Go on Mobile

GopherCon 2015

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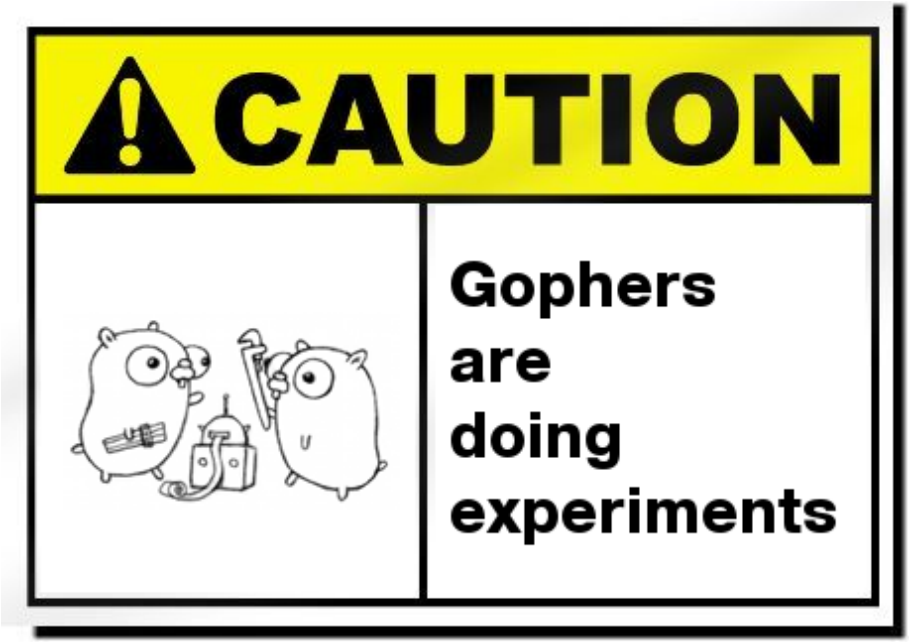
Caution



The Go Mobile project is experimental. Use this at your own risk.

While we are working hard to improve it, neither Google nor the Go team can provide end-user support.

Background

Mobile support was frequently requested

Some users built their own Go binaries for Android with cgo + external linking through NDK tool chains

Some Android Apps used Go even before Go 1.4

- Camlistore android app (out-of-process model)
- Goandroid+Mandala (in-process model)
- ...

golang.org/x/mobile

Goal: Bring Go to Mobile Platforms

Why?

- Use Go to program a complete system (server/client)
- Write a single cross-platform Go library
- Bring a simple language and development tooling to mobile

Two ways of using Go

Native Apps

- Write the whole app in Go
- Use Go packages for graphics, event handling, audio, etc.

SDK Apps

- Write Android UI in Java, iOS UI in Objective-C/Swift
- Write common functionality in Go as a library

