Running Heroku on Heroku

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Strange Loop 2011

Heroku Background

Cloud Application Platform as a Service

Run Anything and See Everything Without Servers

Distributed Unix

Bootstrapping, 19th Cent.

To raise or better oneself by one's own unaided efforts, in a ludicrously far-fetched or quixotic manner

Bootstrapping, 20th Cent.

A self-sustaining process that proceeds without external help

Bootstrapping Applications

Socio-Economics

Business

Statistics

Linguistics

Biology

Compilers

Writing a Compiler in the Language it Compiles

Leads to a Self-Hosting Compiler

Advantages

Non-trivial Test of the Language Being Compiled

Development Can Occur in a Higher-Level Language

Comprehensive Consistency Check

Chicken and Egg

Build Compiler/Interpreter for X in Y

Use an Existing Compiler for X'

Use an Earlier Version With a Subset of X

Hand Compile

Demo: LLVM / clang

LLVM Compiler Infrastructure

Research Project at UIUC in 2000

Clang C / C++, Objective C / C++ Frontend

Written in C++

BSD License

```
#!/usr/bin/env bash
# http://llvm.org/docs/GettingStarted.html

cd /tmp
git clone http://llvm.org/git/llvm.git
git clone http://llvm.org/git/clang.git llvm/t

envs[1]="CC=gcc CXX=g++"
envs[2]="PATH=/tmp/stage1/Release/bin:$PATH CC=
envs[3]="PATH=/tmp/stage2/Release/bin:$PATH CC=

for i in ${!envs[*]}; do
  (
    mkdir -p /tmp/stage$i && cd /tmp/stage$i
    export ${envs[$i]}
    which $CC $CXX
    ../llvm/configure              \
      --enable-optimized           \
      --disable-assertions         \
      --enable-targets=host-only
    time make
    time make -C tools/clang test
  )
done

# Diff binaries
diff <(strings /tmp/stage1/Release/bin/clang)
```

```
$ heroku run bin/llvm.sh
Running bin/llvm.sh attached to terminal... up, run.4

+ export CC=gcc CXX=g++
+ ../llvm/configure --enable-optimized --disable-asserti
checking whether the C compiler works... yes
checking whether we are using the GNU C compiler... yes
checking how to run the C preprocessor... gcc -E
...

+ make
+ make -C tools/clang test
--- Running clang tests for x86_64-unknown-linux-gnu ---
Testing Time: 67.71s
  Expected Passes    : 3814
  Expected Failures  : 26
  Unsupported Tests  : 1
real  1m8.980s

+ export PATH=/tmp/stage1/Release/bin:/usr/local/bin:/us
+ ../llvm/configure --enable-optimized --disable-asserti
checking whether the C compiler works... yes
checking whether we are using the GNU C compiler... yes
checking how to run the C preprocessor... clang -E
...

+ make
+ make -C tools/clang test
--- Running clang tests for x86_64-unknown-linux-gnu ---
Testing Time: 56.57s
  Expected Passes    : 3814
  Expected Failures  : 26
  Unsupported Tests  : 1
real  0m57.331s
```

