

How This Presentation Was Made

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Presentations



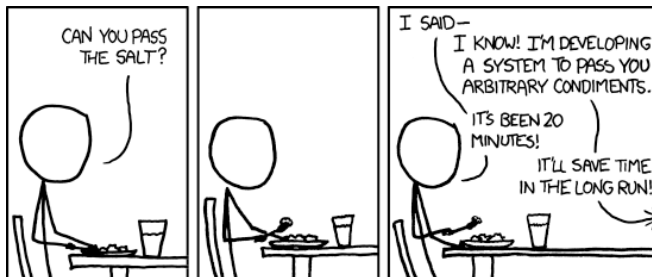
Some Problems

- powerpoint/keynote/google slides/...
- but you can't use git
- pandoc / LaTeX / ...
- how to include code and pictures?

How It All Started

- fighting with graphical editor instead of content
- so, switch to something that is text based
- but: how to handle generated pictures
- but: how to handle code

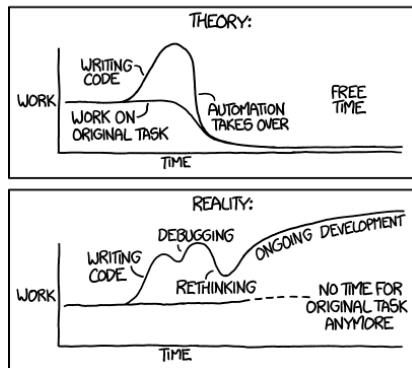
In A Nutshell



XKCD 974

In A Nutshell

"I SPEND A LOT OF TIME ON THIS TASK.
I SHOULD WRITE A PROGRAM AUTOMATING IT!"



XKCD 1319

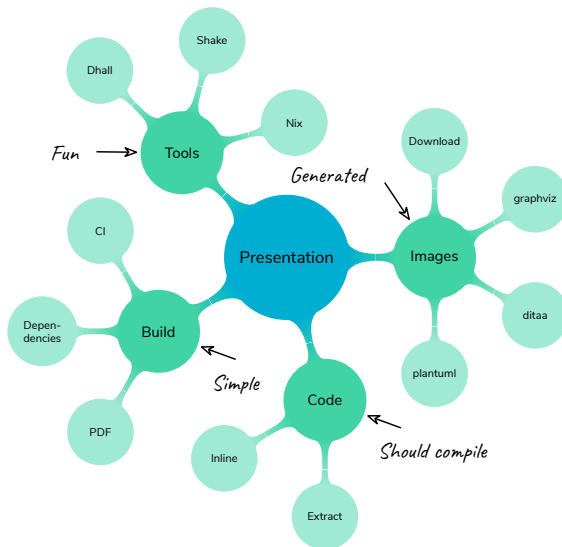
Used Tools Overview

- Nix for system dependencies + build env
- Shake to write a custom build system
- Dhall for “configuration”
- LaTeX for slides
- ditaa, graphviz

Wish List

- version control: use git to track changes
- reproducible: same description for CI and local machine
- single step: **one** command to build presentation
- declarative: generate from description
- checked: source code compiles
- minimal: only re-build what changed

Overview



Goal

- I love theoretical talks about concepts
- it's also fun to **reap some benefits**
- apply FP to your presentation
- as much as possible: description only + build

Tool: Shake

- shakebuild.com/manual
- Shake is a Haskell **library** for writing build systems
- “just” a library, rest is up to you
- Shake vs make is like Monad vs Applicative
- integrates well with other libraries and system tools

Shake — Usage

- specify rules to create output from some input
- avoid rebuilds of unchanged things
- call the shake build from your `main`

```
1  theMain :: IO ()
2  theMain =
3      shakeArgs
4          shakeOptions
5          (want [buildDir </> "slides.pdf"])
```

Shake Rules

```

1  -- +----- file pattern to match
2  -- |
3  -- |      +----- target path to create
4  -- |      |
5  -- v      v
6  pattern %> \out -> do
7      action1      -- <--\
8      action2      -- <---+- Actions to build 'out'
9      action3      -- <--/