Native Apps

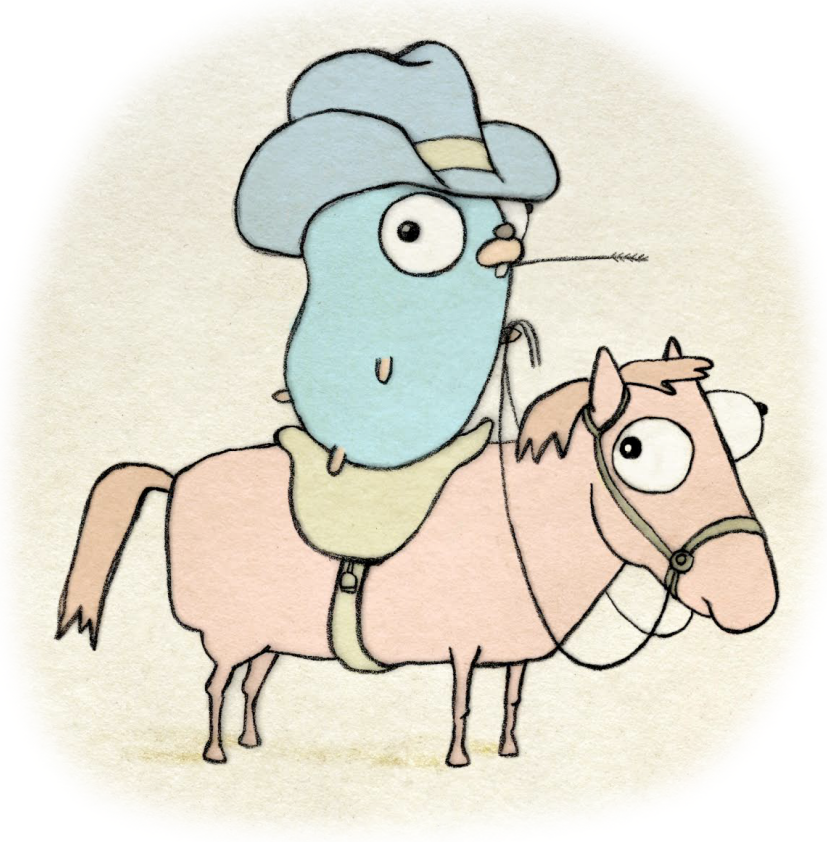
Challenge #1: Cross-platform APIs

Work for Android, iOS, and Desktop environments

Provide a rich set of APIs

Follow idiomatic Go style

Demo: Hello, Gopher!



This program uses the packages from golang.org/x/mobile repo
There is no Java or Objective-C or C in my code

What's available?

golang.org/x/mobile/...

- app: App control (https://golang.org/x/mobile/app)
- asset: Asset management (https://golang.org/x/mobile/asset)
- gl: OpenGL ES 2 (https://golang.org/x/mobile/gl)
- event: Events (https://golang.org/x/mobile/event)
- geom: Screen geometry (https://golang.org/x/mobile/geom)

golang.org/x/mobile/exp/...

- audio: Audio (https://golang.org/x/mobile/exp/audio)
- font: System font (https://golang.org/x/mobile/exp/font)
- sprite: 2-D rendering (https://golang.org/x/mobile/exp/sprite)
- sensor: Sensors (https://golang.org/x/mobile/exp/sensor)

Challenge #2: Build systems

Dealing with

- Toolchain installation
- Cross compilation for `GOOS`/`GOARCH` combos
- Android/iOS-specific build details

That is not fun!

The gomobile tool

```
$ go get golang.org/x/mobile/cmd/gomobile
```

Simplifies toolchain installation and app deployment

To install the Android/iOS compiler tool chain:

```
$ gomobile init
```

To build an Android APK and an iOS app

```
$ gomobile -target=android build
$ gomobile -target=ios     build
```

(Demo)

SDK Apps

Go as a library

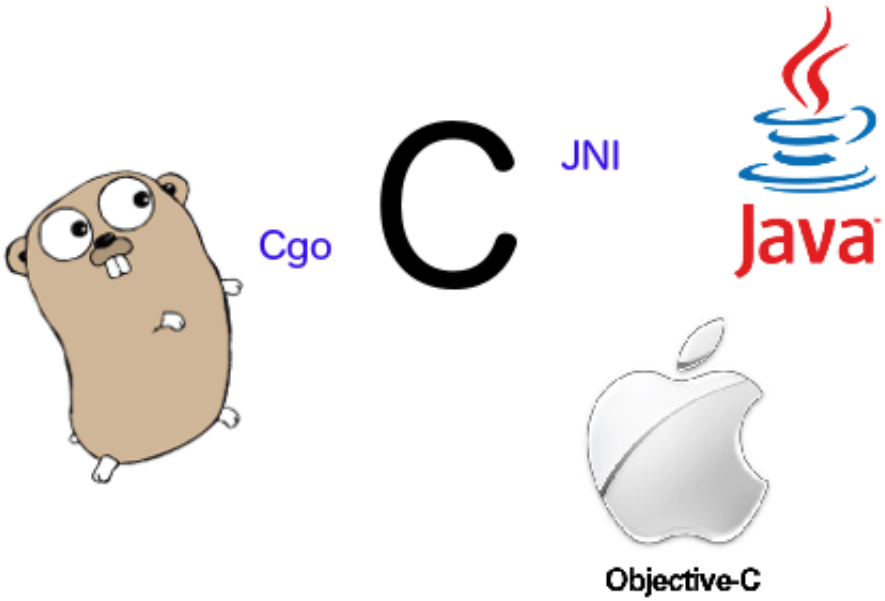
Go 1.5 can build Go programs as a library that can be used by non-Go programs

