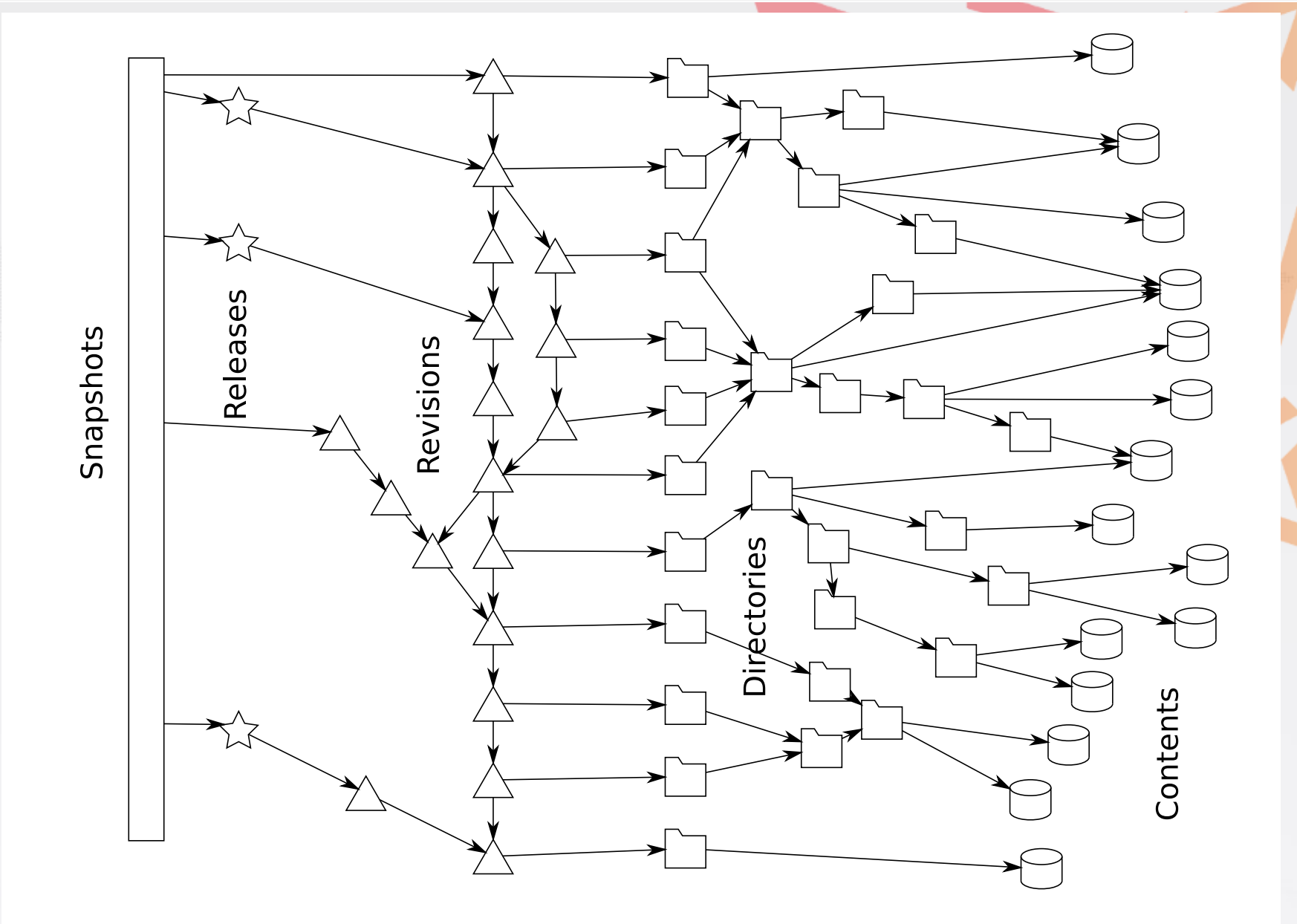
On-disk storage

- flat file storage for contents
- postgres database for the metadata

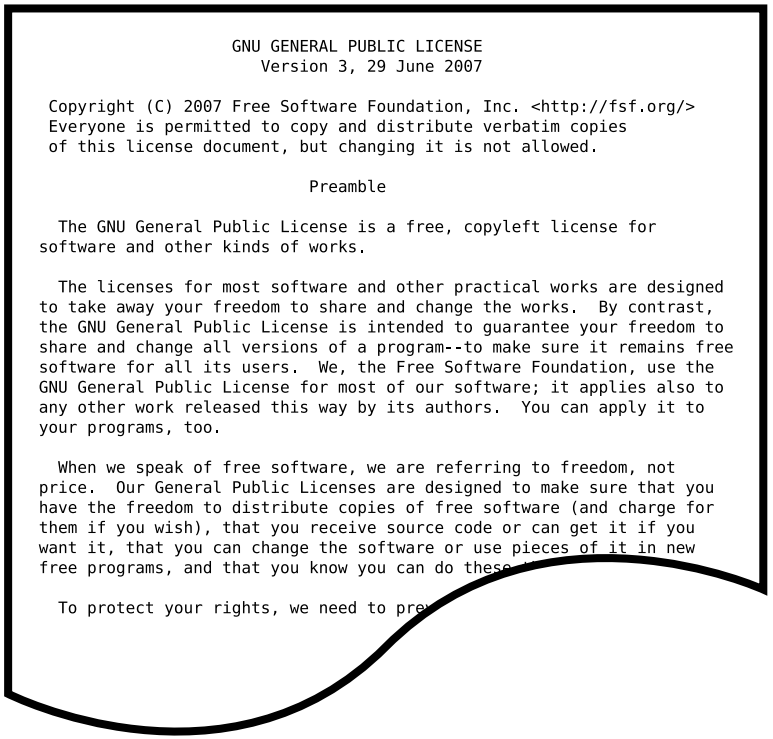
Data model: *one* big Merkle DAG, inspired by the git model

- Origins (= repositories)
- Snapshots (= lists of branches and tags)
- Releases (= tags)
- Revisions (= commits)
- Directories (= trees)
- Contents (= blobs)

The archive in pictures



Contents



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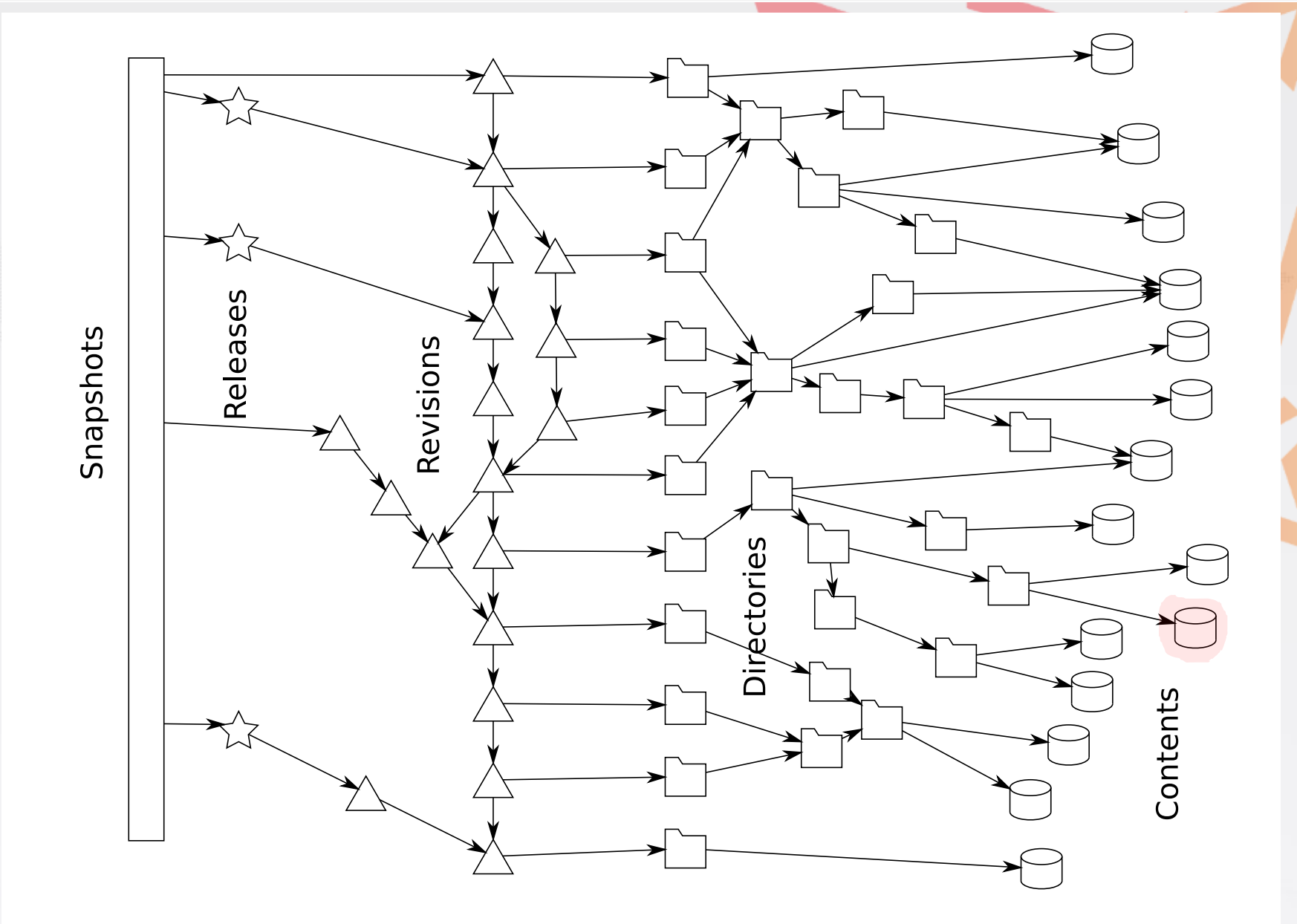
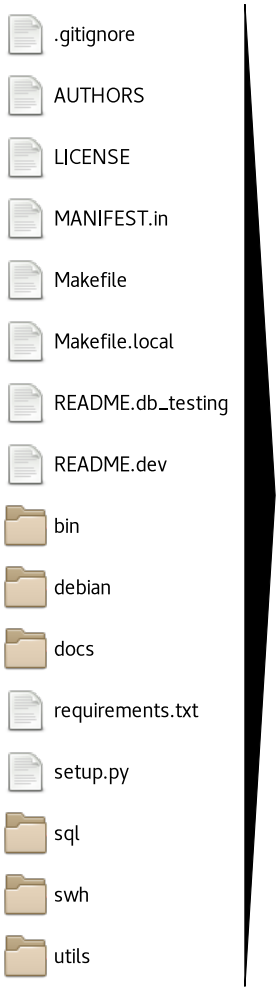
To protect your rights, we need to pre

