Mutant Go compilers

A short talk by Elliott Stoneham at GopherCon on 26th April 2014

Write your own Go compiler
blog.golang.org/fosdem14

Go is addictive,
I want it everywhere…

…mutant compilers take Go to places
that the current compilers cannot reach
(having fun along the way)

The 3 phases of a mutant Go compiler

original Go program to be compiled =>

(1) Use standard library packages to create an intermediate form that entirely describes the original Go program

=> Abstract Syntax Tree (AST) or Single Static Assignment form (SSA) =>

(2) Generate new code with the same behaviour

=> target bitcode or language (e.g. JavaScript) =>

(3) Use normal target compiler or interpreter (e.g. NodeJS)

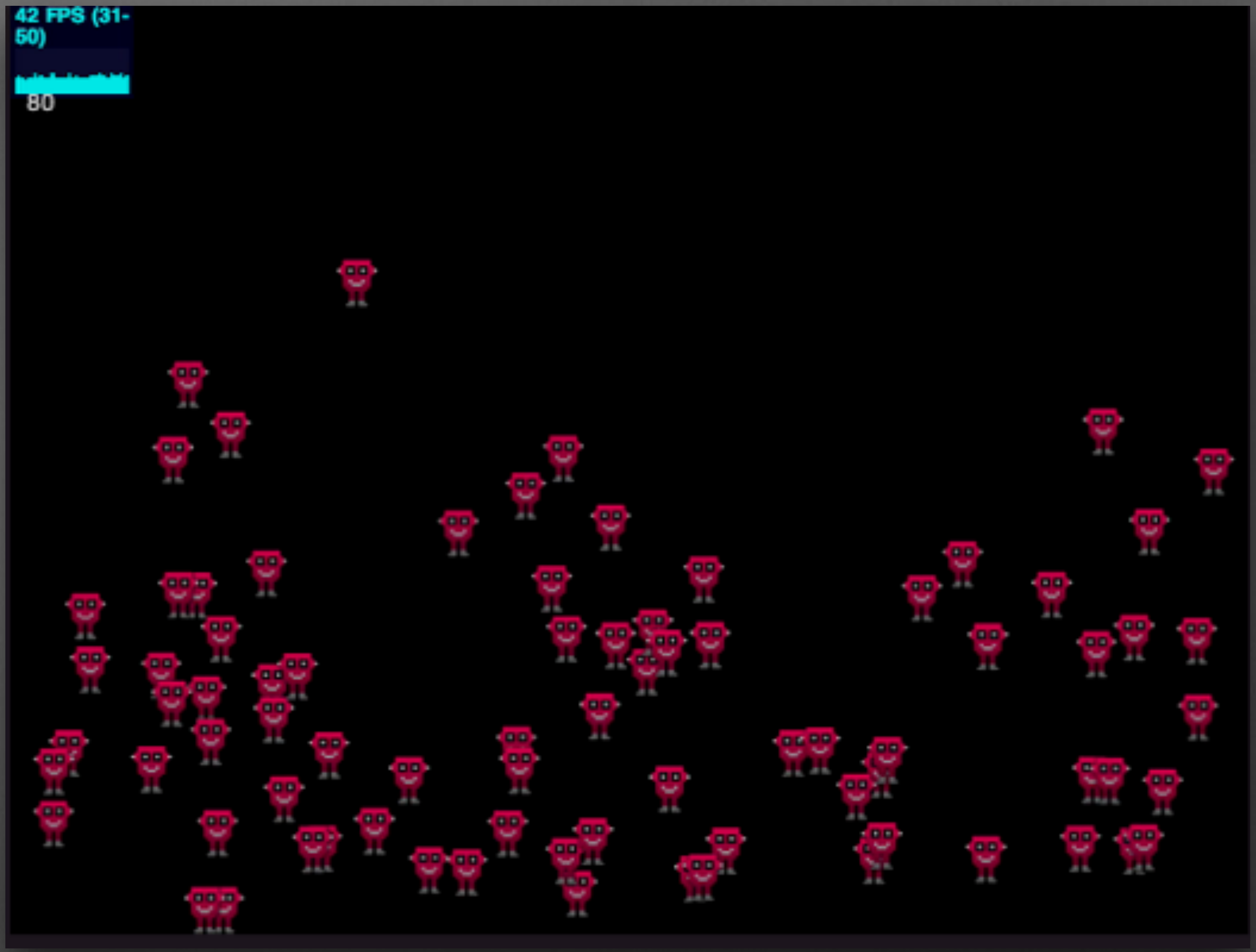
open-source mutant Go compilers

	AUTHORS	PROJECT FIRST PUBLISHED	GITHUB STARS	TARGET
GOPHERJS	Richard Musiol + others	November 2013	400+	JavaScript
LLGO	Andrew Wilkins + others	October 2011	450+	LLVM bitcode
TARDISGO	Elliott Stoneham	January 2014	100+	JS, Flash, Java, C++, C# & PHP via Haxe