- Shared library for dynamic linking (`-buildmode=c-shared`)
- Archive file for static linking (`-buildmode=c-archive`)

Functions marked with `//export` cgo annotations are callable.

golang.org/s/execmodes (https://golang.org/s/execmodes)

Working with Foreign Languages



Manually mapping data structures and functions between languages is tedious and error-prone!

The gobind tool

```
$ go get golang.org/x/mobile/cmd/gobind
```

Automates language binding through code generation

Defines the language binding from exported Go APIs; no explicit annotation

Currently supports a subset of Go types (https://golang.org/x/mobile/cmd/gobind)

Binding Functions, Basic Types & Errors

Go API

```
package mypkg

func Hello() (string, error) { return "Gopher", nil }
```

Generated Java API

```
public abstract class Mypkg {
    public static String Hello() throws Exception { ... }
}
```

Generated Objective-C API

```
FOUNDATION_EXPORT BOOL GoMypkgHello(NSString** ret0_, NSError** error);
```

Binding Structs

```
package mypkg

type Counter struct {
    Value int64
}

func (c *Counter) Inc() {
    c.Value++
}

func NewCounter() *Counter {
    return &Counter{}
}
```

Generated Java API

```
public abstract class Mypkg {
    public static final class Counter {
        public void Inc() { ... }
        public long GetValue() { ... }
        public void SetValue(long value) { ... }
    }

    public static Counter NewCounter() { ... }
}
```

Use it from Java

```
Counter counter = NewCounter();
counter.SetValue(12345);
counter.Inc();
```

