

# REFACTORING TO MODULES:

All you need to know  
in less than an hour

LET'S GO BACK IN  
TIME



**POLL TIME!**



Pre 1.0 (2012)



1.2 (2013)



1.5 (2015)



1.8 (2017)



1.11 (2018)

@jbaruch

#CharlotteGolang

#jcenter

<http://jfrog.com/shownotes>

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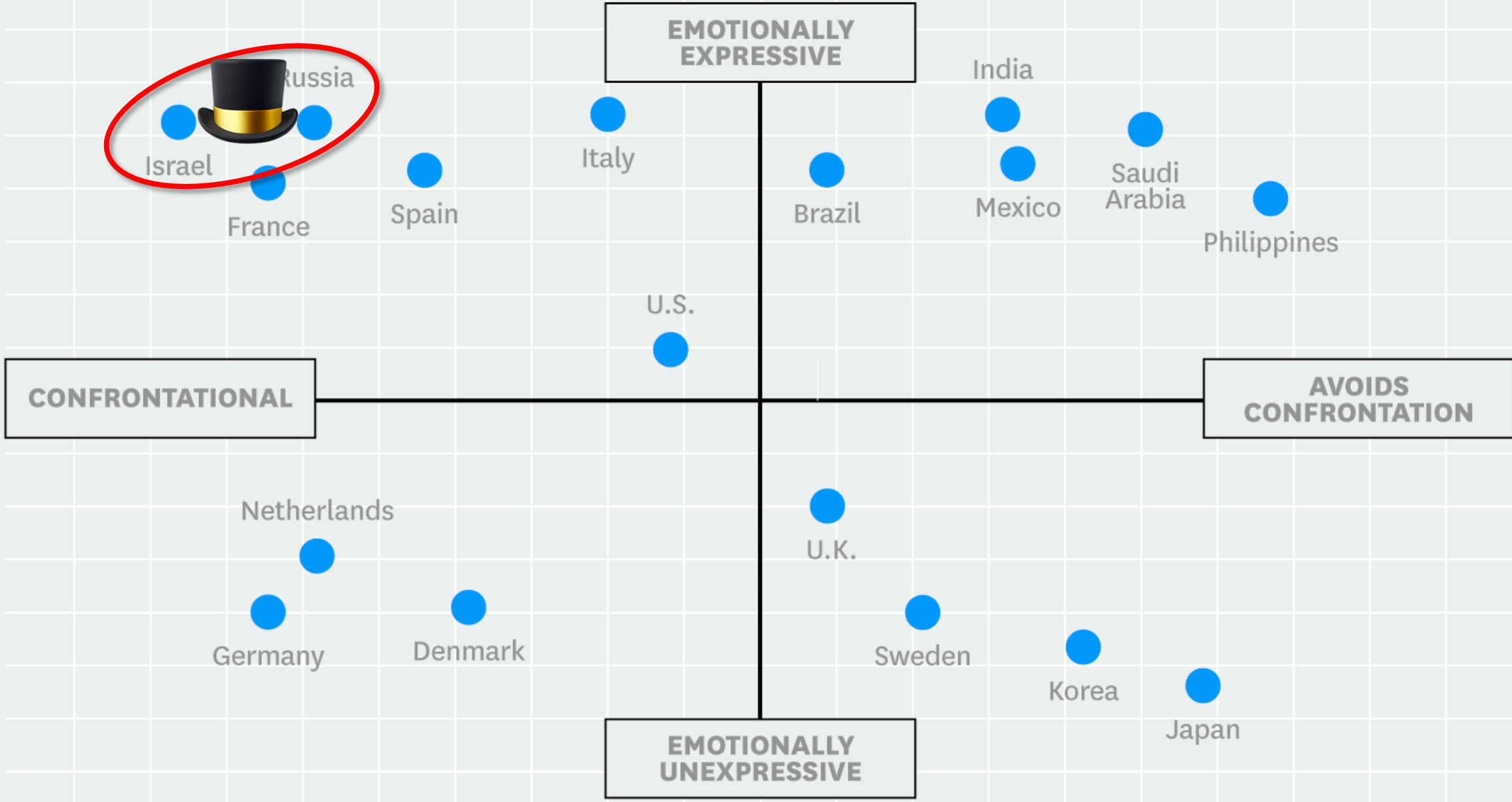


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# SHOWNOTES



<http://jfrog.com/shownotes>



Slides



Video



Links



Comments, Ratings



Raffle

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# WHY WE HAVE A PROBLEM?