sha1: 8624bcdae55baeef...
sha256: 8ceb4b9ee5aded...
sha1_git: 94a9ed024d385...
length: 35147

The archive in pictures





Directories

```
100644 blob c5baade4c44766042186ef858c0fd63d587ebf09 .gitignore
100644 blob 2d0a34af6f52cf3cf6b0c2f7bd0648fbd255e77f AUTHORS
100644 blob 94a9ed024d3859793618152ea559a168bbcbb5e2 LICENSE
100644 blob d9b2665a435a43f8a79a84e0867751dfb095c7bb MANIFEST.in
100644 blob 524175c2bad0b35b975f79284c2f5a6d5eaf2eb4 Makefile
100644 blob 5c7e3a5bbddb038682ba7793f440492ed9678bb3 Makefile.local
100644 blob 8617980629cd24e6080404f09aa749b085b3e07b README.db_testing
100644 blob 76b29f94cf815e0869c414d38d78d7ce08ec514e README.dev
040000 tree e1e10ecef948af0b93adb0372afc89f12e92618a bin
040000 tree 83e56d0beaf7793c77a45a345c80fcb8af503013 debian
040000 tree a34c9c4ba213f0cedc67f9816348d27955577af5 docs
100644 blob f2a6d32c6135aa7287bbd76167b01df2ae4f1539 requirements.txt
100755 blob eee147c36caf1bbc2d820da8dc026cb5b68180bc setup.py
040000 tree 224bb4c1f4c67fca1d160bffd2d06094e7e1abf3 sql
040000 tree 8631c9cd77bbe993168107ab5baf51f40c6300be swh
040000 tree 8fb905b56ba8ed692f1209b2773b474c6c1d66c1 utils
```

id: 515f00d44e92c65322aaa9bf3fa097c00ddb9c7d

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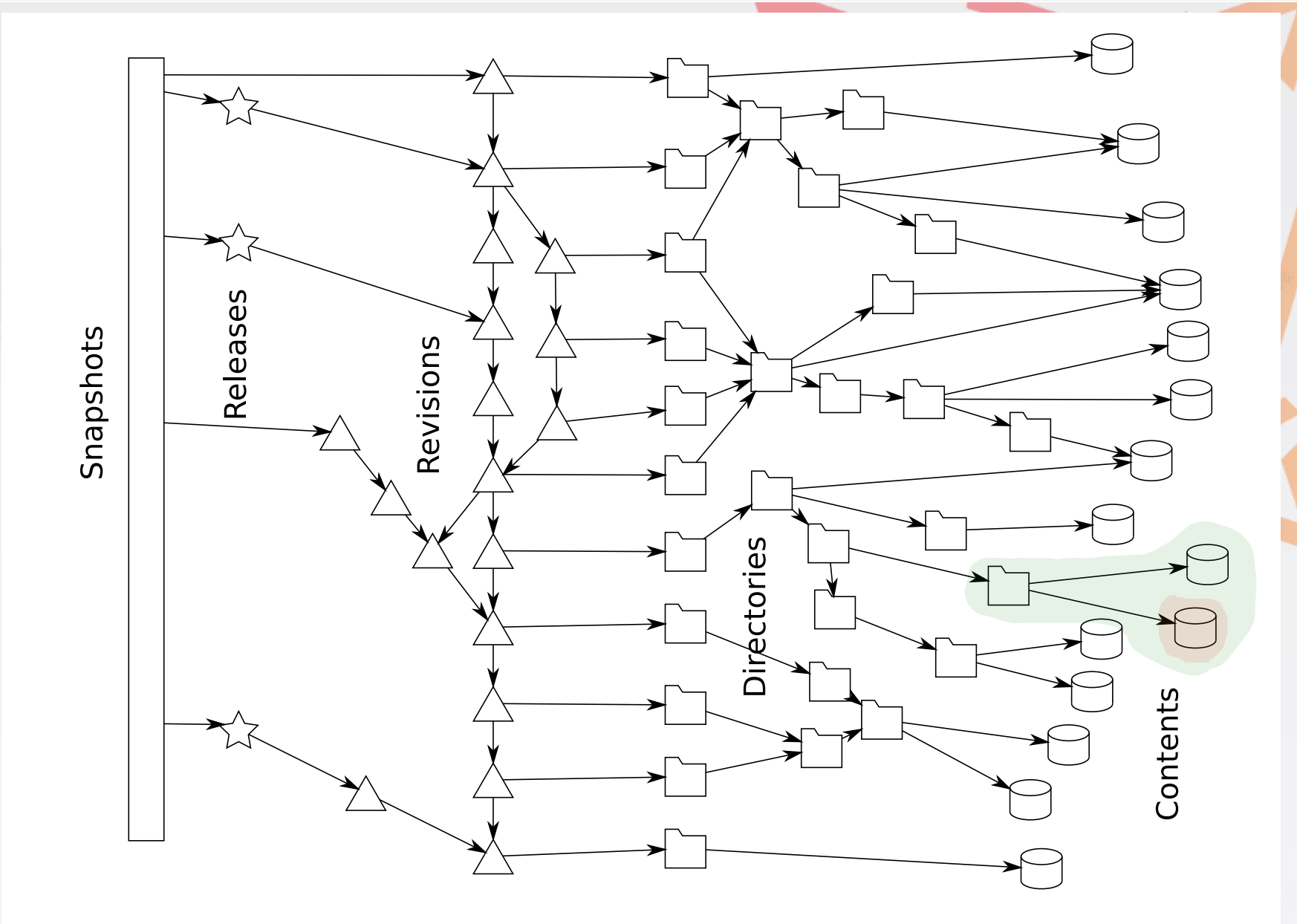
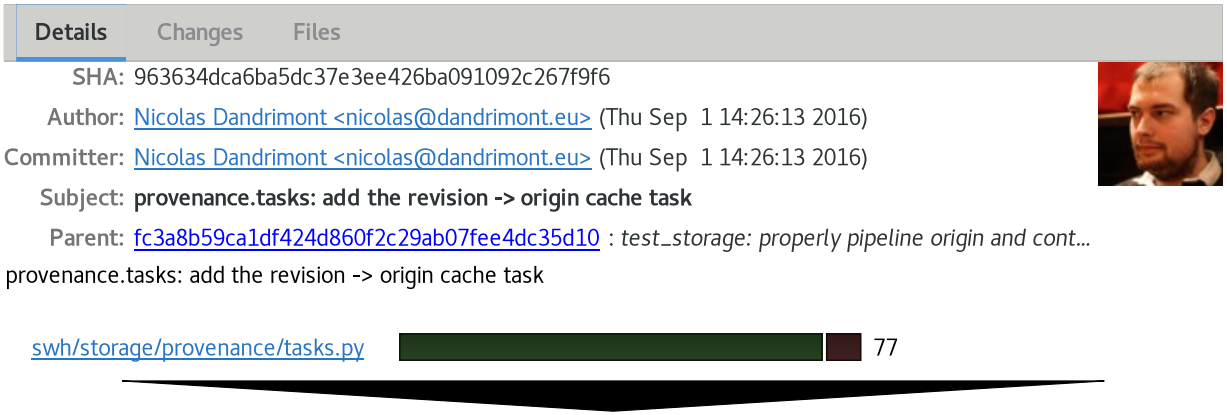