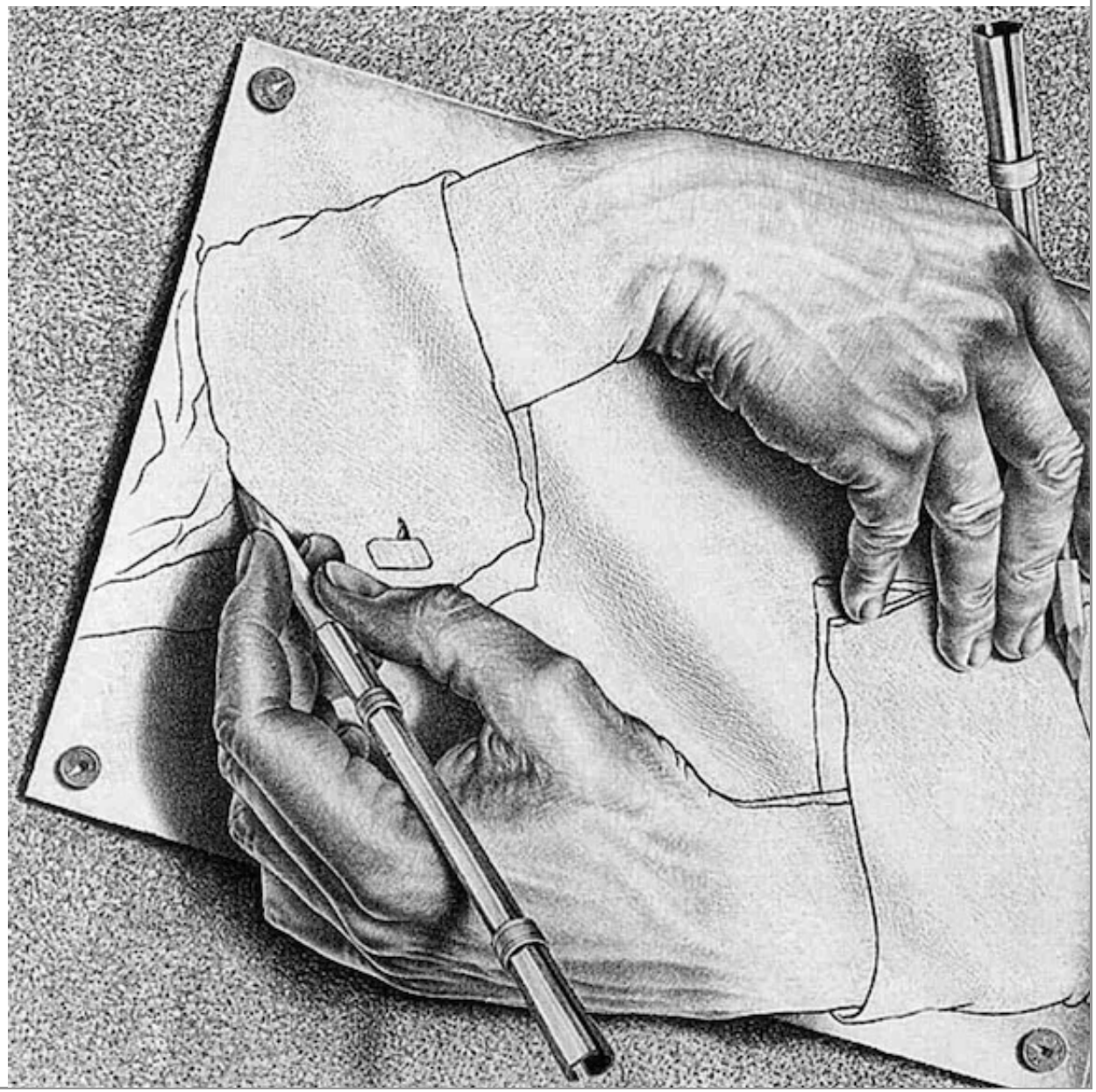
```
$ heroku run bin/llvm.sh
+ wc
++ strings /tmp/stage1/Release/bin/clang
+ diff /dev/fd/63 /dev/fd/62
++ strings /tmp/stage2/Release/bin/clang
 423609  941646 4701258

+ wc
++ strings /tmp/stage2/Release/bin/clang
+ diff /dev/fd/63 /dev/fd/62
++ strings /tmp/stage3/Release/bin/clang
      12      18     178
```

Bootstrap → Self-Hosting

Bootstrap LLVM/Clang with GCC

Compile Clang Cith Clang

Clang is **Self-Hosting**!



