

REFACTORING TO MODULES:

Why and how – all you need to know in (less than) an hour

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Raffle

THE SPEAKERS



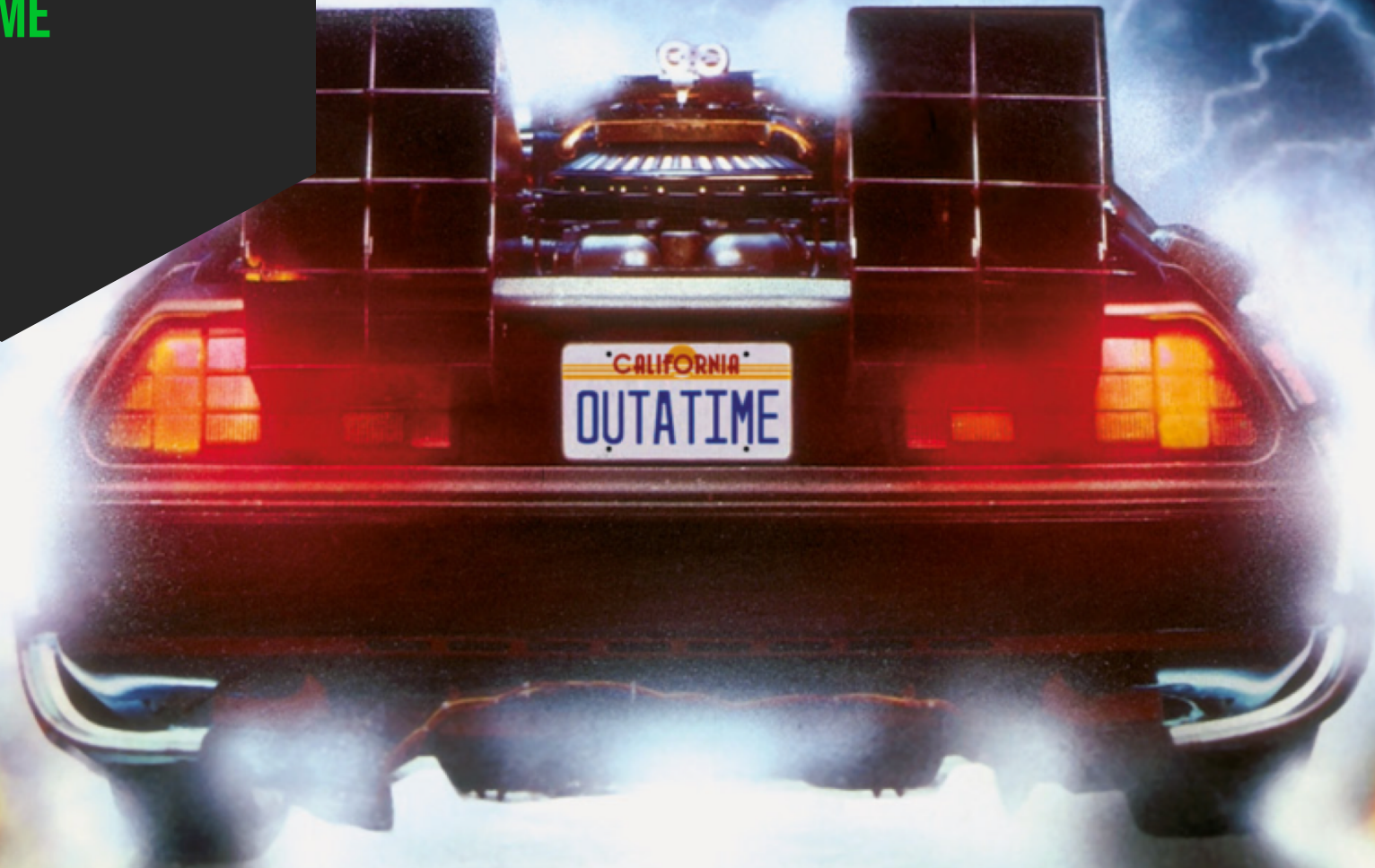
@JBARUCH



@EYALBE4

@jbaruch @eyalbe4 #GopherConIL <http://jfrog.com/shownotes>

LET'S GO BACK IN
TIME



POLL TIME!