```

Shake Rules

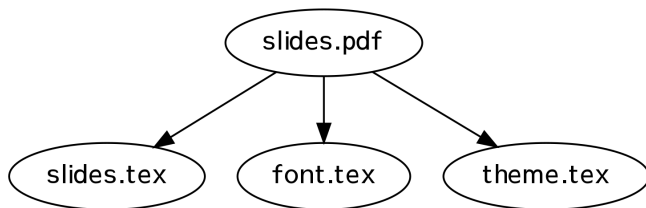
```
1  "*.txt" %> \out -> do
2    putNormal "Debug"
3    cmd "touch" [out]
```

Shake Rules

```
1  buildDir </> "slides.pdf" %> \out -> do
2    let inp = out -<.> "tex"
3    need (inp : includedFont : beamerThemes)
4    latexmk inp

1  latexmk :: FilePath -> Action ()
2  latexmk inp =
3    cmd
4      (Cwd (takeDirectory inp) : cmdOpts)
5      "latexmk"
6      [ "-g"
7        , "-shell-escape"
8        , "-pdfxe"
9        , dropDirectory1 inp
10      ]
```

Shake Rules



Shake

- general idea: express any dependencies via Shake rules
- let shake figure out what needs rebuilding
- ensures minimal rebuilds
- you don't have to worry

Shake

- quick status: use haskell library shake
- get a “build system” for your presentation
- next: source code

Editing Code

- Step 1: Implement your code in a normal project
- Step 2: Wild Copy And Paste Into Presentation
- Step 3: Reformat To Fit Slide
- Step 4: Change Original Source Code
- Step 5: Wild Editing Of Code on Slides
- Step 6: Notice something doesn't make sense

Extract Code

- totally broken: copy & paste
- little better: extract based on lines, still bad
- after edit / formatting / ...they change
- not what we want

Editing Code

- idea: extract source code directly from actual project
- use comments to delimit “snippets”
- write code to extract everything in between

Editing Code

- add comments in the code
- write a small “snippet” file
- let shake automatically extract snippets
- include code snippets in presentation

Annotating Code for Snippets (META)

```
1  --snippet:pdf rule
2  buildDir </> "slides.pdf" %> \out -> do
3    let inp = out -<.> "tex"
4    need (inp : includedFont : beamerThemes)
5    latexmk inp
6  --end:pdf rule
```

Intermezzo: Dhall

A configuration language guaranteed to terminate

- think: lambda calculus for config
- not turing-complete on purpose
- subset can be converted to JSON and YAML
- has **types**!!!11
- can be mapped directly into Haskell types

Dhall Example

```
1 { a =  
2   42  
3 , b =  
4   [] : Optional Natural  
5 , c = -- comments are possible  
6   { c1 = "foo" : Text, c2 = "bar", c3 = [ 1, 3, 3, 7 ] }  
7 }
```

Dhall Features

- booleans/integer/naturals
- optional values
- lists
- records
- functions
- strings + interpolation
- unions
- imports
- ...

Dhall To JSON

```
1  {  
2    "a": 42,  
3    "b": null,  
4    "c": {  
5      "c1": "foo",  
6      "c3": [  
7        1,  
8        3,  
9        3,  
10       7  
11     ],  
12     "c2": "bar"  
13   }  
14 }
```

Dhall To YAML

```
1  a: 42
2  b: null
3  c:
4    c1: foo
5    c3:
6      - 1
7      - 3
8      - 3
9      - 7
10   c2: bar
```

Snippet Files — Type

```
1 { snippetFile :  
2   Text  
3 , snippetStart :  
4   < Search : { term : Text } | End : {} | Start : {} >  
5 , snippetEnd :  
6   < Search : { term : Text } | End : {} | Start : {} >  
7 }
```

Snippet Files — Haskell

```
1  data SnippetSrc = SnippetSrc
2    { snippetFile :: Text
3      , snippetStart :: Addr
4      , snippetEnd :: Addr
5      } deriving (Show, D.Generic)
6
7  instance D.Interpret SnippetSrc
```

Snippet Files — Example

```
1  { snippetFile =  
2      "snippets/Snippet"  
3  , snippetStart =  
4      ./Addr .Start {=}  
5  , snippetEnd =  
6      ./Addr .End {=}  
7  }  
8  : ./Snippet
```

Snippet Files — Example

```
1  { snippetFile =  
2    "Build.hs"  
3  , snippetStart =  
4    ./Addr .Search { term = "--snippet:pdf rule" }  
5  , snippetEnd =  
6    ./Addr .Search { term = "--end:pdf rule" }  
7  }  
8  : ./Snippet
```