## History

Design began in late 2007.

Key players:

- Robert Griesemer, Rob Pike, Ken Thompson
- Later: Ian Lance Taylor, Russ Cox

# WHY WE HAVE A PROBLEM?

A personal history of dependencies at Google

Plan 9 demo: a story

Early Google: one Makefile






2003: Makefile generated from per-directory BUILD files

- explicit dependencies
- 40% smaller binaries

Dependencies still not checkable!








**SIMPLE SOLUTION!**

-  Dependencies are sources
-  Remote import is a VCS path
-  Dump everything together into one source tree (GOPATH)
-  Compile
-  Profit



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**BUT... HOW DO I...**

-  Know which dependencies do I use?
-  Know which dependencies did you use?
-  Know which dependencies should I use?
-  Know is it our code that I am editing right now?
-  WTF is going on?!

# YEAH...

“ To date, we've resorted to an email semaphore whenever someone fixes a bug a package, imploring everyone else to run `go get -u`. You can probably imagine how successful this is, and how much time is being spent chasing bugs that were already fixed.

Dave Cheney

# DUPLICATE YOUR DEPENDENCIES

“ Check your dependencies to your own VCS.

Brad Fitzpatrick

# BUILD YOUR OWN DEPENDENCY MANAGER

“ It’s not the role of the tooling provided by the language to dictate how you manage your code in the production sense.

Andrew Gerrand

# WE EXPECT YOU TO ALREADY HAVE A HOMEGROWN DEPENDENCY MANAGER

“ If you need to build any tooling around what Go uses (Git, Mercurial, Bazaar), you already understand those tools, so it should be straightforward to integrate with whatever system you have.

Andrew Gerrand

# DON'T TRUST WHAT WE'VE BUILT

“ go-get is nice for playing around, but if you do something serious, like deploying to production, your deploy script now involves fetching some random dude's stuff on GitHub.

Brad Firzpatrick








**NEXT THING YOU KNOW...**

**THERE ARE 19 DEPENDENCY MANAGERS**



# QUIZ TIME!

-  godeps.json
-  dependencies.tsv
-  govendor, govend, goven, gv
-  trash, garbage, rubbish
-  Weapons manufacturer

GOPATH + VENDORING = 🧡

### Google Stores Billions of Lines of Code in a Single Repository ...

<https://www.youtube.com/watch?v=W71BtkUbdqE>



### Bazel How to build at Google scale? - YouTube

<https://www.youtube.com/watch?v=OUWu0myF8M>



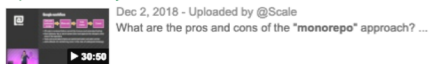
### Billions of lines of code in a single repository, SRSLY? by Guillaume ...

<https://www.youtube.com/watch?v=yM0GQw1zgrA>



### Very interesting talk about how Google handles a monorepo at ...

<https://dev.to/matteojoliveau/comment/7a34>



### Git at Google: Making Big Projects (and Everyone Else) Happy, Dave ...

<https://www.youtube.com/watch?v=cY34mr71ky8>



### The Curious Case of Monorepos, Johannes Stein - React London ...

<https://www.youtube.com/watch?v=DFCIUpKbEk>



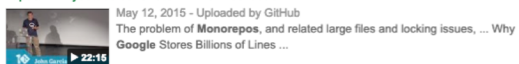
### Uber Technology Day: Monorepo to Multirepo and Back Again ...

