Sustainability and Security in the Go ecosystem

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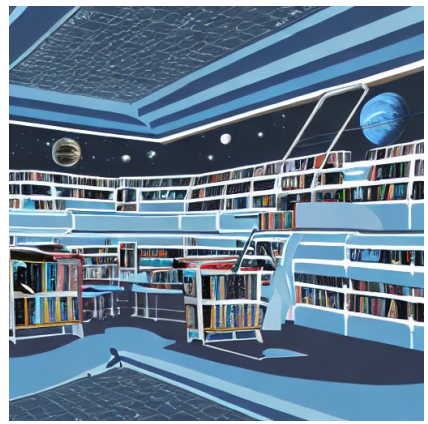
2023-03-11

Hello!

- open data engineer at Internet Archive, working on scholar.archive.org and rclone and software developer at Leipzig University Library on index metadata for libraries in Germany
- learned about Go in 11/2009 through Google Tech Talks
- active user since 2013
- since 2019 co-host of Leipzig Gophers Meetup
- open source contributions, “data space”



A Library in Space

Leipzig Gophers

- *est. 2019*, golangleipzig.space
- blog, 30+ (hybrid) events, 500+ members
- gave away tech books, Jetbrains subs, Zimaboard, and more swag, …

Leipzig Gopher

We talk about language features, libraries, cloud tools, databases and in the past collaborated with interesting companies using Go, like edgeless systems, Gridfuse, deta, CodeNotary and others.

Reach out!

Overview

- sustainability, as in **maintenance**
- security, as in **bugs**
- sustainability, as in **resource efficiency**

Surviving Software Dependencies

Surviving Software Dependencies, Cox, 2019

The Copay and Equifax attacks are clear warnings of real problems in the way software dependencies are consumed today.

Version control systems package repository

Package names are locators. A decentralized infrastructure. There is not package *central*. There is an aggregation, however, pkg.go.dev.

```
package main

import "github.com/fatih/color"

func main() {
    color.Yellow("alert")
}
```

Go modules are the defacto standard

Relevant files are `go.mod` and `go.sum`, checked into version control. Both are mostly edited by tools, e.g. `go mod ...`

```
$ ls -1
main.go  # your program
go.mod   # dependencies
go.sum   # checksums
```

No lockfile. Run `go mod tidy` and you're good.

Example `go.mod`

The latest tag is used as version, but any commit id or pseudo-version would work.

```
module yellowalert

go 1.20

require github.com/fatih/color v1.14.1

require (
        github.com/mattn/go-colorable v0.1.13 // indirect
        github.com/mattn/go-isatty v0.0.17 // indirect
        golang.org/x/sys v0.3.0 // indirect
)
```