Generated Objective-C API

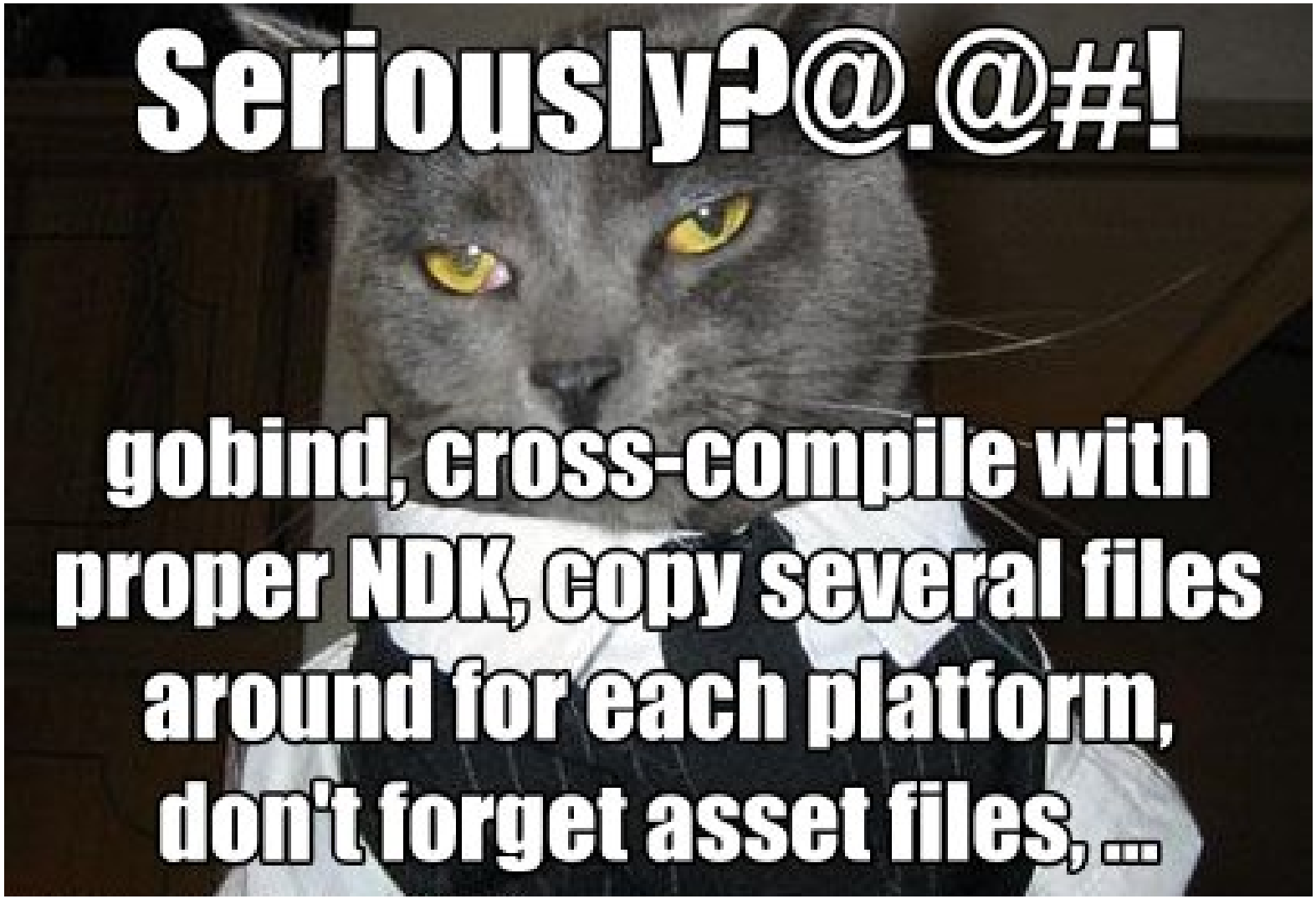
```
@interface GoMypkgCounter : NSObject { }
@property(strong, readonly) GoSeqRef *ref;
- (int64_t)Value;
- (void)setValue:(int64_t)v;
- (void)Inc;
@end

FOUNDATION_EXPORT GoMypkgCounter* GoMypkgNewCounter();
```

Use it from Objective-C

```
GoMypkgCounter* counter = GoMypkgNewCounter();
[counter setValue:12345];
[counter Inc];
```

How to build it?



The gomobile bind command

Simplifies the build process. For example, for Android,

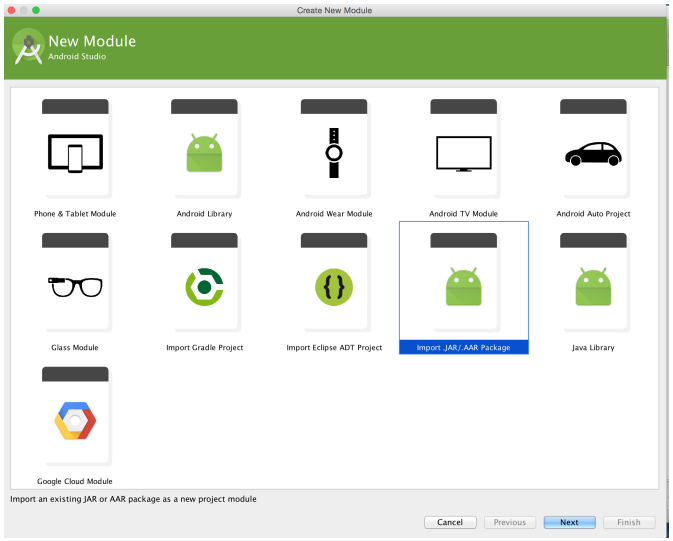
- Generates language bindings for Go packages
- Compiles Go code to a shared library
- Compiles the generated target language code
- Bundles everything into a `.aar` file (modern way to distribute android libraries)

(DEMO)

iOS support is a work in progress.