<https://www.youtube.com/watch?v=IV8-1S28yctM>



### The Challenge of Monorepos: Strategies from git-core and Open ...

<https://www.youtube.com/watch?v=FSYBask5ao>



### Monorepos in the Wild - Markus Oberlehner @ WeAreDevelopers ...

<https://www.youtube.com/watch?v=kwhOl4mmqnm>



### BazelCon 2018 Day 1: Virtual Mono-Repo & Bazel - YouTube

<https://www.youtube.com/watch?v=2gNITegwQD4>



# GOPATH, THE PROUD SON OF THE MONOREPO

# TWO HUGE PROBLEMS WITH GOPATH



It only allows a single version of any given package to exist at once (per GOPATH)








We cannot programmatically differentiate between code the user is working on and code they merely depend on

# VENDORING – THE WORST KIND OF FORKING

“ Copy all of the files at some version from one version control repository and paste them into a different version control repository

# WHAT'S WRONG WITH IT (WELL, WHAT'S NOT)

-  History, branch, and tag information is lost
-  Pulling updates is impossible
-  It invites modification, divergence, and bad fork
-  It wastes space
-  Good luck finding which version of the code you forked

BBC


**WAIT A MINUTE...**

**WE USE SUBMODULES!**



**STILL WRONG!**

 You still have no idea what version are you using

 You have to connect each dependency as a submodule manually

 Switching branches and forks LOL

 Working on modules with other teams ROFL



**THE GO DEP  
EXPERIMENT**



# So you want to write a package manager

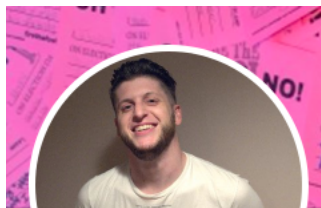
You woke up this morning, rolled out of bed, and thought, “Y’know what? I don’t have enough misery and suffering in my life. I know what to do—I’ll write a language package manager!”

...

## Package management is awful, you should quit right now

Package management is a nasty domain. Really nasty. On the surface, it *seems* like a purely technical problem, amenable to purely technical solutions. And so, quite reasonably, people approach it that way. Over time, these folks move inexorably towards the conclusion that:

1. software is terrible
2. people are terrible
3. there are too many different scenarios
4. nothing will really work for sure
5. it’s provable that nothing will really work for sure
6. **our lives are meaningless perturbations in a swirling vortex of chaos and entropy**



**sam boyer**

@sdboyer





systems | people

📍 Detroit metro

📅 Joined December 2008

★ Top highlight

# PROPER DEPENDENCY MANAGEMENT?

-  Working in project directories
-  Local cache for dependencies
-  Version declarations
-  Conflict resolution

**CONFLICT ON THE  
CONFLICT  
RESOLUTION**



**ENTER GO  
MODULES**






# ENTER GO MODULES

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# BACKWARDS COMPATIBILITY AND MIGRATION

-  `go mod init`
-  `go.mod` file is created
-  The rest is the same:  
imports in code just work

THAT'S SOME  
SERIOUS MAGIC...