compilation sequences

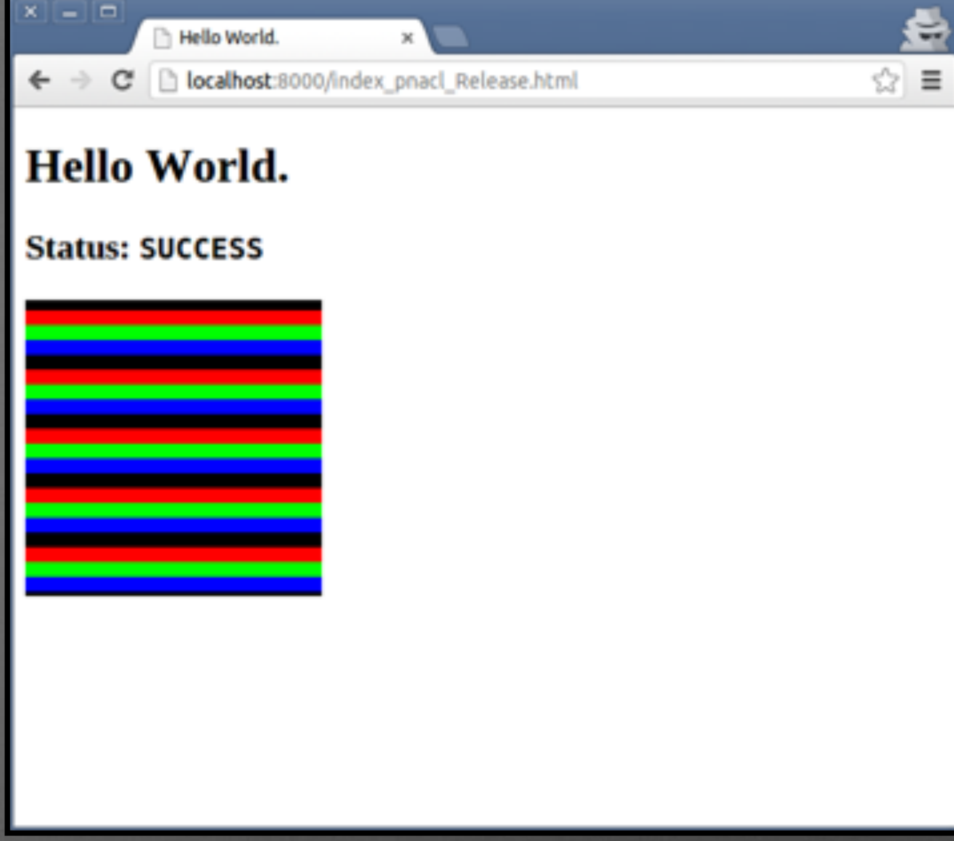
GopherJS	**llgo**	**TARDIS Go**
Go source => go/* libraries => AST		
AST => go.tools/go/types => types.Info		
AST + types.Info => GopherJS => JavaScript	AST+types.Info=>go.tools/go/ssa=>SSA	
	SSA+types.Info => llgo => LLVM module	SSA+types.Info => tardisgo => Haxe (haxe.org)
	LLVM modules => llgo-build => executable	Haxe => JavaScript, Flash, Java, C++, C#, PHP & Neko

GopherJS



- Most immediately useful
- Active user community
- See: ajhager.com/enj/
- jQuery and AngularJS bindings
- Now runs over 5x faster for fannkuch.go benchmark
- …but no goroutines or channels yet