Self-Hosting

A computer program that produces new versions of that same program

Compilers

Kernels

Programming Languages

Revision Control Systems

Text Editors

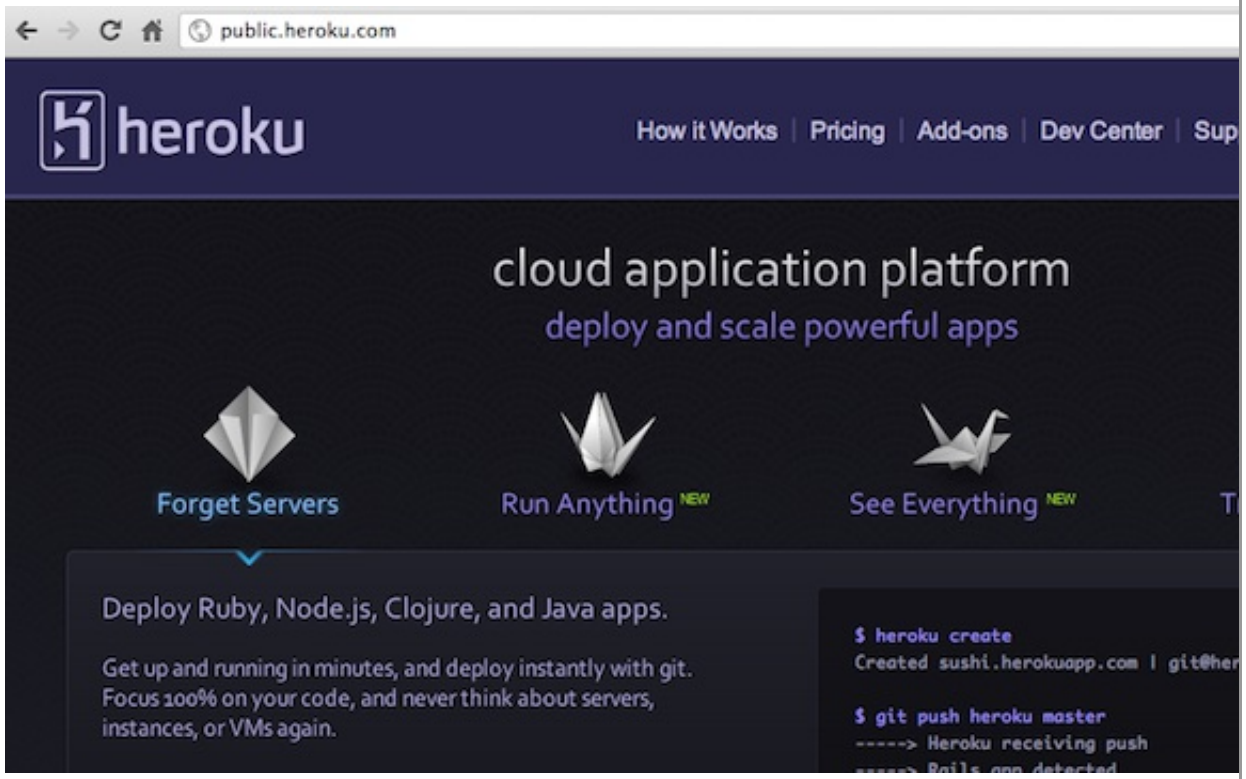
Self-Hosting

Applicable Metaphor for Services?

Heroku Self-Hosting: E

www.heroku.com

devcenter.heroku.com



Motivations

Dogfooding

Efficiency

Separation of Concerns

Heroku Self-Hosting: Normal

addons.heroku.com

Cron Addon

```
$ heroku ps --app cron
Process        State         Command
-------------  ---------  ------------------
exec.1         up for 9d  rake resque:work Q
exec.2         up for 9d  rake resque:work Q
finder.1       up for 9d  rake resque:work Q
finder.2       up for 8d  rake resque:work Q
scheduler.1    up for 9d  rake resque:schedu
web.1          up for 9d  bundle exec unicor
web.2          up for 9d  bundle exec unicor
```