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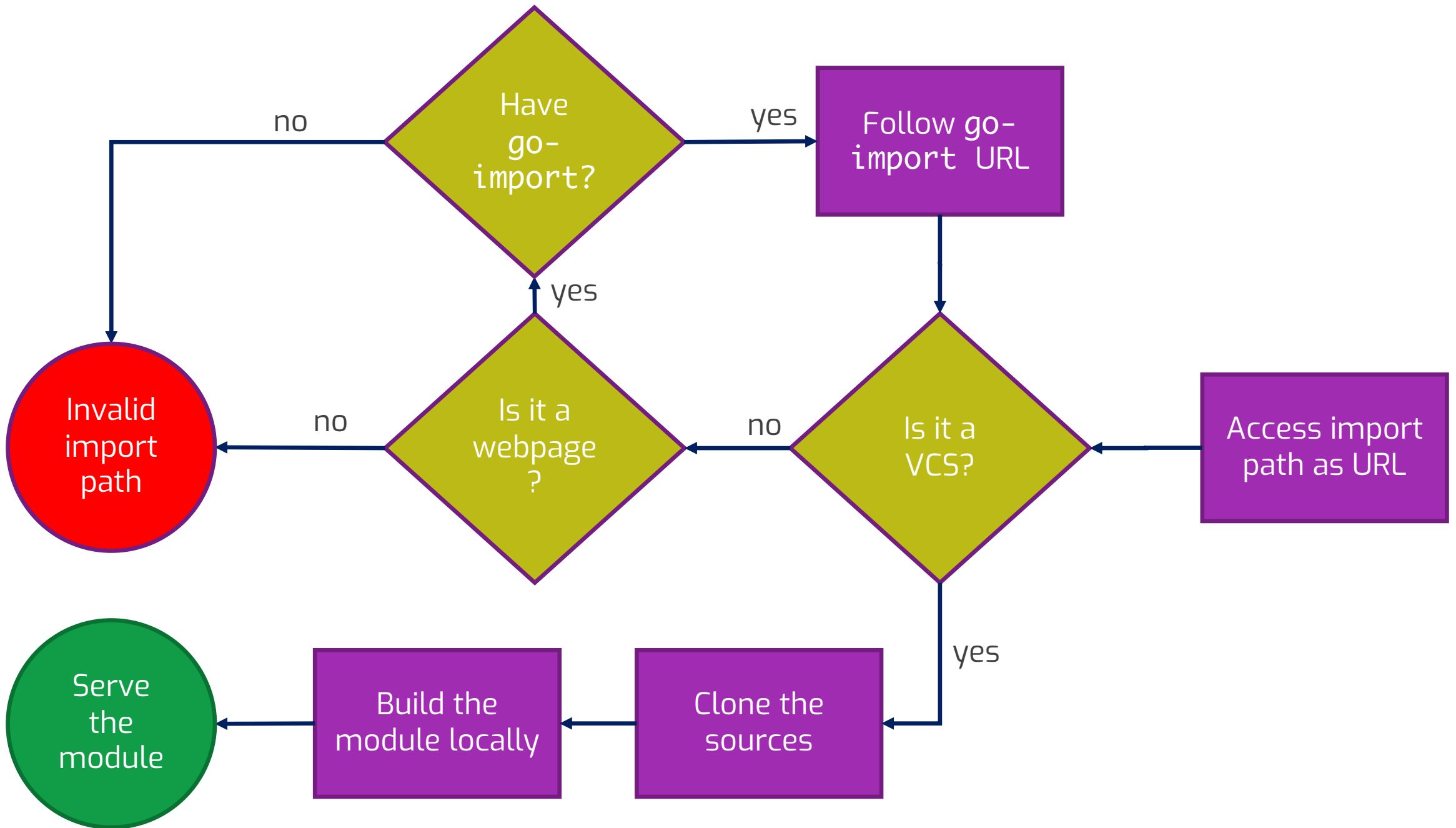
<http://jfrog.com/shownotes>

# GO MODULES CONVERT EVERYTHING (ALMOST?)

```
var Converters = map[string]func(string, []byte) (*modfile.File, error){
    "GLOCKFILE":          ParseGLOCKFILE,
    "Godeps/Godeps.json": ParseGodepsJSON,
    "Gopkg.lock":         ParseGopkgLock,
    "dependencies.tsv":   ParseDependenciesTSV,
    "glide.lock":         ParseGlideLock,
    "vendor.conf":        ParseVendorConf,
    "vendor.yml":         ParseVendorYML,
    "vendor/manifest":    ParseVendorManifest,
    "vendor/vendor.json": ParseVendorJSON,
}
```



**WHAT HAPPENS TO GO.MOD WHEN  
YOU ADD IMPORT  
(AND RUN GO GET/GO BUILD)**



# SELECTING A VERSION?


Latest  
compatible  
version tag

**EASY.**




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COMPATIBLE?!

 Let's assume SemVer works (LOL)

 The latest version of v1.x.x is compatible with v1.0.0 and up


 Premise: import path string should always be backwards compatible



# WHAT ABOUT VERSION 2?!

 Incompatible code can't  
use the same import path

 Add `/v2/` to the module  
path

 Use `/v2/` in the import  
path

```
import "github.com/my/module/v2/mypkg"
```

WHAT IF IT DOESN'T  
HAVE ANY SEMVER  
TAGS?!