Snippet Files — Extraction

```
1  extractSnippet :: FilePath -> Action String
2  extractSnippet file = do
3      putQuiet ("Extracting from " <> file)
4      need [file]
5      SnippetSrc (T.unpack -> sourceFile) startSearch endSearch <
6      readDhall file
7      lns <- readFileLines sourceFile
8      let result = findSnippet startSearch endSearch lns
9      if null result
10         then error
11             ("Empty snippet for:\n" <> file <> ":0:")
12         else return (unlines result)
```

Extracting Code

- will always be up to date with the compiling source (yay)
- but we also have to format and maybe check again

Checking Code

- let's tackle checking first
- lots of times: broken code snippets that don't compile
- style errors you would notice in your actual setup
- after extracting a snippet into an includable file
- run linter/compiler/...
- fail building presentation if the command fails

Checking Code

- haskell with hindent + hlint
- scala with sbt and scalafmt
- actually any programming language and linter

Formatting Code

- just another step like linting
- run formatter of choice on the source file
- e.g. format to a width of 55 chars

Snippet Rule — Broken Formatting

```
1  --snippet:hs snippet rule
2  buildDir </> "snippets" </> "*.hs" %> \out -> do
3      snip <- extractSnippet (dropDirectory1 $ out -<.> "snippet")
4      withTempFile $ \temp -> do
5          liftIO (writeFile temp snip)
6          hlint temp
7          hindent temp
8          content <- liftIO (readFile temp)
9          writeFileChanged out content
10 --end
```

Snippet Rule — After Auto-Formatting

```
1  buildDir </> "snippets" </> "*.hs" %> \out -> do
2      snip <-
3          extractSnippet
4          (dropDirectory1 $ out -<.> "snippet")
5  withTempFile $ \temp -> do
6      liftIO (writeFile temp snip)
7      hlint temp
8      hindent temp
9      content <- liftIO (readFile temp)
10     writeFileChanged out content
```

Snippets — Summary

- automatic snippet extraction, robust
- snippets compile
- snippets are formatted
- no worries over broken code
- confidence in examples

Pictures

- scenario 1: search on the web and download
 - but you will forget from where
 - resize and rotate are manual steps
 - you have to store them in git
- scenario 2: generated from description
 - graphviz graphs
 - ditaa diagrams
 - plantuml diagrams
 - and more...

Downloading Pictures



Picture: me having to do too many manual steps

Downloading Pictures

- use Haskell and Shake to download on demand
- download of the file from the internet
- file that describes from where plus transformations
- transformations performed by imagemagick

Downloading Pictures



```
1  {  
2    url = "http://bit.ly/maintain-make-jpg",  
3    transformations = ["-resize 1101"]  
4  }
```

Downloading Pictures

```
1  [ buildDir </> "images/*" <.> ext
2  | ext <- ["jpg", "png", "gif"]
3  ] |%> \out -> do
4    let inp = dropDirectory1 $ out -<.> "src"
5    need [inp]
6    ImageSrc uri ts <- traced "image-src" (readDhall inp)
7    download downloadResource (TS.unpack uri) out
8    for_ ts $ unit . applyTransformation out
```

Generating Pictures

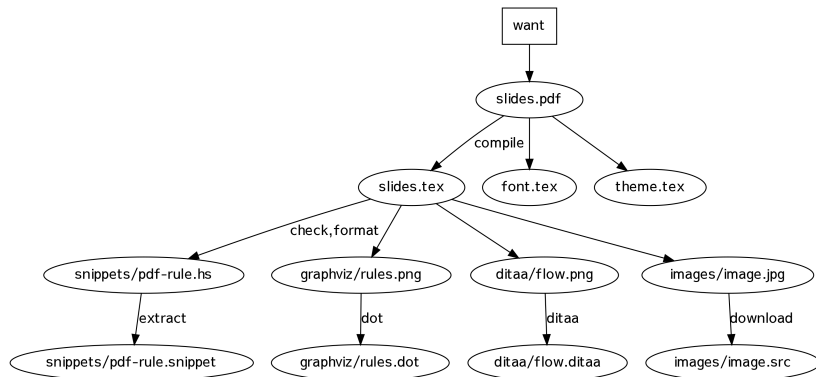
- second scenario: picture is generated
- there is a file that describes it + tool to render
- Steps:
 - write the description file
 - generate graphic
 - include in presentation
 - change description
 - generate graphic
 - include in presentation
 - change description again...