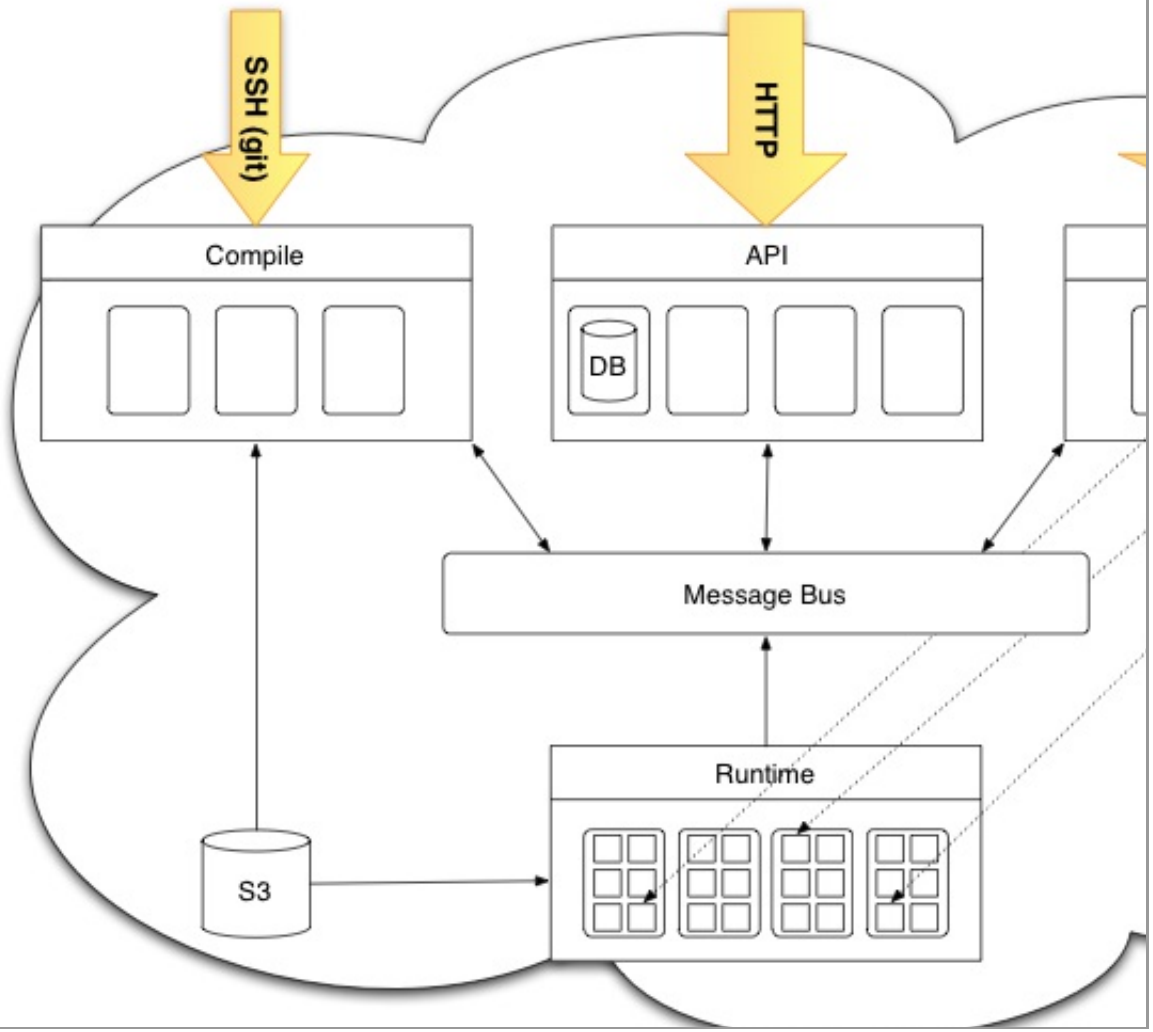
Heroku Self-Hosting: He

Database Cloud Built with Heroku A