Pseudo version

v0.0.0-yyyymmddhhmmss-abcdefabcdef

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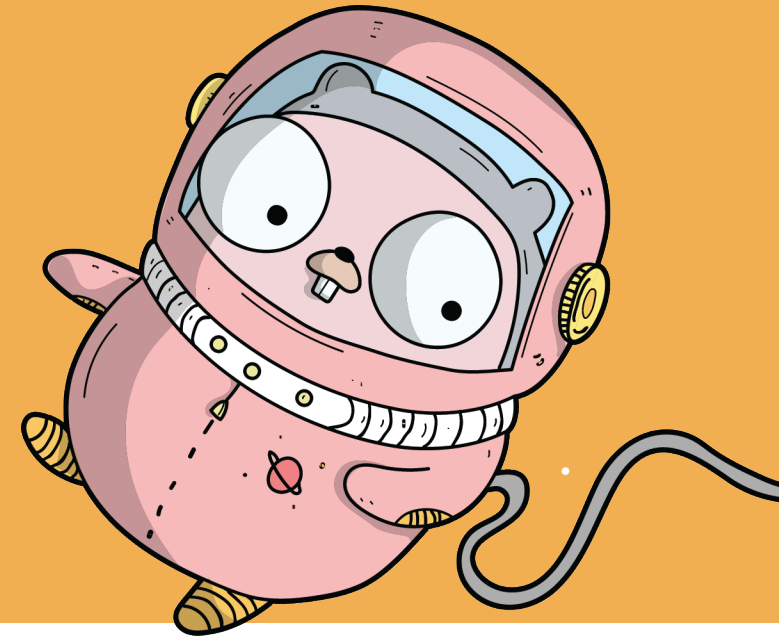
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# WHAT IF (WHEN) I WANT TO BAN A VERSION?!

 You can specify “version X or later”: `>= x.y.z`

 You can use `exclude` or `replace` for better control

**HOUSTON... I THINK I LOST MY MODULE?**



FROM VENDORING  
TO HIERARCHY OF  
MODULE  
REPOSITORIES



# MODULES SHOULD BE IMMUTABLE

The `<module>@v<version>` construct should be immutable

That means that

`github.com/myuser/myrepo/@v/v1.0.0`

Should forever be the same...