Pre 1.0 (2012)



1.2 (2013)



1.5 (2015)



1.8 (2017)



1.11 (2019)

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 Fitzpatrick

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 = 

GOPATH, THE PROUD SON OF THE MONOREPO

About 960 results (0.18 seconds)

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

<https://www.youtube.com/watch?v=W71BTKUbdqE> ▼



Sep 15, 2015 - Uploaded by @Scale

This talk will outline the scale of **Google's** codebase, describe **Google's** custom-built monolithic source ...

Bazel How to build at Google scale? - YouTube

<https://www.youtube.com/watch?v=IOUwu0myF8M>



Mar 10, 2018 - Uploaded by FOSDEM

Bazel is **Google's** own build tool, open-sourced in Fe... ... Uber Technology Day: **Monorepo** to Multirepo and ...

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

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

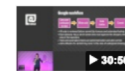


Nov 10, 2016 - Uploaded by Devxxx

Google stores all its source code in one single monolithic repository! Imagine 25000 software developers ...

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

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



Dec 2, 2018 - Uploaded by @Scale

What are the pros and cons of the "**monorepo**" approach? ...

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

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



May 12, 2015 - Uploaded by GitHub

Google likes to push the boundaries of what's possible with Git. With big projects like Android and Chrome, we ...

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

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



Sep 4, 2017 - Uploaded by Red Badger

Monorepos have often stigmatized as bad practice and as such something that ... Still, big companies like ...

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

<https://www.youtube.com/watch?v=IV8-1S28ycM>



Apr 7, 2017 - Uploaded by Uber Engineering

Aimee Lucido, a mobile engineer on Uber's Driver Signups team, spoke about Uber's transition from a ...

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

<https://www.youtube.com/watch?v=F5YBaske5ao> ▼



May 12, 2015 - Uploaded by GitHub

The problem of **Monorepos**, and related large files and locking issues, ... Why **Google** Stores Billions of Lines ...

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

<https://www.youtube.com/watch?v=kwhOI4mmqnM>



May 30, 2017 - Uploaded by WeAreDevelopers

Visit the largest developers congress in Europe: WeAreDevelopers World Congress, 16 - 18 May 2018 in ...

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

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



Nov 2, 2018 - Uploaded by Google Open Source

Reproducible HEAD dependency in a many-repo world Ittai Zeidman (Wix.com)

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

- “ 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

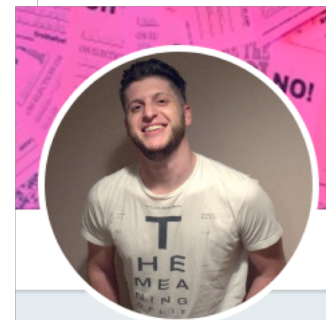
You woke up this morning, rolled out of bed, and thought, “Y’know what? I don’t have enough misery and suffering in my life. I know what to do—I’ll write a language package manager!”

...