Revisions



tree 515f00d44e92c65322aaa9bf3fa097c00ddb9c7d
parent fc3a8b59ca1df424d860f2c29ab07fee4dc35d10
author Nicolas Dandrimont <nicolas@dandrimont.eu> 1472732773 +0200
committer Nicolas Dandrimont <nicolas@dandrimont.eu> 1472732773 +0200

provenance.tasks: add the revision -> origin cache task

id: 963634dca6ba5dc37e3ee426ba091092c267f9f6

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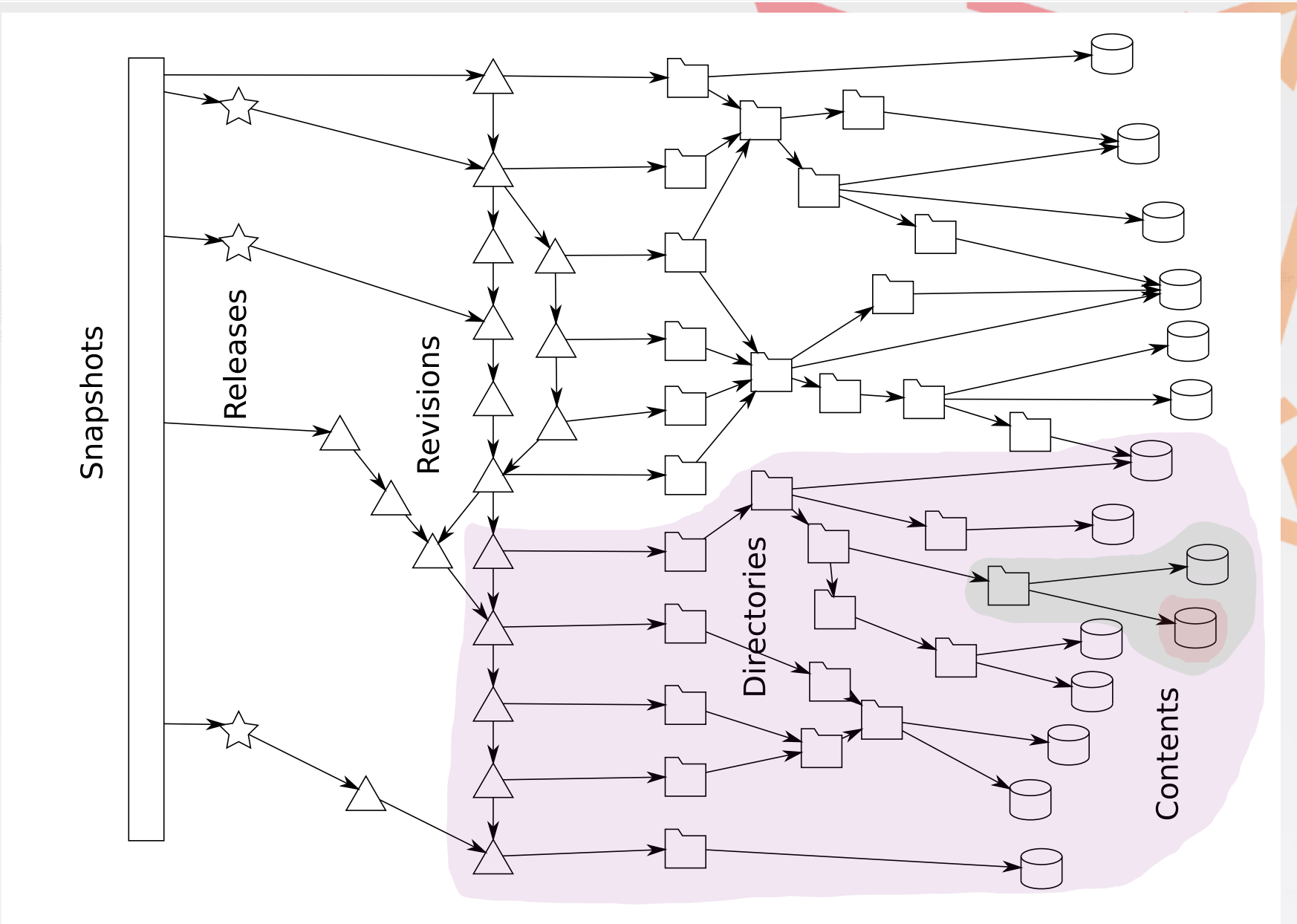

Releases

```
tag v0.0.51
Tagger: Nicolas Dandrimont <nicolas@dandrimont.eu>
Date:   Wed Aug 24 14:36:03 2016 +0200

Release swh.storage v0.0.51

 - Add new metadata column to origin_visit
 - Update swh-add-directory script for updated API
[...]

commit c0c9f16b1e134f593e7567570a1761b156e6eb1d
```

```
object c0c9f16b1e134f593e7567570a1761b156e6eb1d
type commit
tag v0.0.51
tagger Nicolas Dandrimont <nicolas@dandrimont.eu> 1472042163 +0200

Release swh.storage v0.0.51

 - Add new metadata column to origin_visit
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-----BEGIN PGP SIGNATURE-----

iQIzBAABCAAdBQJXvZTNFhxuaWNvbGFzQGRhbmRyaW1vbnQuZXUACgkQ7AWLMo2+
neqorw//aq6SOb5DijzEa+kWN3rXgVS+1K1vEVh1wNKAwx8eKJ7aX2kEiLDtt7uf
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ICBlit2uJtXuCrDt93eKKPwvzZXg+hB0sMWy35Dr6jW7Z7K4Mu/PGglylHPY55yo
lGEndWno7VfH1Vm6t1n5qB7l5mXRaqA+becqddubTZ2xjj+jplUqC8cyqN3hm/fL
qsj2mu8kyz3t8tG/H1/pV+I5OwBlnPoS5TH0tujoJEVgPK/dHSP79QuHDHZFkCao
klj6kAWyU80Mxb+nKV/jeLbrR3+yWBFj3Qp5a1/V8oOTh6E1dALcNMpEaKCoKtMt
d/gMRax1l1/g0EDfnsW67G6sDwKPKPHhgfVLQ3nV3GaQQTnu1RpMz006H9/tAwzC
Gg/K1PdHT4hzOiI46wYPZyje0U2VXGFu6vVU9vFQ4ZR/Wjn+0zMzdcRdrlJSUOMn
RpTTfUsbXUeXHGOpkgXhSYTnvp1gdPc76USTsK0aGe84AZm1lk0mGrwXCVfPqlYo
nhhibBSHBNMoqyF6yTSOpUbYK70tpYRRUGKWDeRK0wKSxkWKUZGtKzy6JYqljo29
gulwgZQif5qWQCB0OontAL2+HvPFaVyckMejUhg62cP/+EHIvUk=
=kOxP
-----END PGP SIGNATURE-----
```

id: 85083a5cc14a441c89dea73f5bdf67c3f9c6afdb

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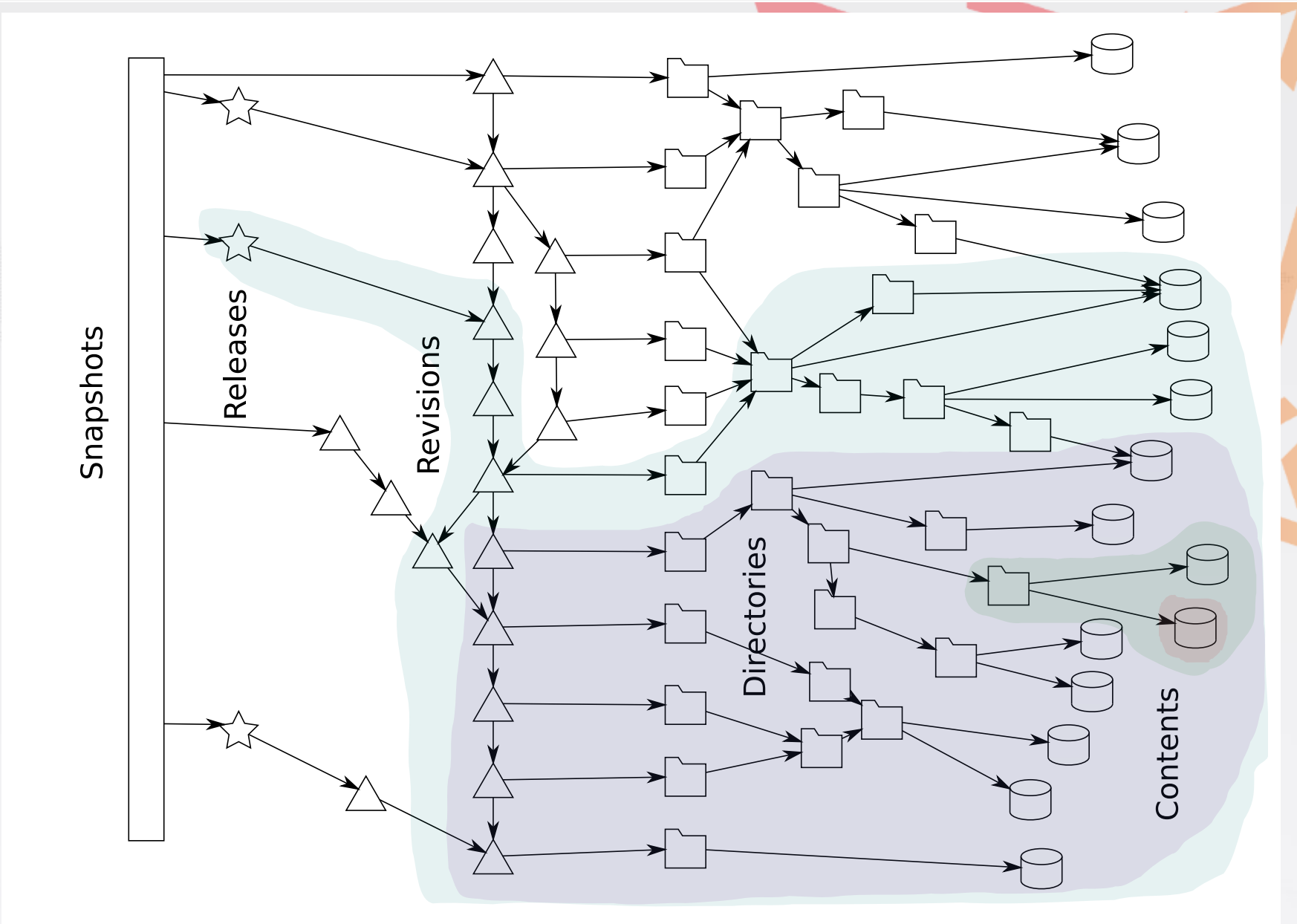