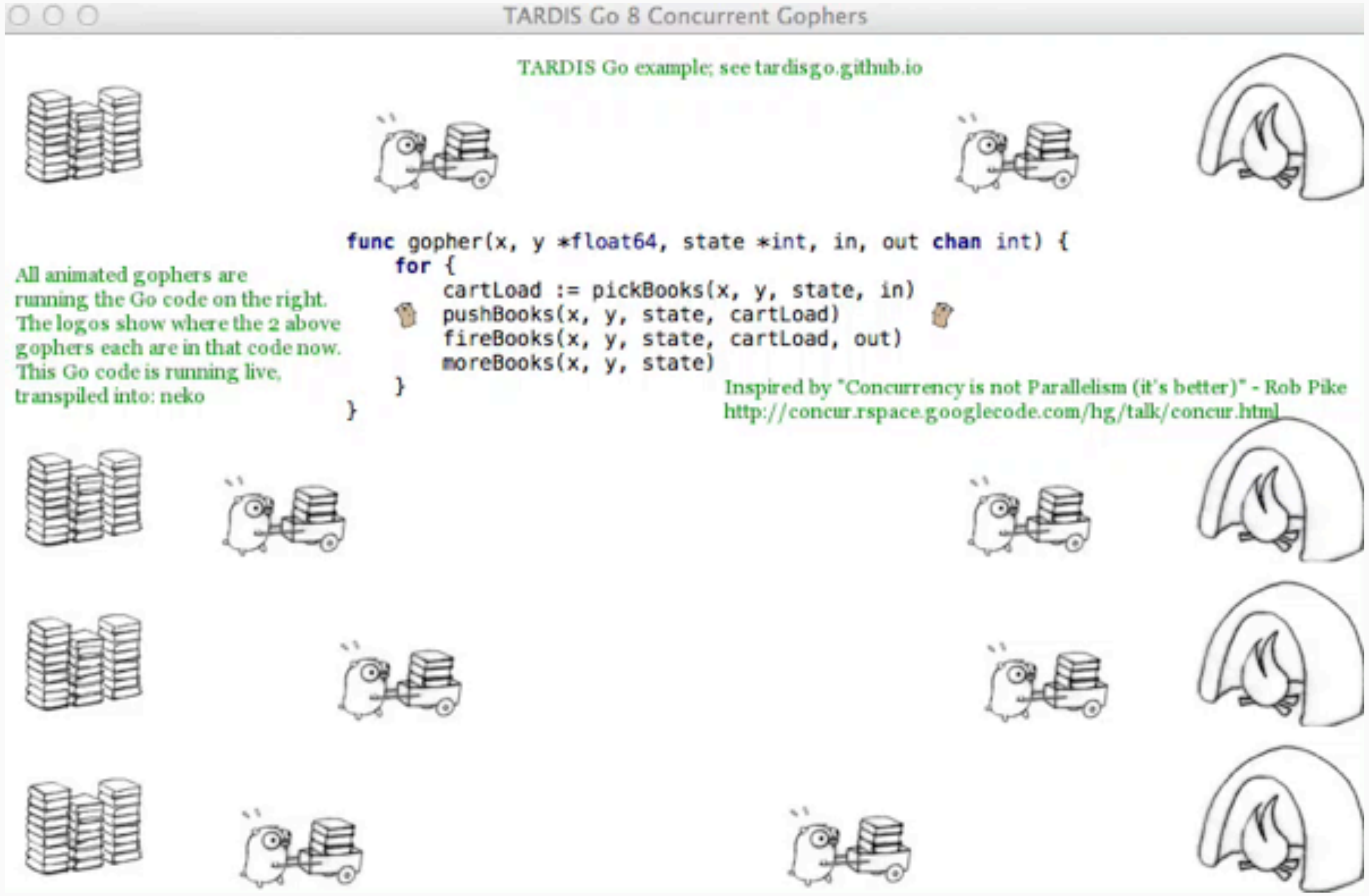
llgo



Hello World.

Status: SUCCESS

- On-track to become a mainstream Go implementation
- Fastest Go execution speed for some benchmarks
- Portable Native Client (PNaCl)? Emscripten=>asmJS?
- Now using libgo, thanks to Peter Collingbourne
- …but still some stabilisation and bug fixes to do



TARDIS Go 8 Concurrent Gophers

TARDIS Go example; see tardisgo.github.io

All animated gophers are running the Go code on the right. The logos show where the 2 above gophers each are in that code now. This Go code is running live, transpiled into: neko