Android Studio Integration

Android Studio 1.2+ supports `.aar` import.



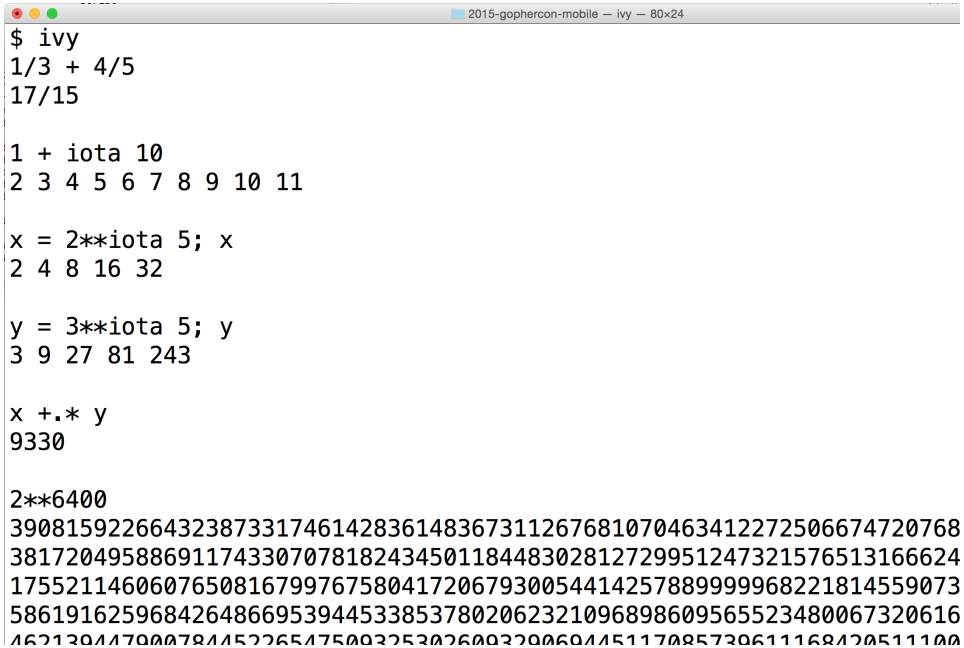
To update the .aar,

- Build script to invoke `gomobile bind`, or
- Gradle plugin to invoke `gomobile bind` and publish the output

The Story of Ivy

The Ivy (robpike.io/ivy) is a command line tool developed by Rob Pike

It's a useful desktop calculator that handles big int, rational and floating-point numbers, vectors, matrices, ...