# BUT ARE THEY REALLY?

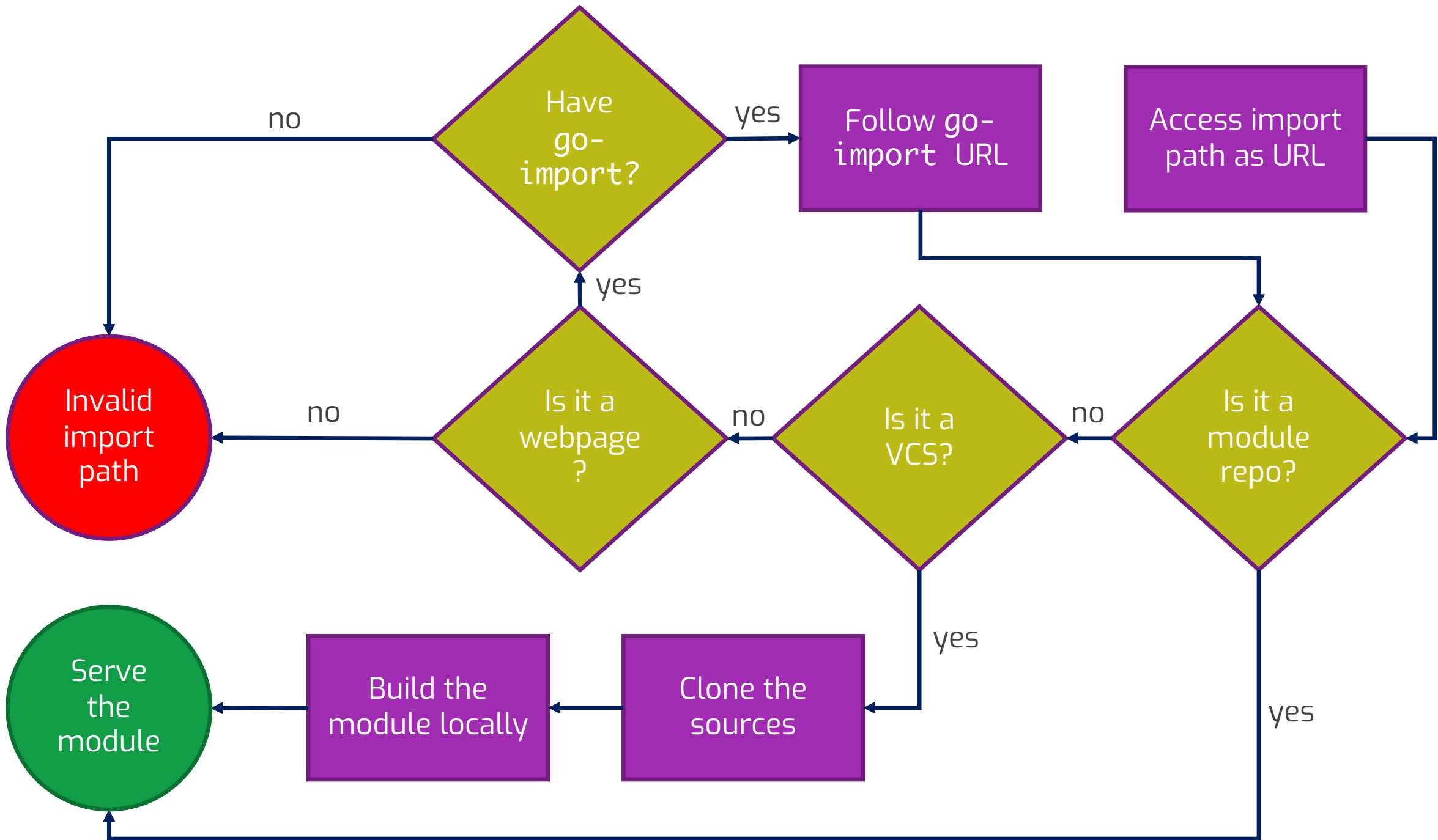
“Friends don't let friends do git push -f”

Aaron Schlesinger

# USING THE GOPROXY VARIABLE

```
export GOPROXY=https://myawesomeproxy.com  
go get github.com/myuser/myrepo
```





# KEEPING MODULES



Local cache ( $\$GOPATH/pkg/mod$ )

Immediate access, not shared, can be wiped...



Organizational cache (private proxy)

Fast access, requires infra, shared across devs



Public cache (public proxy)

Highly available, CDN, no infra, free



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# IMMUTABLE AND REPEATABLE BUILDS



Immutable dependencies

The best way to guarantee issues is force push



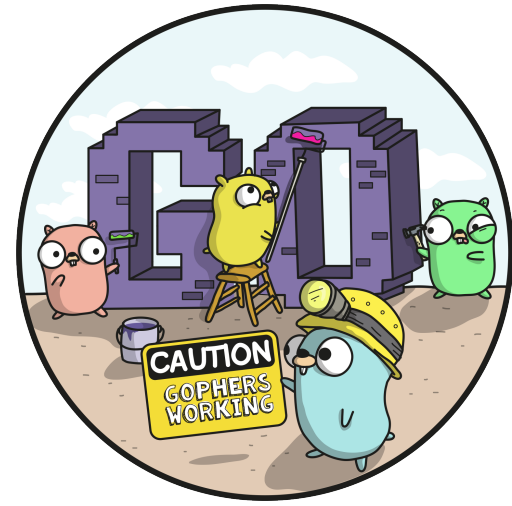
Lost Dependencies

Who doesn't remember left-pad with Node.js?



Internet Issues

Even build when GitHub is down!?



AND ALSO FASTER BUILDS...



# MORE VALUE TO GOCENTER



Documentation



Stats



Nudges



Ratings













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# WHO THE JUDGES ARE?!

-  Documentation
-  Active Development
-  # of stars
-  Unit test coverage
-  Licensing
-  # of Dependents
-  Passing unit tests
-  # of forks
-  # of maintainers
-  Score of dependencies
-  Security
-  # of downloads

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