git show-refs

Snapshots

```
commit 08ffeb25770109525eb3ce21691466c53a1d9158 refs/heads/atime
commit ba5443a24e3f9fe323a46c292cec4fcbe61c67eb refs/heads/directory-listing-arrays
commit d69e0dbf892383ff6589b27fbe1c05d27238d9c5 refs/heads/foo
commit cf7ff9eea0eb22f8946908f5a8019f67de468e08 refs/heads/master
commit 7eca197fc66d2024047e54b1ed9e8b44361a0fc2 refs/heads/tmp-directory-add
commit 642a205f37de85005a85d427b53ee4fb2252e82e refs/heads/tmp/generic-releases
tag 20f043b1379cf768d966597799fd4907c757f755 refs/tags/v0.0.1
tag 72a21991a384e539996dbb867bfb0bee72aee2cd refs/tags/v0.0.10
tag 3590e0ca0ebb070e5b376705fa230bbfa4ffa5cc refs/tags/v0.0.11
tag 33378427a403ba569a67777b8d58f6674fbc6556 refs/tags/v0.0.12
tag 06f74652755b327cf590311c2bfa036cf3b4b35d refs/tags/v0.0.13
tag 5a6325fe86ab854b581d7442667d92a11e32f3bd refs/tags/v0.0.14
tag 586fba4e580b4f5fab05f599367643cbcb1a9c7f refs/tags/v0.0.15
tag 8cd8b885f4098bf363177742bd289f660e5be51c refs/tags/v0.0.16
tag a542444ee3f0fbed35efb202fee035c809abc7d6 refs/tags/v0.0.17
tag 228a2f1650dd12222e556559462e1e06fc4993d9 refs/tags/v0.0.18
tag 606979a4ca05d497fc0d24aad00dce82636ef47c refs/tags/v0.0.19
tag 32bf5a59fc2a323baa6d5f15a6ad5382ec275a67 refs/tags/v0.0.2
tag 3147c3d31ec46cf6492f881e908b1237ebdff2c7 refs/tags/v0.0.20
tag 215ea50daba111e082e0b72e76eb4b6073a87908 refs/tags/v0.0.21
tag 3fb168c2072a5d6252124257a1e5dfc0f5ffa1df refs/tags/v0.0.22
tag 8cdbee8da4d73fc5d262789e460a16ac3c72aba4 refs/tags/v0.0.23
...
```

id: b464cad1b66fff266a37b46ea6e7a04b545e904b

Software Heritage in numbers

Volume

- 120TB used by (gzipped) files on disk
- 3.1TB PostgreSQL database for the metadata

Counts

- 2.7 billion files
- 2.2 billion directories
- 600 million revisions
- 12 million people
- 5 million releases

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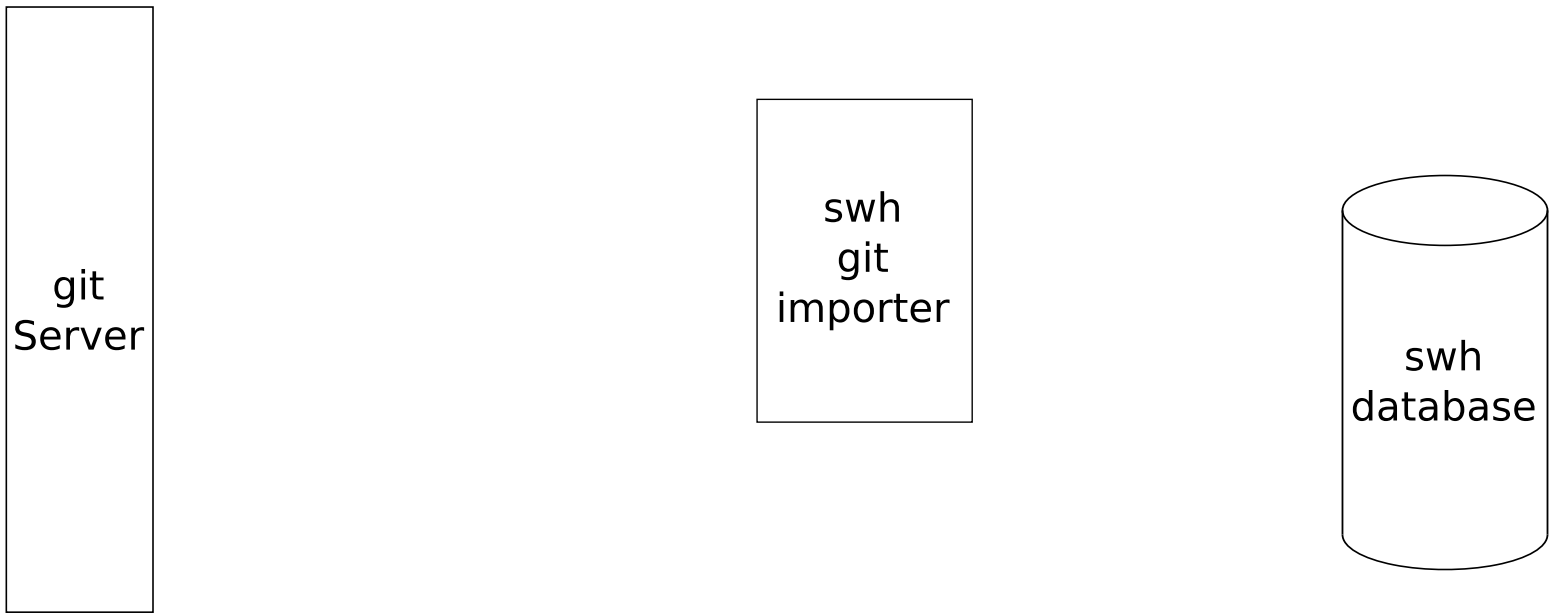
By far, the biggest DVCS tree in existence

Git loader architecture



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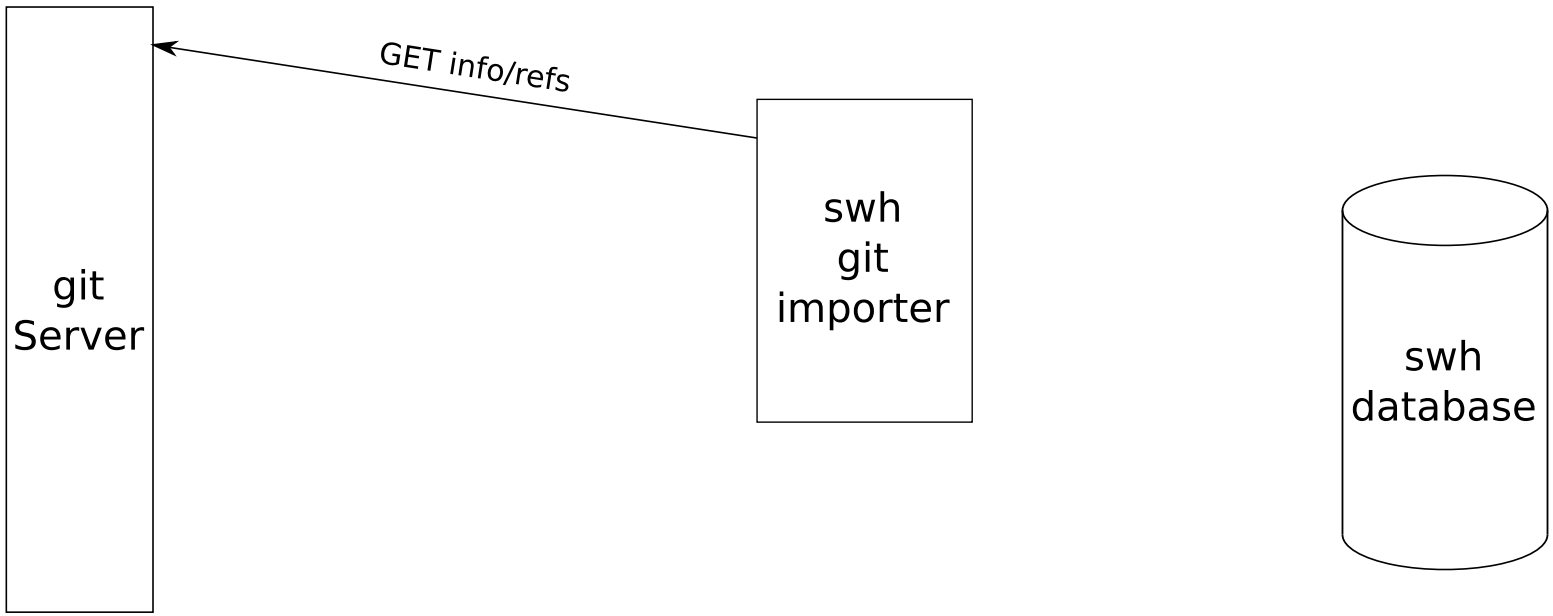

