Game of Trees Hub

Stefan Sperling <stsp@openbsd.org>

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What is Game of Trees?

Game of Trees (Got) is a distributed version control system.

- in development since November 2017
- compatible with Git repositories and Git network protocol
- designed with OpenBSD developer use cases in mind
- OpenBSD-style C code base
- extensive use of OpenBSD pledge and unveil
- ISC licence
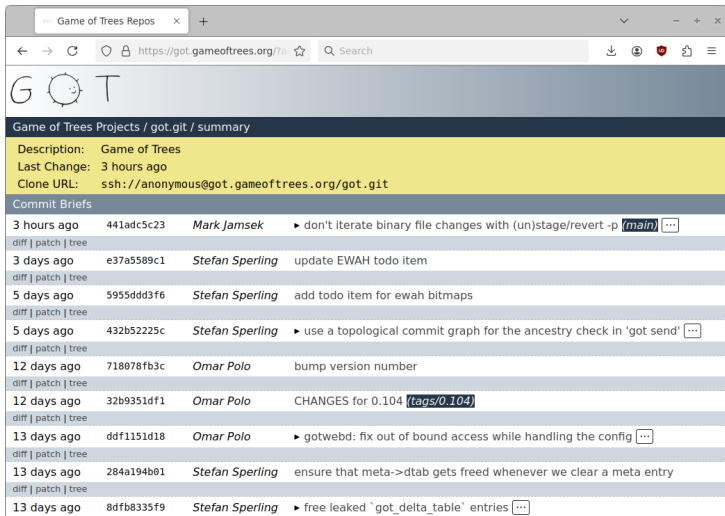- -portable version for Linux, MacOS, {Free,Net,Dragonfly}BSD

got – command line interface

Commands:

- import, clone, fetch, checkout, update
- log, diff, blame, tree, status
- ref, branch, tag
- add, remove, patch, revert, commit, send
- cherrypick, backout, rebase, histedit
- integrate, merge, stage, unstage, cat

Online documentation: https://gameoftrees.org/got.1.html

gotwebd – repository viewer for web browsers

Shows commits, diffs, trees, blobs, and tags (with RSS feed)

gotd – Game of Trees Daemon

Use cases:

- host Git repositories for open source projects or private use
  - each project should host their own server instance
- host public read-only Git repository mirrors
  - let anonymous users fetch source code over SSH,[1] authenticating the server but not the client

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[1]like AnonCVS: https://www.openbsd.org/papers/anoncvs-paper.pdf

gotd – Game of Trees Daemon

Live instance you can clone got and gotd source code from:
`git clone ssh://anonymous@got.gameoftrees.org/got.git`
Host key fingerprints:

- `SHA256:aDX3rrQNDfIA5lyXIbynY+goiomgR4Cdx5j4qmWq26I` (DSA)

- `SHA256:kmeRVbw2BLak1iZJIv6/AkNhGqW97WIu58SeH8kUfls` (ECDSA)

- `SHA256:jvQMQNSKE+p7roYA3Tl8/giZyOUqL7emXS+lJT7KMQ4` (ED25519)

- `SHA256:q/CWVAukwojxNL3srvWhfHZX00t+eO1IhmnwFAEhE6o` (RSA)

And there are mirror servers:
`https://gameoftrees.org/code.html`

Game of Trees and OpenBSD

Game of Trees as a successor to CVS:

- No concrete plans for switching away from CVS yet.
- Some people in the project are starting to seriously consider it, maybe starting with the ports repository.
- There is no need to rush from my side:
  - The more time we can use to stablize the tooling, the better.
  - I would rather see a late successful attempt than a failed one.

Main concern: We need to keep improving performance and stability towards production-grade quality.

The Game of Trees Hub

Git hosting site powered by gotd and gotwebd.
Goals:

- Be a live test bed for Game of Trees to improve quality.
- Be useful and reliable enough to serve a steady user base.
- Be maintainable by Game of Trees developers and volunteers.
- Encourage self-hosting. Avoid locking people in.