Shake It

- express the dependency as a shake rule

```
1 buildDir </> "graphviz/*.png" %> \out -> do
2   let inp = dropDirectory1 out -<.> "dot"
3   need [inp]
4   graphviz inp out
```

Everything As A Rule



Getting Dependencies

- the missing piece: how to “discover” dependencies?
- all of hackage is available
- parse LaTeX via HaTeX (this time)
- use the pandoc library
- ...whatever you need

Extraction from LaTeX

```
1  commandDeps ::
2      [String] -> FilePath -> Action [[FilePath]]
3  commandDeps cmds file = do
4      etex <- liftIO (parseLaTeXFile file)
5      case etex of
6          Left err ->
7              error
8                  ("Parsing of file " <> file <> " failed: " <>
9                     show err)
10         Right t -> do
11             let result =
12                 map (map T.unpack . mapMaybe cmdArgs . snd) .
13                 matchCommand (`elem` cmds) $
14                     t
15             return result
```

Develop Environment and CI

- we freely mixed stuff and used lots of tools
 - haskell + libraries
 - imagemagick
 - graphviz
 - ditaa
 - LaTeX plus packages and special font
 - scala, sbt, scalafmt

Travis

- let's get it working on travis
- (how hard can it be?!)

Continuous Integration via Travis

```
sudo: required
```

```
language: haskell
```

```
cache:
```

```
  directories:
```

```
    - ~/.stack
```

```
branches:
```

```
  except:
```

```
    - pdf
```

```
before_install:
```

```
  - wget -q -O- http://download.fpcomplete.com/ubuntu/fpc.key | sudo apt-key add -
```

```
  - echo 'deb http://download.fpcomplete.com/ubuntu/precise stable main' | sudo tee /etc/apt/sources.list.d/fpc
```

```
  - sudo apt-get update
```

```
  - sudo apt-get install -qq -y stack
```

```
  - stack --version
```

```
  - sudo apt-get install -qq -y texlive-base texlive-fonts-recommended texlive-latex-extra texlive-latex-recommen
```

```
  - latex --version
```

```
  - sudo apt-get install -qq -y python-pip
```

```
  - pip --version
```

```
  - wget 'http://downloads.typesafe.com/scala/2.11.7/scala-2.11.7.tgz' && tar xzf scala-2.11.7.tgz && export PAT
```

```
  - scala -version
```

```
  - sudo apt-get install -qq -y fort77 libblas3gf libblas-doc libblas-dev liblapack3gf liblapack-doc liblapack-d
```

```
  - sudo apt-get build-dep -qq -y r-base r-base-dev
```

Continuous Integration via Travis

```
- sudo apt-get build-dep -qq -y r-base r-base-dev

# May result in error during R ./configure
# checking whether mixed C/Fortran code can be run... configure: WARNING: cannot run mixed C/Fortran code
# configure: error: Maybe check LDFLAGS for paths to Fortran libraries?
- sudo mv /usr/lib/libf2c.so /usr/lib/libf2c.so_backup
- sudo ln -s /usr/lib/libf2c.a /usr/lib/libf2c.so

- wget 'https://cran.r-project.org/src/base/R-3/R-3.1.3.tar.gz' && tar xzf R-3.1.3.tar.gz
- (cd R-3.1.3 && ./configure --with-blas --with-lapack --prefix=/usr/local && make)
- export PATH="$(pwd)/R-3.1.3/bin:$PATH"
- R --version
- R --slave --no-save -f R/install-packages.R

- sudo pip install --upgrade pygments
- pygmentize -V

install:
- mkdir -p "$HOME/texmf/tex/latex"
- (cd "$HOME/texmf/tex/latex" && wget -O lineno.zip "http://mirrors.ctan.org/macros/latex/contrib/lineno.zip"
- texhash "$HOME/texmf"
- (cd "$HOME/texmf/tex/latex" && wget -O minted.zip "http://mirrors.ctan.org/macros/latex/contrib/minted.zip"

# setup $HOME/bin
- mkdir -p "$HOME/bin"
- export PATH="$HOME/bin:$PATH"

# install latexmk
- (mkdir -p "install-latexmk" &&
  cd "install-latexmk" &&
```