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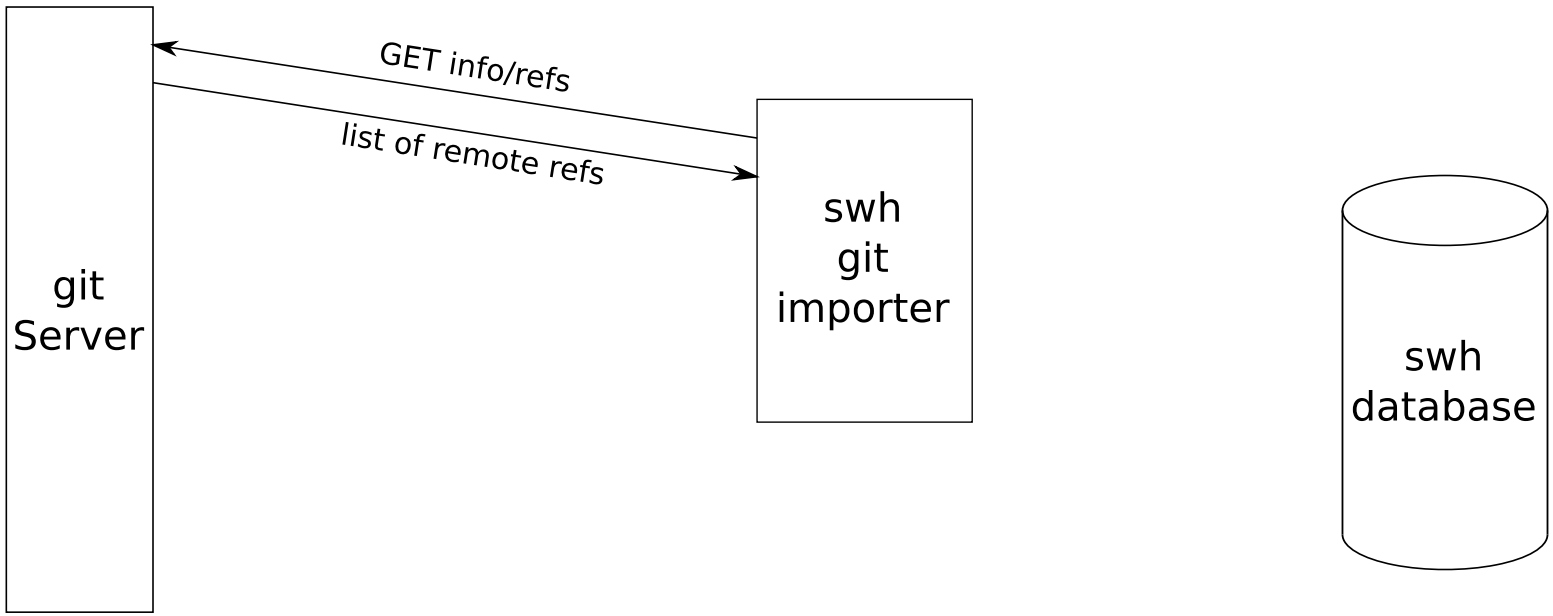

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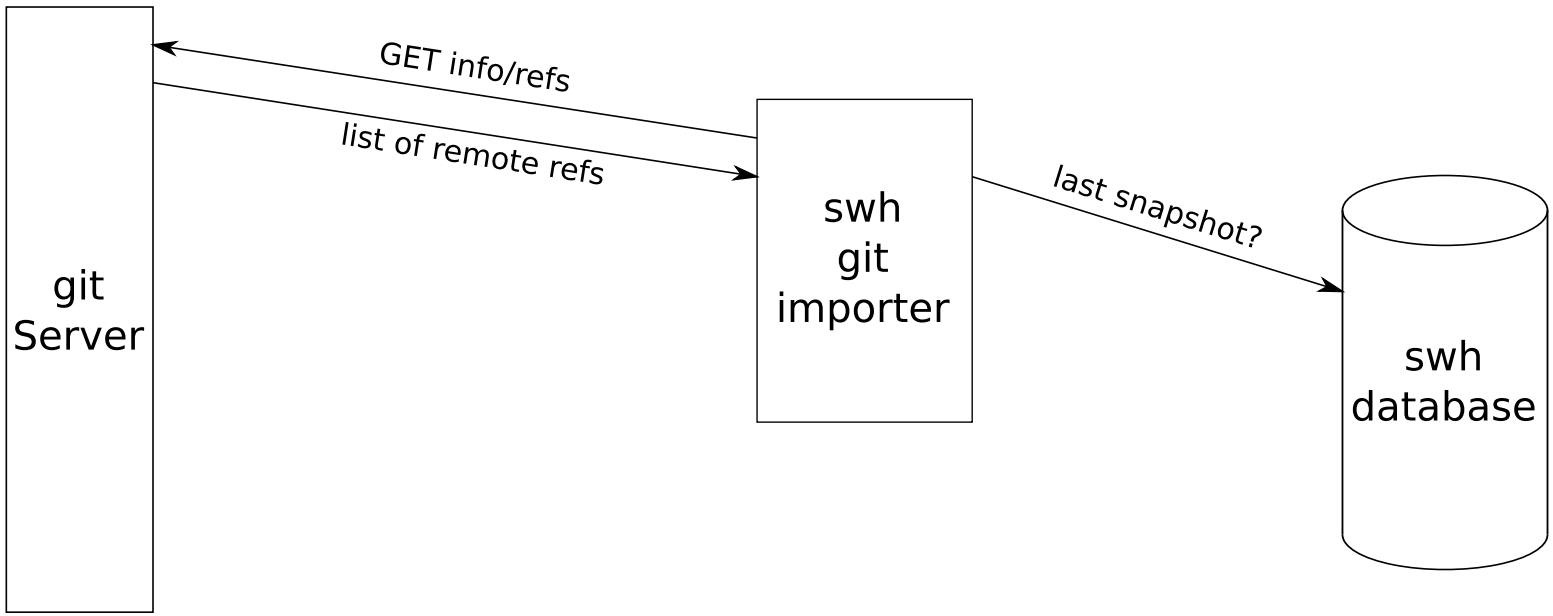

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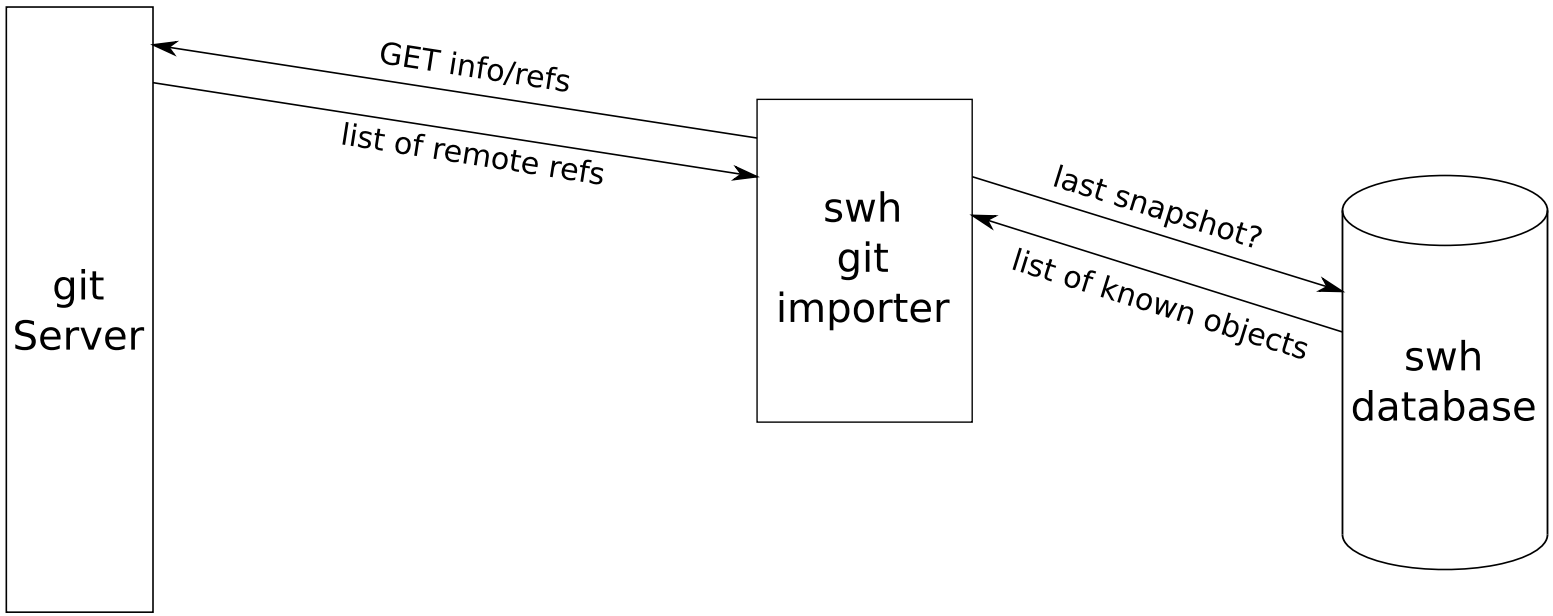