The Game of Trees Hub: Financial goals

Running a hosting site will cost money and time.

- Do not become a financial burden on Game of Trees developers. We already provide our skills and time.
- Charge users, while being transparent about required funding.
- Provide financial support to Hub admins (response time).
- Pay for Game of Trees development, if funds allow. We would like to provide more of our skills and time!

Open Collective

https://opencollective.com "fundraising + legal status + money management platform for your community"
Key concepts:

- <u>Collectives</u>: Collaborative groups of individuals.
- <u>Non-Financial Contributors</u>: People who provide time and skills to the Collective.
- <u>Financial Contributors</u>: People or organisations who contribute money to the Collective (sponsorship or membership).
- <u>Fiscal Host</u>: A legal entity with a bank account. Holds funds. Deals with external obligations such as taxes.

Open Collective

What can Open Collective do for Game of Trees Hub?

- Public ledger for full financial transparency.
- Automated payment processing (via 3rd party).
- Provide a non-profit legal entity that deals with taxes.
- Expenses can be peer-reviewed.
- Collectives can pay people for their time.

Open Collective Fiscal Hosts

Several fiscal hosts already exist:

- <u>Open Source Collective</u>: Open source projects. US-based.
- <u>Open Collective Europe</u>: For EU-based collectives.
- <u>Gift Collective</u>: New Zealand charity fundholder.
- <u>Open Collective NZ</u>: New Zealand social enterprise fundholder.
- <u>Women Who Code</u>: US-based, various other countries.
- <u>All for Climate</u>: Climate and social justice in Europe.
- <u>Social Change Nest</u>: UK social impact initiatives.

Just have to pick one and go!

Open Collective Fiscal Hosts

Interesting overlap:

- Open Collective Europe: For EU-based collectives. Brussels-based.
- Stefan Sperling (Brussels, Belgium)

Obvious choice!

Open Collective Europe's response:

"In fact, what you are proposing to do is setting up a paying service for your users. As a charity which works with donations, OCE is not the right place for this kind of initiative."

"Thus, we have decided not to proceed with your application, but would like to recommend applying to Open Source Collective."

Charging for non-profit services

"paying service for your users"
Misunderstanding? Charging money doesn't imply making profit.
Non-profits can charge membership fees in return for services:

- RIPE NCC (€1550 per year)
- Linux Foundation ($5000 - $500,000 per year)
- IN-Berlin e.V. (community ISP) (€5 - €14 per month)

No funding of developers via OCE?

"not the right place for this kind of initiative."
Seems contradictory to me.

- Non-profits can charge membership fees in return for services.
- We have developers able to send valid invoices.
- Collectives can pay people for their time.
- Open Collective Europe FAQ: "Collectives pay a percentage of the money they raise to cover OCE's administrative costs, staff and <u>development of the Open Collective platform</u>."
    - They do this themselves!

Anyway, let's take a closer look at their recommendation.

Open Source Collective

- Open Source Collective: Open source projects. <u>US-based</u>.
- Most active Game of Trees developers:
  - Stefan Sperling (<u>Belgium</u>)
  - Omar Polo (<u>Italy</u>)
  - Thomas Adam (<u>UK</u>)
  - Mark Jamsek (<u>Australia</u>)

Should our bank account really be in the US?

Rescue plan: Fiscal Self-Hosting

Any suitable legal entity can act as Collective's fiscal host...
... I own a limited liability company in Belgium.

- Get OK from my company's accountant. (done)
- Open a dedicated bank account. (done)
- Start collecting funds. (done)
- Deal with tax obligations with help from accountant.

Easy way to get started.

Fiscal Self-Hosting

Not an ideal situation:

- This is supposed to be a community project.
- But legally it has become my company's project.
- My company has to be trusted with funds and legal aspects.