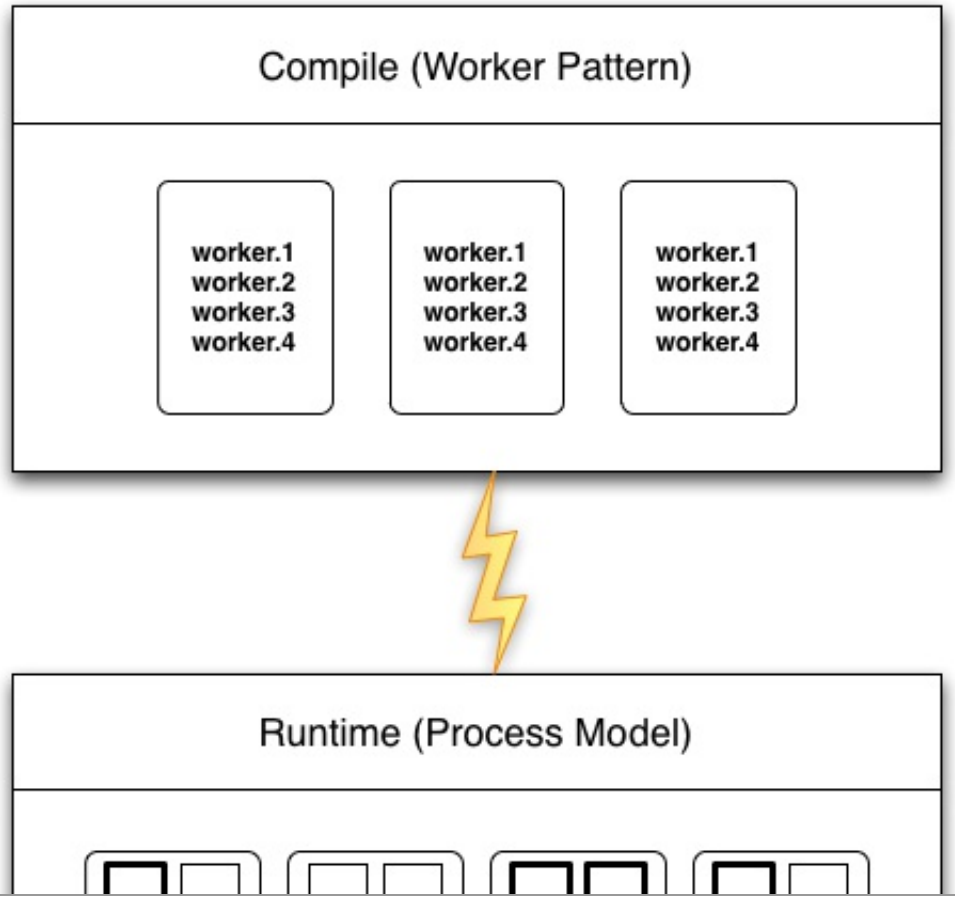
Shogun / PGBackups

Heroku Self-Hosting: Legendary?