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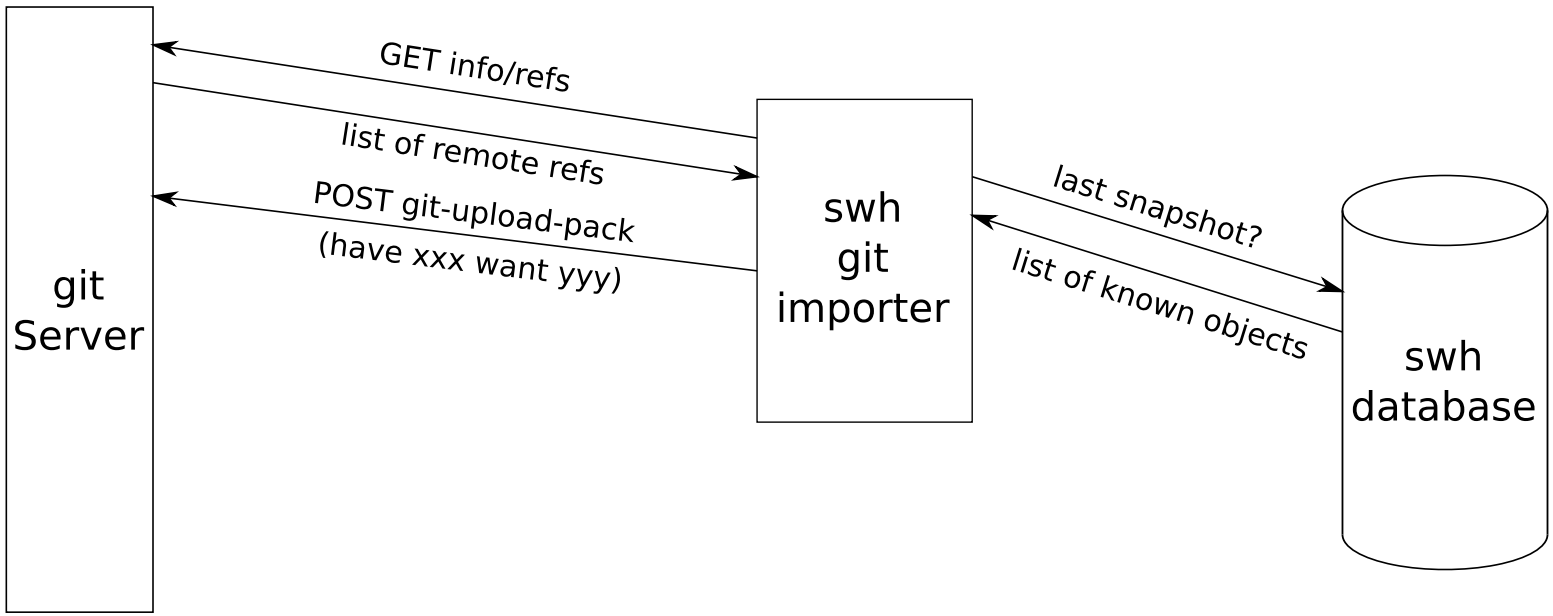

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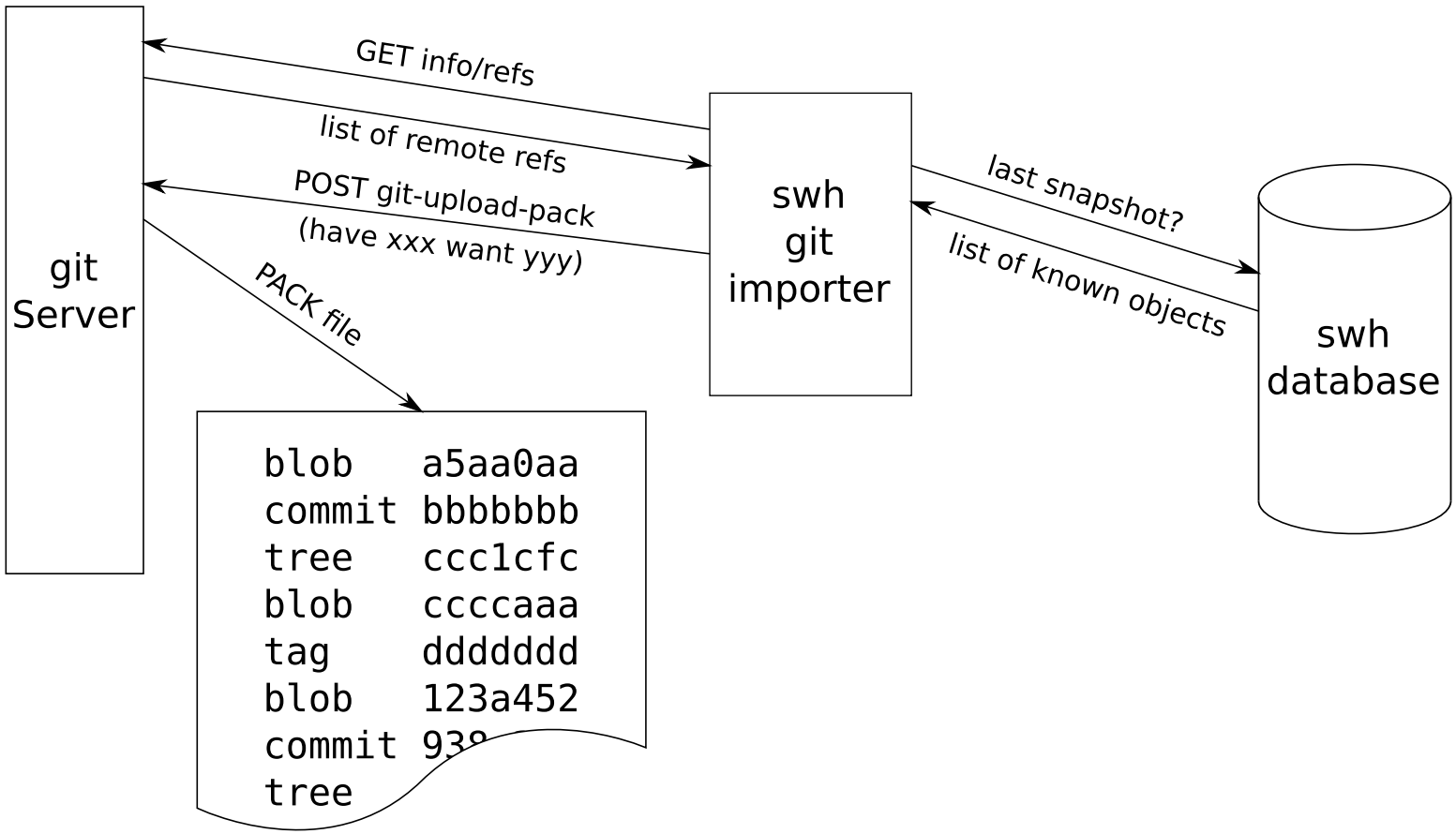