I would prefer a non-profit structure in the long term.
But first, let's build something worthwhile.

Envisioned sign-up workflow

To create a new project you would need to:

- Have an account on `opencollective.com`.
- Select a service tier on `opencollective.com/gothub`.
- Provide a project name, which will be in DNS:
  `myproject.gothub.org`
- Provide a public SSH key for project admin access.

Your projects remain active while recurring contributions arrive
from your opencollective account.

Inactive projects will be set read-only, and will disappear eventually.

Envisioned project admin workflow

Project administrators can access a special Git repository.
Clone this repository and edit the gotsys.conf file.

- Declare repositories in gotsys.conf.
- Declare user accounts and groups in gotsys.conf.
  - User credentials: SSH keys or hashed password strings.
  - User shell: gotsh, not a real shell
- Set read/write permissions for users on repositories.
- Publish repositories or keep them private.

gotsys.conf syntax example (draft)

```
group developers

user anonymous {
  allow-empty-password
}

user flan_hacker {
  password "$2b$08$CFWp/ZC.DQi34.iHBgRzBerTzEGB9WY9tDN1CLCbPUpGC.fmNi4E
  group developers
}

repository "flanbsd/src" {
  publish
  permit rw :developers
  permit ro anonymous
}

repository "secret" {
  permit rw flan_hacker
}
```

```
gotsysd(8)
```

gotsysd is a daemon which cooperates with gotd and
reconfigures the running OpenBSD system.

- Listen for gotd notifications with data from gotsys.conf.
- Add/expire Git repositories.
- Add/disable users and groups.
- Manage per-user .ssh/authorized_keys files.
- Recreate /etc/gotd.conf and restart gotd.

Needs strong security boundaries and very careful coding.

Required Infrastructure

- Integration with opencollective.com and payment processor
  - Handle sign-up, check payments, expire inactive projects.
- Monitoring
  - Service reachability checks, status board, alerts.
- Project machine hosting
  - Host machines at several selected hosting providers.
  - Probably a mix of bare-metal servers and VPS.
  - Keep some spare idle machines to serve sign-ups quickly.
- Backups of site and user data
  - Backup: Store Git repositories and meta-data.
  - Restore: Reinstall server and restore repositories.
- SMTP relay for gotd email notifications.

Expected Issues

- Bugs in Game of Trees.
  - The more get found and fixed, the better.
- Missing features in Game of Trees.
  - Repository size quotas, performance features, ...
  - Initially, fallback on Git may be needed for some things.
- IPv4 address shortage:
  - Each project machine needs a dedicated IP address.
  - Fix: IPv6
  - Workaround: per-hosting site port-forwarder (`pf rdr-to`).
    Git clients are able to deal with port numbers in URLs.
- Abuse:
  - Users do not have shell access, reducing abuse potential.
  - Content takedown requests can occur.
  - Repositories could contain malware.
  - DDoS against Git hosting sites are a thing...

Server RAM requirements

Memory usage spikes occur while compressing repositories.
Creating a 10 MB pack file requires roughly:

- 160 MB of RAM (git repack -a -f --threads=1)
- 300 MB of RAM (gotadmin pack -a)

Creating a 1.5 GB pack file requires roughly:

- 2.3 GB of RAM (git repack -a -f --threads=1)
- 3 GB of RAM (gotadmin pack -a)

Should have at least 1 GB of RAM for small repositories.
4 GB or more for large repositories.

Server storage requirements

A 40 GB disk can offer at most 18 GB of repository space.

- OpenBSD install fits into 4 GB or less.
- Recompressing repositories temporarily doubles repository size.
    - OpenBSD repo: 1.5 GB, need 4 GB disk space
    - LLVM repo: 3 GB, need 7 GB disk space
    - Linux repo: 5 GB, need 12 GB disk space

Need to reserve an equivalent amount of repository space in backup storage.