Continuous Integration via Travis

```
wget -O latexmk.zip "http://mirrors.ctan.org/support/latexmk.zip" &&
unzip latexmk.zip &&
cp latexmk/latexmk.pl "$HOME/bin/latexmk" &&
chmod +x "$HOME/bin/latexmk")
- latexmk -version

# install custom design and fonts
- wget -O some-design.zip 'http://some-custom-design_1.0.20140928.zip'
- unzip some-design -d "$HOME/"
- wget -O some-other-design.zip 'http://some-other-custom-design_0.0.20140703.zip'
- unzip some-other-design.zip -d "$HOME/"
- unzip some-fonts.zip -d "$HOME/"

- (wget -O excludeonly.zip "http://mirrors.ctan.org/macros/latex/contrib/excludeonly.zip" && unzip excludeonly
- (wget -O cleveref.zip "http://mirrors.ctan.org/macros/latex/contrib/cleveref.zip" && unzip cleveref.zip -d "
- (wget -O microtype.zip "http://mirrors.ctan.org/macros/latex/contrib/microtype.zip" && unzip microtype.zip -

- mkdir -p "$HOME/.texmf-var"
- mkdir -p "$HOME/.texmf-config/updmap.d"

- mv -v "$HOME/texmf/updmap.d" "$HOME/.texmf-config/"
- cat "$HOME/.texmf-config/updmap.d/20tex-fonts.cfg"
- sed -i -e '/DebianProvided/d' "$HOME/.texmf-config/updmap.d/20tex-fonts.cfg"
- texhash "$HOME/texmf"

- update-updmap || echo update-updmap failed
- updmap || echo updmap failed

# Diagnosis
- updmap --listmaps
```

Continuous Integration via Travis

```
- updmmap --listmaps | egrep "^Map[[:blank:]]*5" || echo nop
- kpsewhich --all updmmap.cfg

- stack setup
- stack build hlnt

script:
- stack build
- stack exec thesis

after_failure:
- ls -lha
- cat thesis.log
- cat thesis.blg
- cat presentation/final/final.log

after_success:
- git config --global user.email "travis-ci@travis.org"
- git config --global user.name "Travis CI"
- git checkout -b pdf
- git add -f thesis.pdf
- git add -f presentation/final/final.pdf
- git commit -m "$(date --iso-8601) @ $(git rev-list --max-count=1 --abbrev-commit $TRAVIS_BRANCH)" -m "[skip
- git tag -f -a -m "Compilation on $(date --iso-8601) of commit $(git rev-list --max-count=1 --abbrev-commit $
- git push --tags -f origin pdf
```


Continuous Integration Madness

- it's huge and a mess, good luck maintaining this
- OS specific, your own setup vs travis
- not reproducible at all
- very brittle

The One Command Lie

- you just have to run this **one** command
- it's mostly a lie
- with nix, you can actually achieve that!
- perfect: use it in “.travis.yml” as well as every pc

Nix

- <https://nixos.org/nix/>

Nix is a powerful package manager for Linux and other Unix systems that makes package management reliable and reproducible.

Continuous Integration Made Easy

```
1  language:
2    - nix
3
4  script:
5    - "./Build.hs"
```

Executing Our Shake Build

```
1  #! /usr/bin/env nix-shell
2  #! nix-shell shell.nix -i "runhaskell
   ↪  --ghc-arg=-threaded --ghc-arg=-Wall"
3  #! nix-shell --pure
```

The Nix File (Simplified)

```
1  with import <nixpkgs> {};
2
3  mkShell {
4    buildInputs = [
5      (texlive.combine {
6        inherit (texlive)
7          beamer;
8      })
9      pythonPackages.pygments
10     graphviz
11     imagemagick
12     (ghc.withPackages (p: with p; [shake dhall]))
13   ];
14 }
```

Only LaTeX

- all of this is not specific to LaTeX
- other: pandoc, reveal.js, ...
- e.g. download reveal.js automatically
- use pandoc to analyze the markdown

I Want To Use This

- github.com/markus1189/how-this-presentation
- you need Nix, but that's it

Thanks for your attention

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