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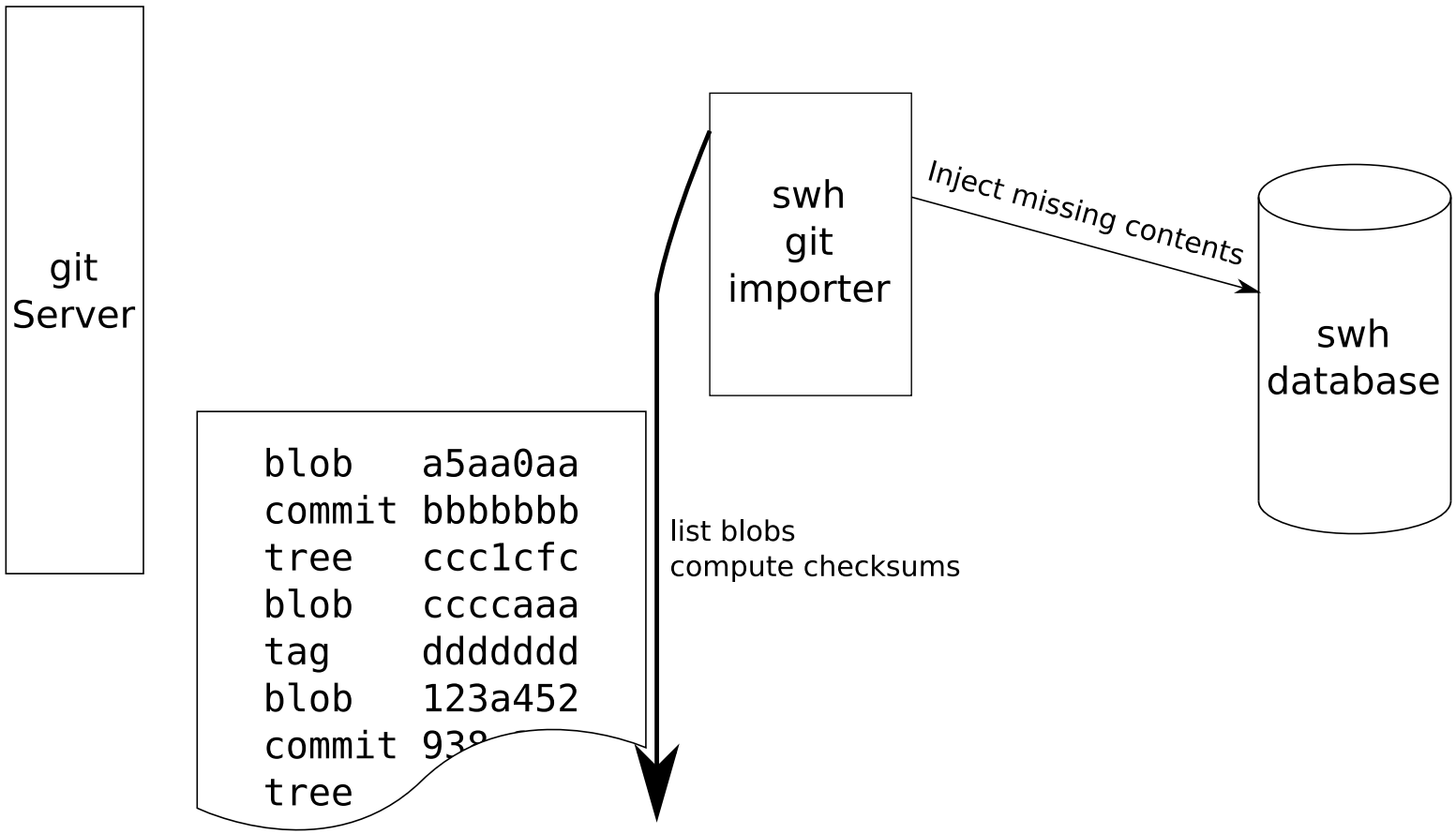

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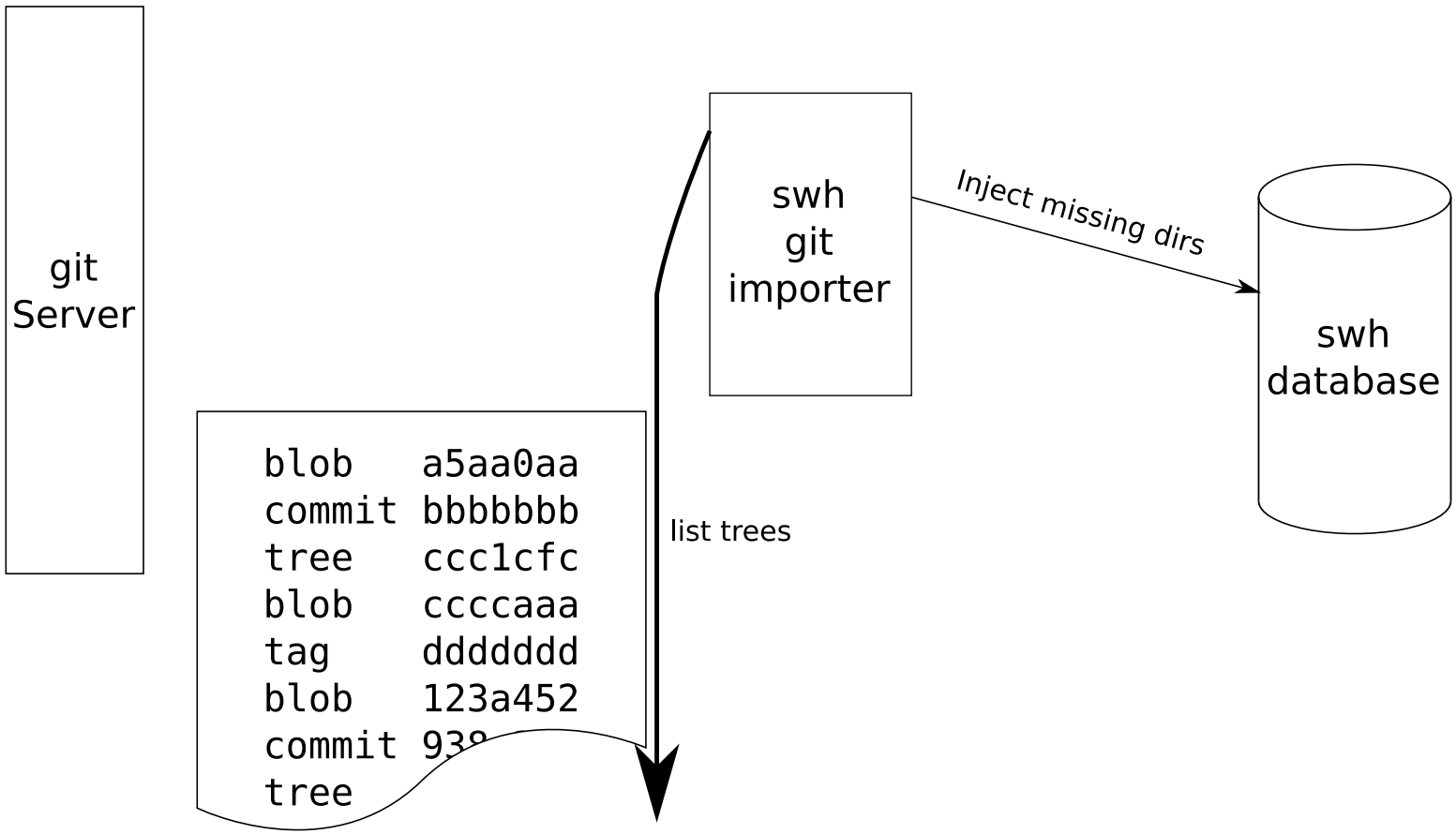

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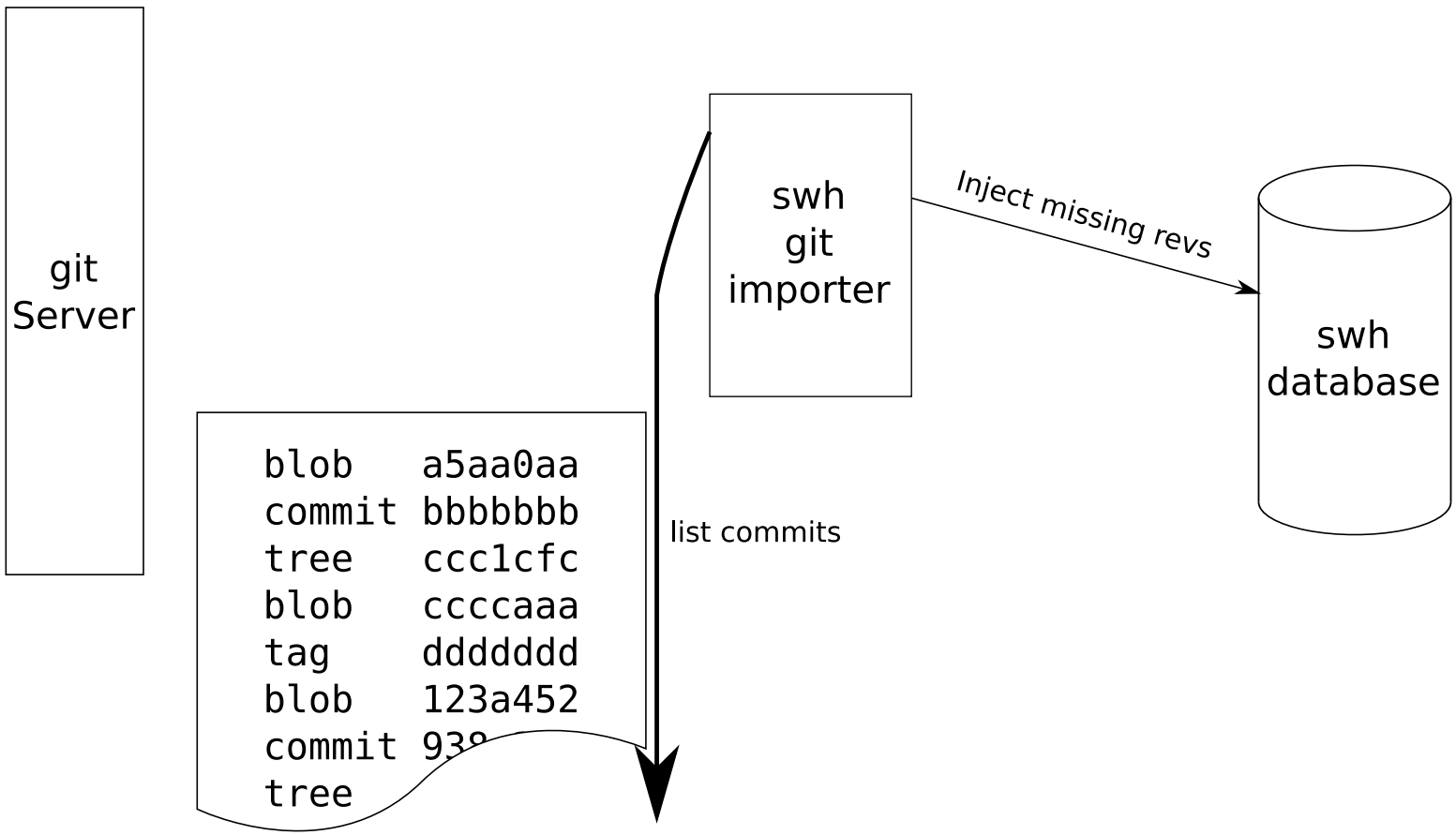