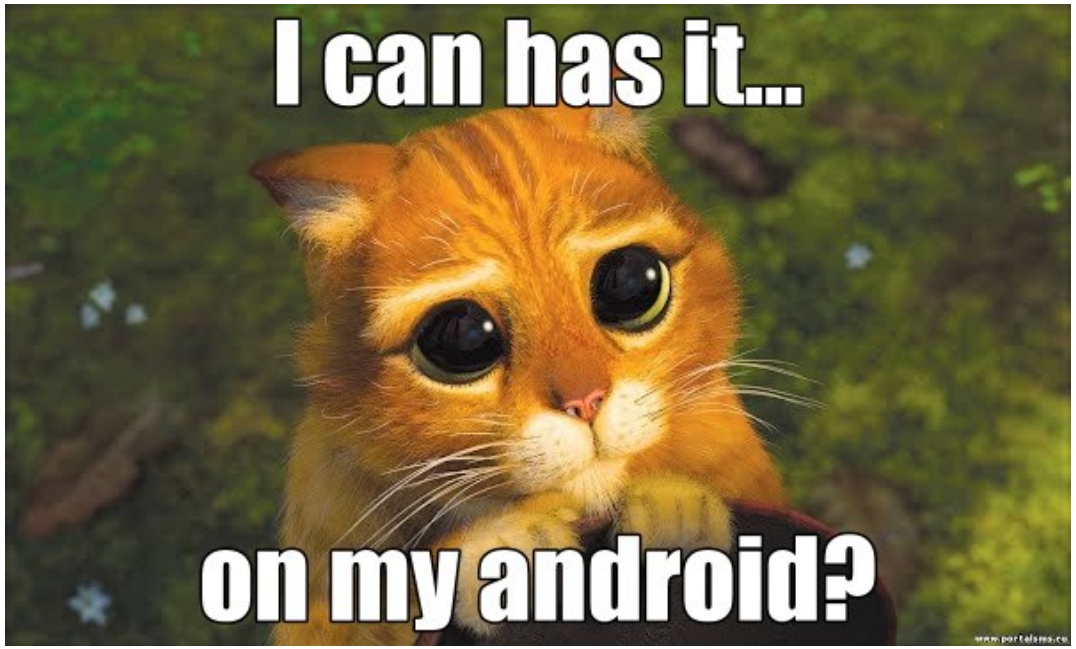


It is in fact an interpreter for an APL (https://en.wikipedia.org/wiki/APL_(programming_language))-like language

Ivy on Mobile?

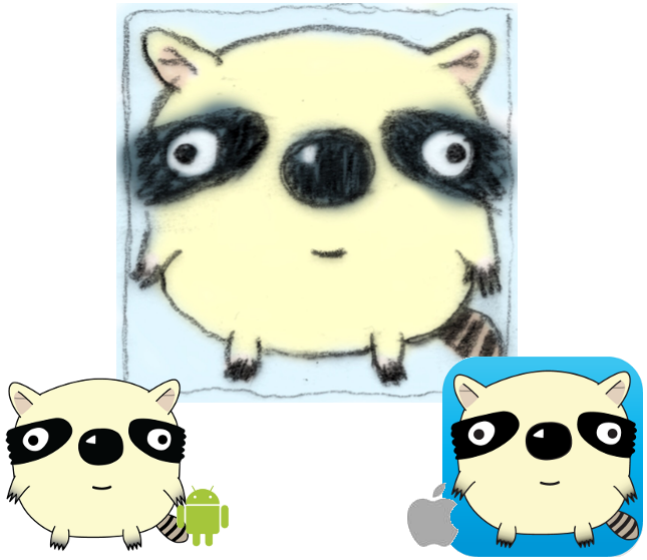
~5k lines of Go code (not including tests, docs)

Dependency on `math`, `math/big`, `math/rand`, `unicode`, ...



Rewriting in Java or Objective-C is a non-starter

Ivy apps



Ivy logo by Renée French (https://www.reneefrench.com)

Google Play Store (https://play.google.com/store/apps/details?id=org.golang.ivy)

Apple App Store (https://itunes.apple.com/us/app/ivy-big-number-calculator/id1012116478)

Gomobile bind

Write it once as a library in Go

Enjoy great language features and packages available in Go

Where are we now?

Go 1.4: Hello Android!

Released in December 2014

Can build Android apps (`arm`)

Android builder

The `gobind` tool for Java and Go language binding

Packages for cross-device apps: basic app control, OpenGL ES 2, touch

golang.org/s/go14android (https://golang.org/s/go14android)

golang.org/s/gobind (https://golang.org/s/gobind)

Go 1.5: Hello iOS!

Planned release early August 2015

Experimental support for iOS (`arm`,`arm64`)

iOS builder

Go 1.5: Go programs as libraries

Can call Go functions from foreign language in a clean way

golang.org/s/execmodes (https://golang.org/s/execmodes)

Go 1.5: Better tools & more packages

`golang.org/x/mobile` repo getting better

- The `gomobile` tool for mobile app/library build
- Extended `gobind` tool: Objective-C binding
- `golang.org/x/mobile/exp`: experimenting with audio, sensor, sprite, ...

Go 1.6+

- Improvement in GL/UI packages
- More APIs available to "pure Go" apps
- Testing, profiling, debugging
- Support for more platforms (e.g. android/x86, iOS simulator)
- Richer type support in `gobind`
- IDE integration

Contributions from Go community

git log | word_cloud

Thank you

GopherCon 2015

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