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



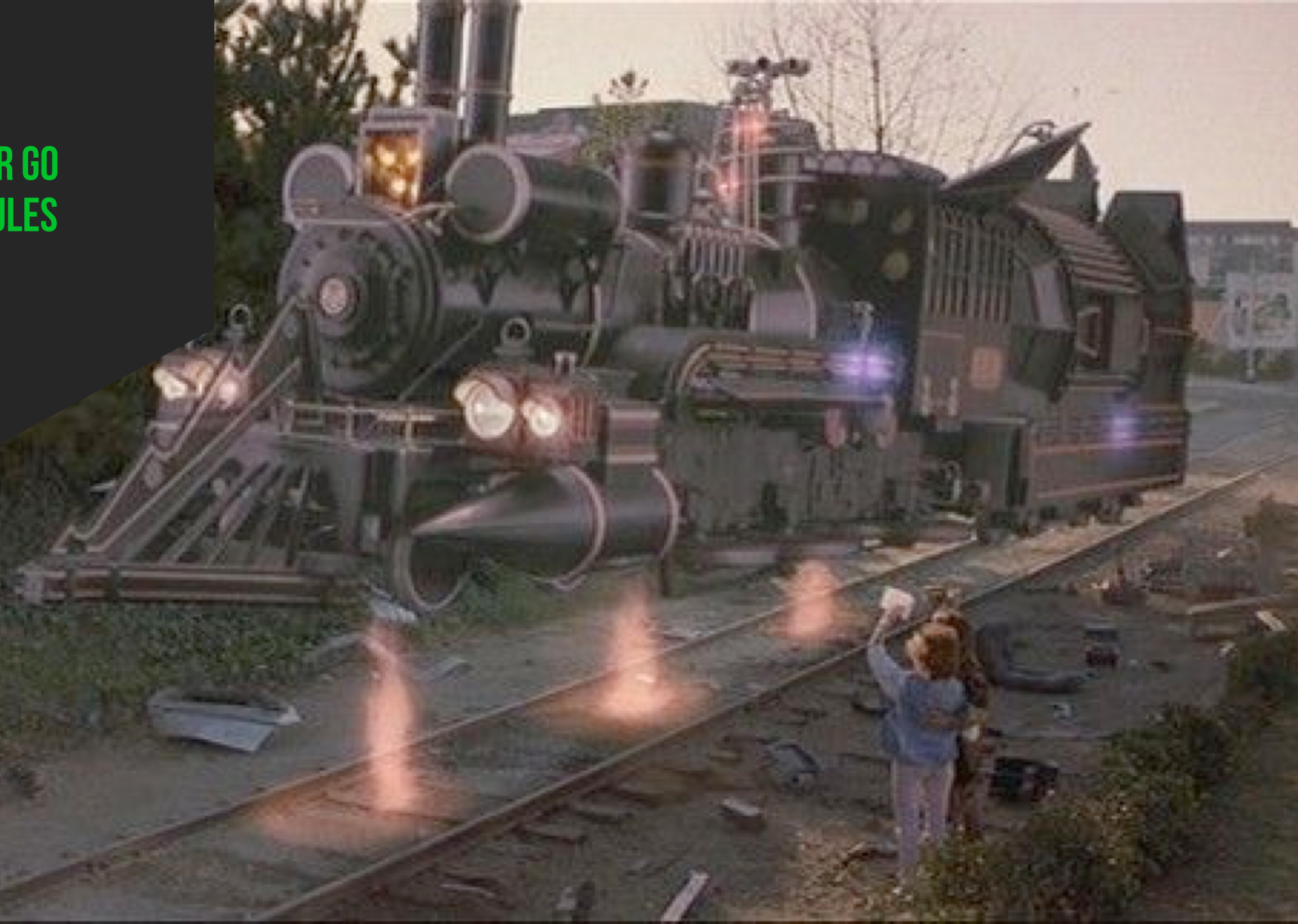
Conflict resolution

**CONFLICT ON THE
CONFLICT
RESOLUTION**



SAT/SMT
vs
MVS/SIV

ENTER GO
MODULES



ENTER GO MODULES

BACKWARDS COMPATIBILITY AND MIGRATION



`go mod init`

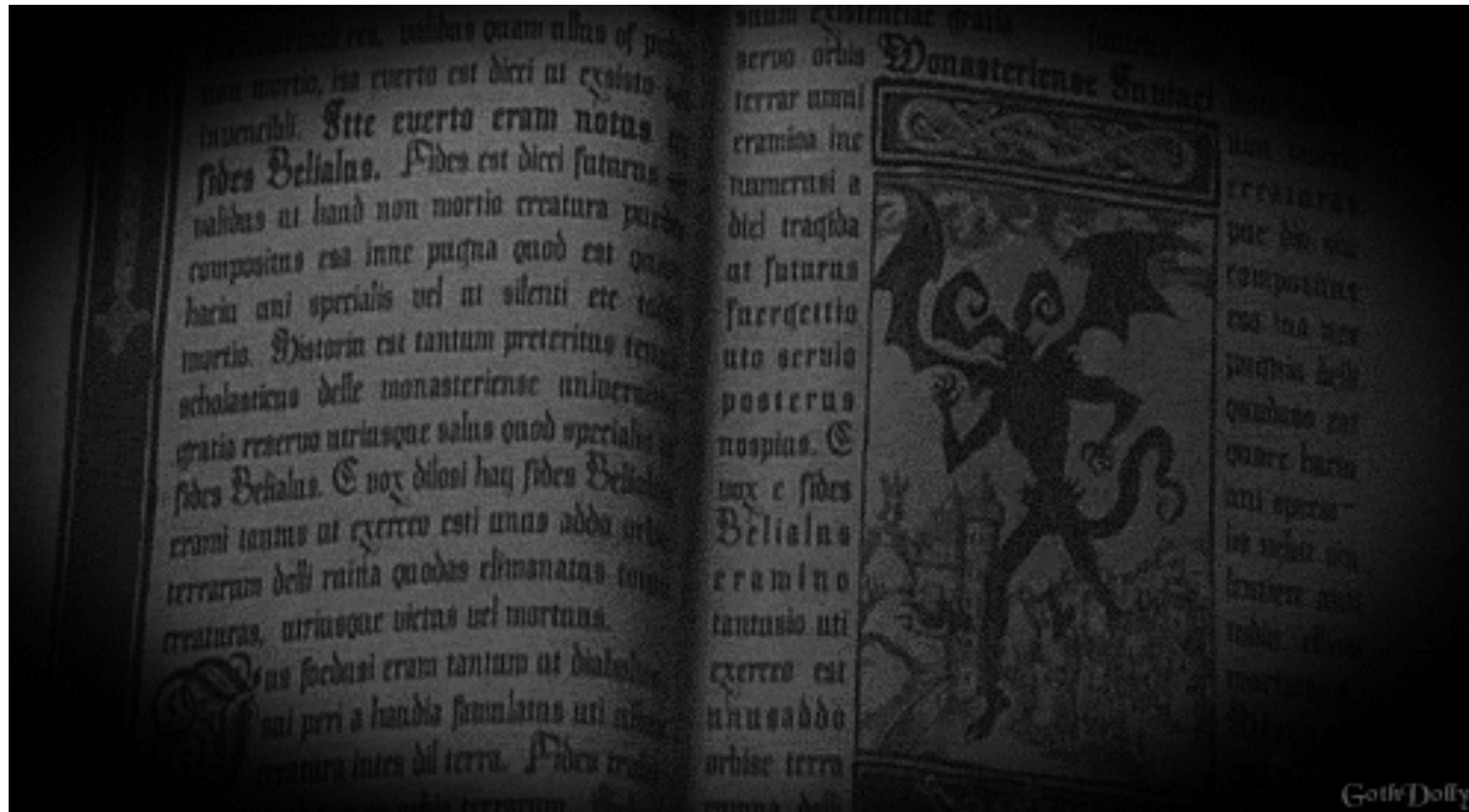


`go.mod` is created



The rest is the same: imports in code just work

THAT'S SOME SERIOUS DARK MAGIC...



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)



Go checks the URL:



If it's Go Proxy (module repository), it gets the module



If it's a VCS it clones and builds the module locally



If it's a web page, looks for go-import meta tag



Selects the latest compatible version tag



Semantic import versioning



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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

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

FROM VENDORING
TO HIERARCHY OF
MODULE
REPOSITORIES



GO MODULES DEFINE AN HIERARCHY OF CACHES

Public Modules Repository

GoCenter

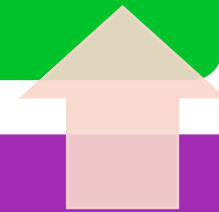
Organizational Modules Repository

Project Athens

JFrog Artifactory

Local cache on the developer's machine

`$GOPATH/pkg/mod`



LOCAL CACHE ON THE DEVELOPER'S MACHINE



After the mods are resolved (or built) they are cached in
`$GOPATH/pkg/mod`



Provides immediate access



Not shared



Not reliable (can be wiped at any moment)

ORGANIZATIONAL MODULES REPOSITORY



JFrog Artifactory or Athens



Provides faster (Intranet) access



Provides reproducible builds as it caches the dependencies used once for build reproduction



Requires team infrastructure and maintenance (SaaS offers exist)

PUBLIC MODULES REPOSITORIES

 GoCenter

 Google announced a vision for a federation of public repositories

 Provides fast access

 Provides reproducible builds as it caches the popular and requested dependencies from version control

 Highly available, requires no maintenance, free

DEMO TIME!



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