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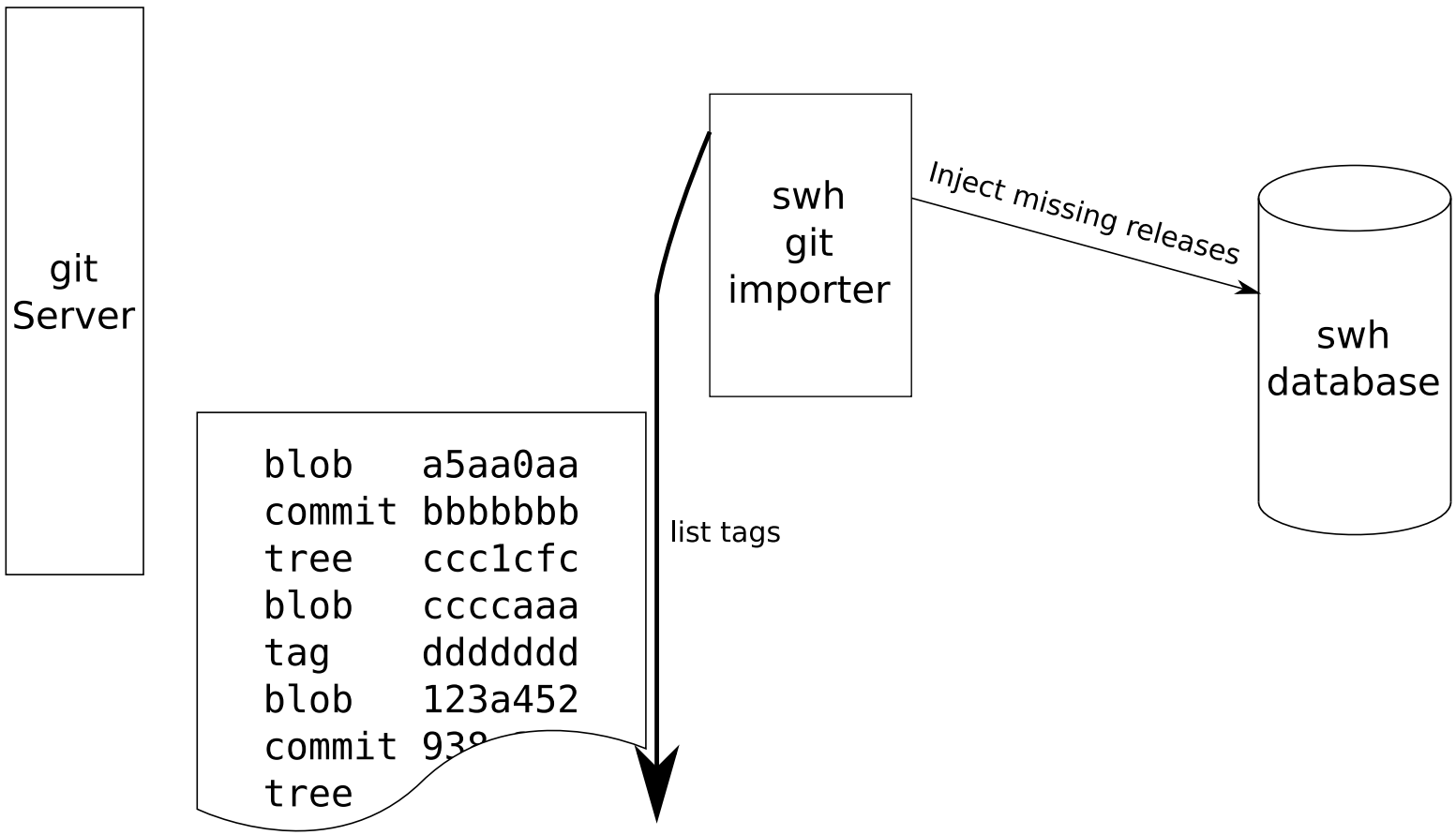

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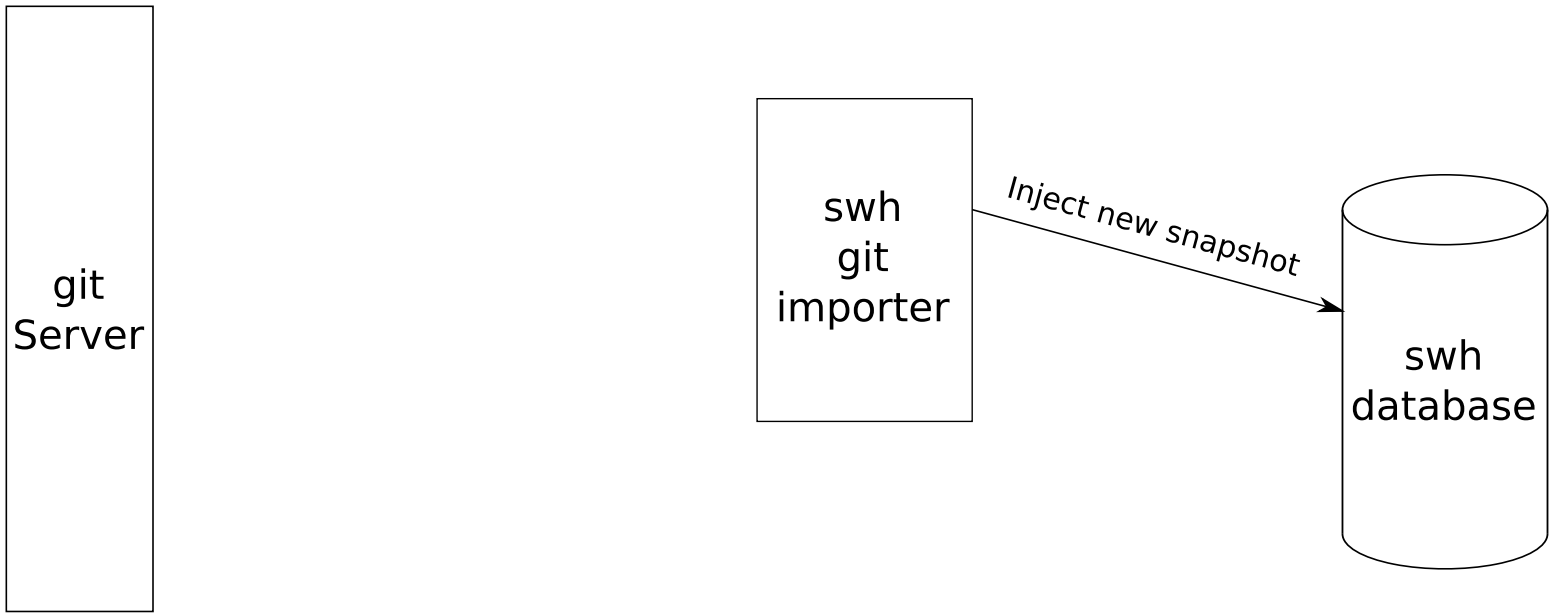

Outline

How to contribute to Software Heritage

Developers

- Info: www.softwareheritage.org/community/developers
- Code: forge.softwareheritage.org

Sponsors

(founder)

- sponsorship opportunities
  www.softwareheritage.org/support/sponsors

Contact us

- *email:* {olasd,zack,info}@softwareheritage.org
- *twitter:* @swheritage
- *web:* www.softwareheritage.org