Server rentals

Quick survey comparing hosting some providers.

- Cheapest VPS:
  €1/m, 10 GB disk (3 GB repository space), 1 GB RAM.
- Midrange VPS (assuming nested virtualization):
  €26/m, 1 TB disk (496 GB repo space), 32 GB RAM.
- Midrange Root Server:
  €150/m, 4 TB disk (2 TB repo space), 64 GB RAM
- Expensive Root Server:
  €185/m, 8 TB disk (4 TB repo space), 128 GB RAM.

Rental costs per hosted project

Small gothub project: 1 GB RAM
Large gothub project: 4 GB RAM

- Cheapest VPS:
  €1 for 1 small project with 3 GB repository space
- Midrange VPS:
  32 small projects: €0.8 each with 15 GB repository space
  8 large projects: €3.25 each with 62 GB repository space
- Midrange Root Server:
  64 small projects, €2.5 each with 30 GB repository space
  16 large projects: €9.5 each with 125 GB repository space
- Expensive Root Server:
  128 small projects: €1.4 each with 30 GB repository space
  32 large projects: €5.8 each with 125 GB repository space

Not included: Disk space for backups.

Backup costs

Online backup providers list prices below €0.10 per GB per month.
When self-hosting, disk space is practically infinite.
The most expensive factor is power.

- Server without disks may need 100 - 150 Watts.
- Each hard disk adds about 15 Watts + spikes.
- Server with 16 disks may draw 400 - 500 Watts.

Prices vary:
€0.123/kWh (Belgium): roughly €50 per month
€0.45/kWh (Germany): roughly €130 per month

Game of Trees Hub Tiers (example)

Excluding money to pay people for their time:

	Small	Medium	Large
RAM	1 GB	2 GB	4 GB
Repository space	10 GB	64 GB	128 GB
Server rental	€2	€5	€10
Backup costs	€1	€2	€2
Infrastructure	€1	€2	€3
Result	€4	€9	€15
Taxes (21%VAT)	€0.84	€1.89	€3.15
Total per month	€5	€11	€19

Belgian 21% VAT rate should cover taxes charged elsewhere.
Could pay small amounts of people's time out of a tip-jar.

Game of Trees Hub Tiers (example)

Allowing contractors to draw €2000/month per 100 users:

	Small	Medium	Large
RAM	1 GB	2 GB	4 GB
Repository space	10 GB	64 GB	128 GB
Server rental	€2	€5	€10
Backup costs	€1	€2	€2
Infrastructure	€1	€2	€3
Contractors	€20	€20	€20
Result	€24	€29	€35
Taxes (21% VAT)	€5.04	€6.09	€7.35
Total per month	€30	€35	€42

Game of Trees Hub Tiers (example)

Employing one sysadmin for €60000/year per 500 users:

	Small	Medium	Large
RAM	1 GB	2 GB	4 GB
Repository space	10 GB	64 GB	128 GB
Server rental	€2	€5	€10
Backup costs	€1	€2	€2
Infrastructure	€1	€2	€3
Employee	€10	€10	€10
Result	€14	€19	€25
Taxes (21% VAT)	€2.94	€3.99	€5.25
Total per month	€17	€24	€30

Pricing considerations

We should try to be affordable, but not cheap.
We cannot compete with free hosting tiers in any case.
Need to experiment, see what works. Tiers can always be adjusted.
Financial transparency allows anyone to review our expenses and
suggest improvements.

Milestones

- Start collecting funds (on-going since June 2024).
- Write `gotsysd` (currently in draft state)
- Write sign-up integration software.
- Set up monitoring and backup.
- Internal testing.
- Start renting a handful of servers, wait for them to be used.
- Once up and running and stable:
  - Add more features (issue tracking, pull requests, CI, ...)
  - Gradually accept more sign-ups.

Thank you for listening! Got questions?

https://opencollective.com/gothub