Heroku Architectu



Self-Hosted Architecture



Motivations

Dogfooding

Efficiency

Separation of Concerns

Motivations

Effortless Scaling

Decrease Surface Area

Build/Compile Symmetry

Secure, Ephemeral Containers

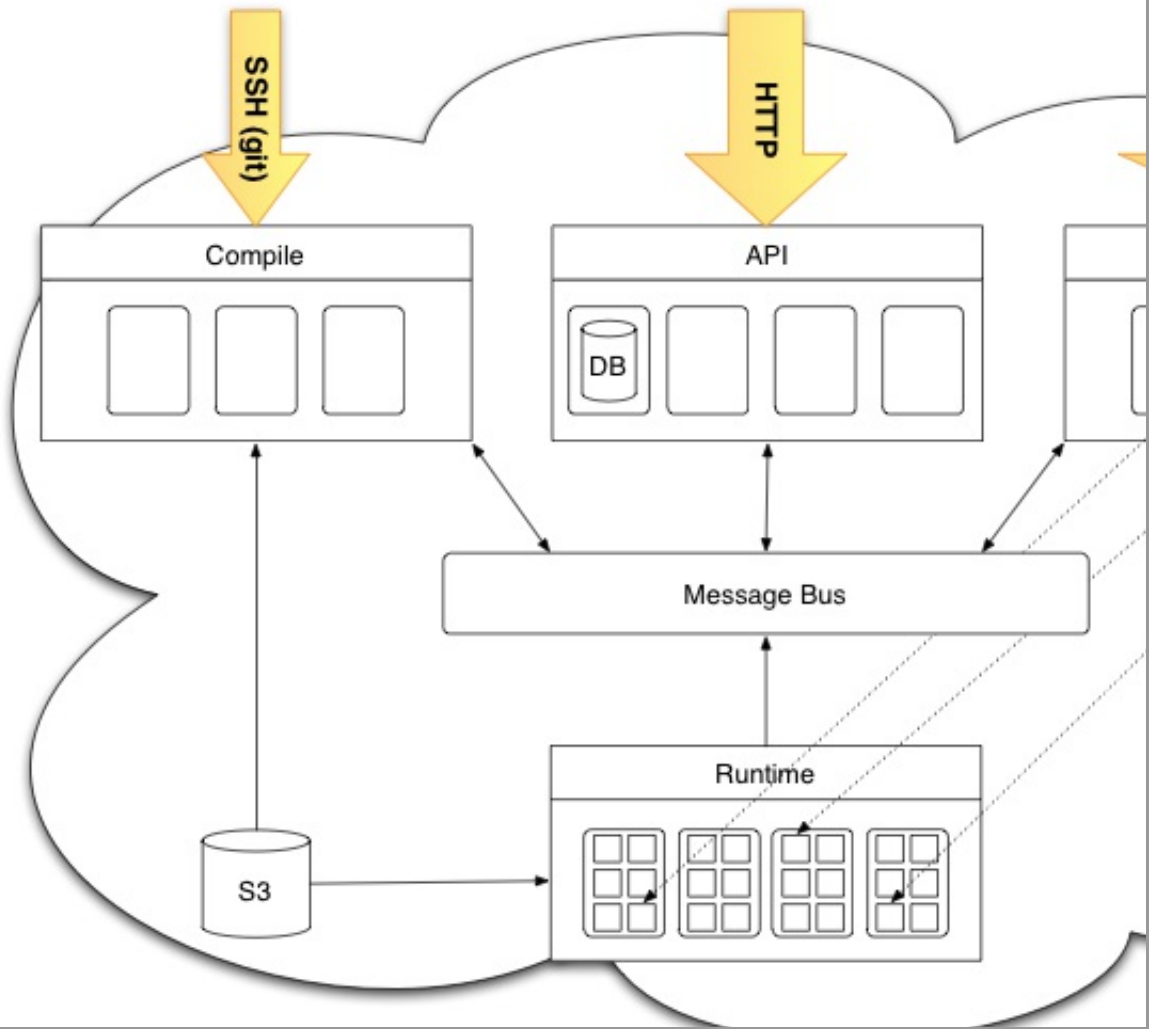
Demo: Slug Compile

Bundle Code for the Heroku Runtime

```
#!/usr/bin/env bash

SRC_DIR=1
TMP_DIR=$(mktemp -d /tmp/t.XXXXX)
BUILD_DIR=$TMP_DIR/app

trap "rm -rf $TMP_DIR" EXIT

# Copy src to build dir
bin/rsync -avz
  --exclude vendor/ --exclude .bundle/ --exclu
  $SRC_DIR $BUILD_DIR/ 2>&1 | log

# Bundle with a clean env
(
  export GEM_HOME=vendor/bundle/ruby/1.9.1
  export HOME=$BUILD_DIR
  export PATH=$GEM_HOME/bin:/usr/local/bin:/us

  gem install bundler --pre --no-rdoc --no-ri
  bundle install --without development:test --
)

[ $? -ne 0 ] && {
  echo Heroku push rejected, failed to compile
}

# Squash
```

```
$ heroku run bin/compile .
Running bin/compile . attached to terminal... up, run.13
-----> Heroku receiving push
-----> Ruby/Rack app detected
-----> Installing bundler using ruby 1.9.2p180 and gem 1
-----> Installing dependencies using Bundler version 1.1