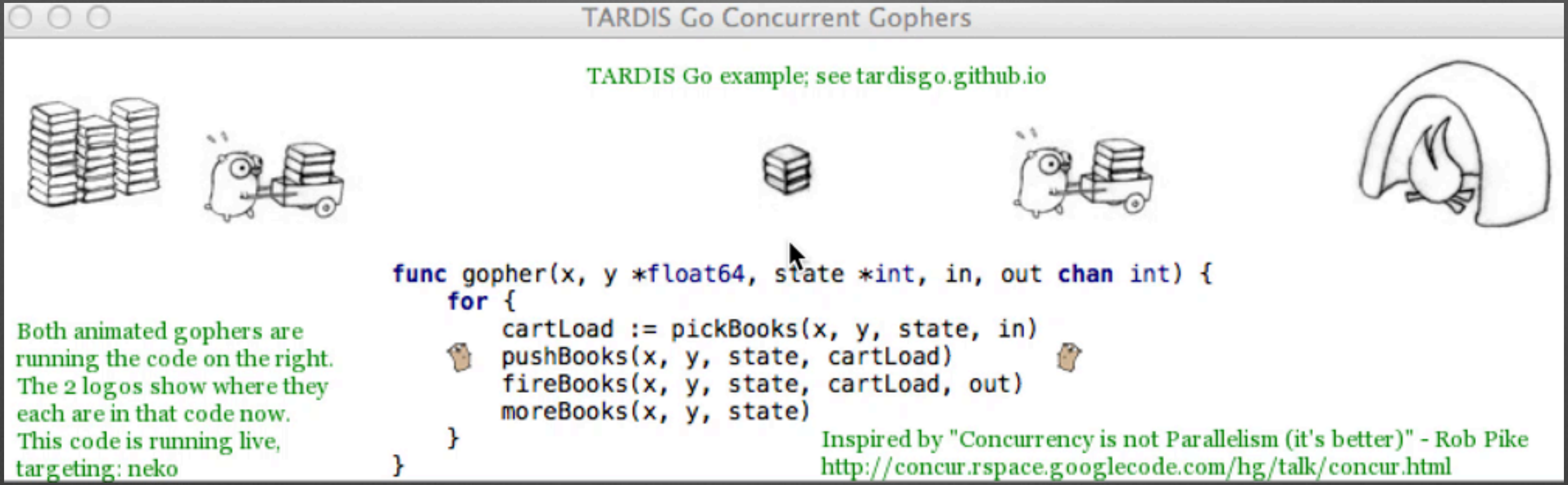
```
func gopher(x, y *float64, state *int, in, out chan int) {
    for {
        cartLoad := pickBooks(x, y, state, in)
        pushBooks(x, y, state, cartLoad)
        fireBooks(x, y, state, cartLoad, out)
        moreBooks(x, y, state)
    }
}
```

Inspired by "Concurrency is not Parallelism (it's better)" - Rob Pike
http://concur.rspace.googlecode.com/hg/talk/concur.html

HTML5, Flash, Windows, Mac, Linux, iOS, Android, BlackBerry, Tizen, webOS, Xbox, PlayStation and Emscripten

[Gopher images by Renee French]

tardisgo.github.io



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- The most target environments, with cross-platform UI
- Go core spec, including goroutines and channels
- …but slowest overall compile times, limited Go library support, single threaded, and no run-time optimisation

Other mutant Go projects

- **igo** - https://github.com/sbinet/igo - A simple interactive Go interpreter built on exp/eval with some readline-like refinements

- **arogue** - https://github.com/glycerine/arogue - A Go-Repl using R underneath (port of GopherJS)

- **hho** - github.com/arjenroodselaar/hho - Go to HHAS for HHVM (Assembler for Facebook's complete toolchain for the PHP language)

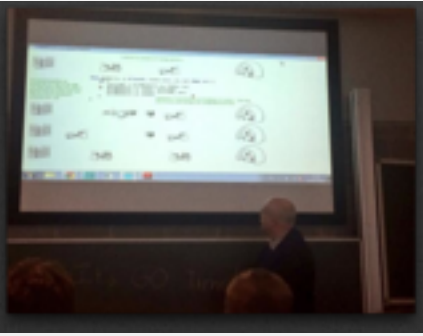
GopherCon daily guest blog gophercon.sourcegraph.com

1. Go compilers that target the Microsoft CLR and Oracle JVM?

2. Running untrusted Go code as part of your application, an outline idea

3. Reflections on @_rsc's C-to-Go talk

Help a mutant Go compiler ...or write your own!

GopherJS		github.com/gopherjs/gopherjs
llgo		github.com/go-llvm/llgo
tardisgo		github.com/tardisgo/tardisgo
your project here		blog.golang.org/fosdem14