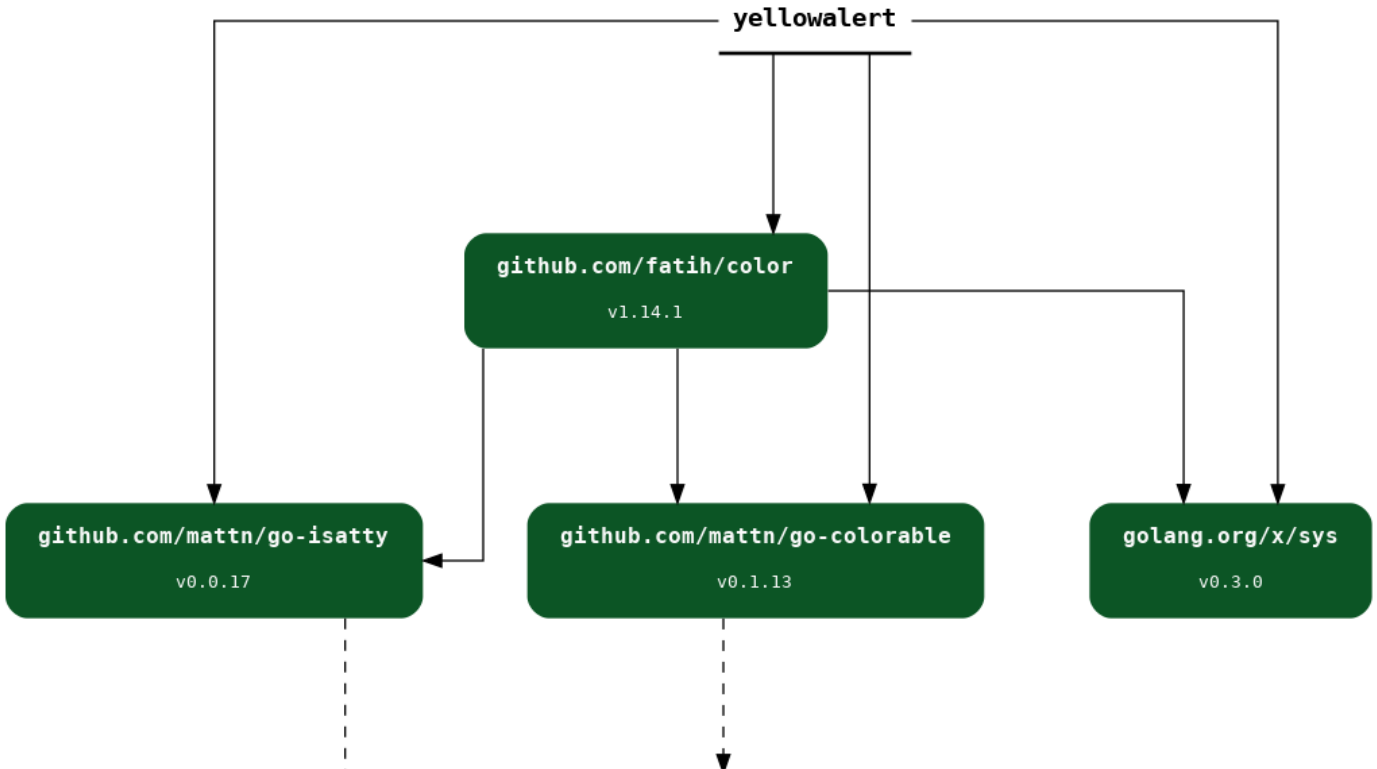
Visually

Go + tools =

```
$ go install github.com/lucasepe/modgv@latest
```

Generate a dependency graph from `go.mod`, e.g. via:

```
$ go mod graph | modgv | dot -Tpng > gomod.png
```



Example `go.sum`

Currently, SHA256 (h1) is used; hashes over files or trees. Not a lock file.

```
github.com/fatih/color v1.14.1 h1:qfhVLaG5s+nCROl1zJs...
github.com/fatih/color v1.14.1/go.mod h1:2oHN61fhTpgc...
...
```

Once a dependency has been fetched and its hash computed, it cannot be changed without notice.

- flip a bit (e.g. git would allow us to move a tag, …)

```
$ go mod verify
github.com/fatih/color v1.14.1: dir has been modified (...)
```

Any domain works

Not tied to any source code host, or any domain for that matter.

```
$ go install golangleipzig.space/clt23@latest
```

Details: CLT23 - that site is run by a static-site-generator and redirects to the actual repository.

Leftpad!

Any problem … can be solved by another level of indirection.

- Go Module Proxy, launched 2019-08-29

The go tool will ask proxy.golang.org first, use `GOPRIVATE="*"` to disable.
Run your own proxy, if you run a company.

Minimal Version Selection

An algorithm to resolve dependencies. Fast (not NP-complete), does not require lock files.

- choose minimal version required for any dependency
- depends on *import compatibility rule*

A human element required for any dependency management (e.g. we expect 1.2.3 be compatible with 1.2.4, and we expect a v2 to be backwards incompatible).

Other ecosystems are curious, e.g. cargo:

```
$ cargo -Z help | grep minimal-versions

    -Z minimal-versions -- Resolve minimal dependency versions inst
```

Major Version Update

Go has a strict recommendation, when it comes to major version upgrades: you should use a different name - i.e. a different import path, typically `.../v2`, `.../v3`, ...

- golangleipzig.space/clt 1.0.0
- golangleipzig.space/clt/v2 2.0.0

The story so far

- cannot change code, once required (and `go.sum` is checked in)
- very slim chance for **leftpad** (when using a proxy)
- very **fast** dependency resolution and high-fidelity builds
- with vendoring, we get **reproducible builds**