       Running: bundle install --without development:tes
       Fetching dependency information from the API at h
       Installing addressable (2.2.6)
       Installing blankslate (2.1.2.4)
       Installing bluecloth (2.1.0) with native extensio
       Installing gli (1.3.3)
       Installing launchy (2.0.5)
       Installing mime-types (1.16)
       Installing rest-client (1.6.3)
       Installing term-ansicolor (1.0.6)
       Installing heroku (2.5.0)
       Installing json (1.6.0) with native extensions
       Installing kgio (2.0.0) with native extensions
       Installing nokogiri (1.5.0) with native extensior
       Installing parslet (1.2.1)
       Installing rack (1.3.2)
       Installing tilt (1.3.3)
       Installing sinatra (1.2.6)
       Installing showoff (0.7.0)
       Installing unicorn (3.0.0) with native extensions
       Using bundler (1.1.pre.9)
       Your bundle is complete! It was installed into ./
       Cleaning up the bundler cache
-----> Compiled slug is 13M
```

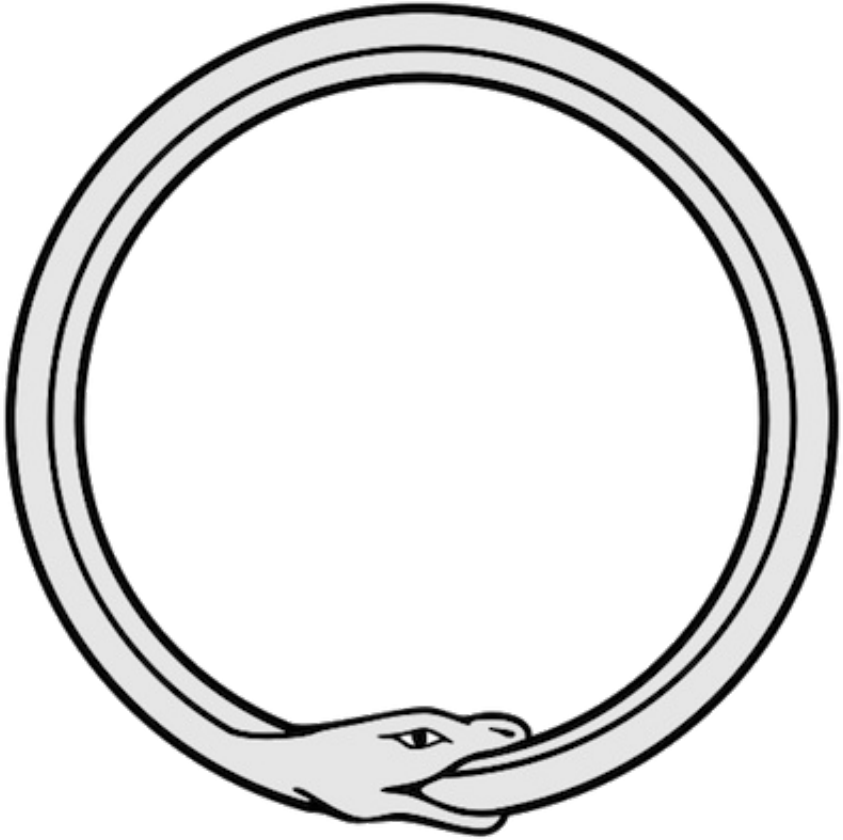
What Else?



Challenges

Circular Dependencies

CGFs



Questions?

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