The Library Infrastructure Project

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Our Thanks to $\lambda\mu$

- For the use of his lazer pointer
- Lambda's Namesake:

Overview & Goals

- “Languages flourish when libraries are plentiful, reliable, and well documented.” – SPJ
- Currently, there is no great way for tool authors to contribute and widely distribute their libraries and tools
- Except to have them included with the implementations.
- BUT... This is a strain on the implementation & library authors.
- Lets give library & tool authors a way to “contribute” their software

Issues Facing 3rd Party Tool Authors

- Difficult to distribute binary Haskell libraries
- ... so the end user must build (and rebuild) all the libraries on their own system
- ... but there is no standard build system
- ... all of which make it hard to build Debian packages (for instance)

...Issues Facing 3rd Party Tool Authors

- Several Haskell implementations which treat “packages” differently (different binary formats, different means of collecting packages)
- Language extensions and supporting libraries are a moving target (and oh, so tempting), causing the bitrot of tools that aren’t actively maintained
- No way to express dependency on particular libraries, compilers, or versions thereof (job of the packaging system?)
- No central repository for packages / libraries

Why Should We Solve This

Its all about the community...

- Help operating system packagers build packages (Debian, RPM, etc) to keep users happy
- Give library authors ways to contribute their libraries in a “Bazaar” style
- Help the community feel they “own” the open-source projects and give them a common set of tools to maintain them, as Debian does.
- In Debian, everyone knows how to: file bugs, download & build source, submit patches, announce new projects, ask for help maintaining tools, flame

What a Solution Might Look Like

- A nice build system with which a library author can build binary versions for a variety of architectures and implementations (in practice, this is a very large number of binaries)
- A repository where the author can announce or upload their tool

We're Already on Our Way

- Building
  - "FPTools" make-based system. Point of contact: Alastair Reid
  - Yale's make-based system. Point of contact: Henrik Nilsson
  - HMake Haskell-based system. Point of contact: Malcolm Wallace
- Announcing
  - Haskell mailing lists
  - The haskell.org web page and Wiki
- These are a big step forward! Keep up the good work!

A Haskell-Based System

I propose a Haskell-based build system which performs the following tasks:

- Compiles or prepares Haskell libraries and tools
  - By reusing code from hmake to build directly *or*
  - By calling through to a make-based system
- Installs Haskell libraries and tools
- Tracks metadata about installed packages and Haskell implementations (a new packaging system)

...A Haskell-Based System

Taking a page from Python's book, each distributed library or tool (except for the compilers) comes with a Haskell program, Setup.hs which provides standard targets to wrap other build systems, or builds the packages itself.

Why Haskell-Based?

- The one thing that all the systems of interest have in common: Haskell
- Side-effect of improving the libraries needed for common scripting tasks (lets steal some of the market from Python)
- Haskell beats Make for abstraction and reuse
- Reuse: Each piece of the project (Building, Installing, and Packaging) can be leveraged elsewhere if we make them into libraries
- “Eat your own dogfood” is a good policy

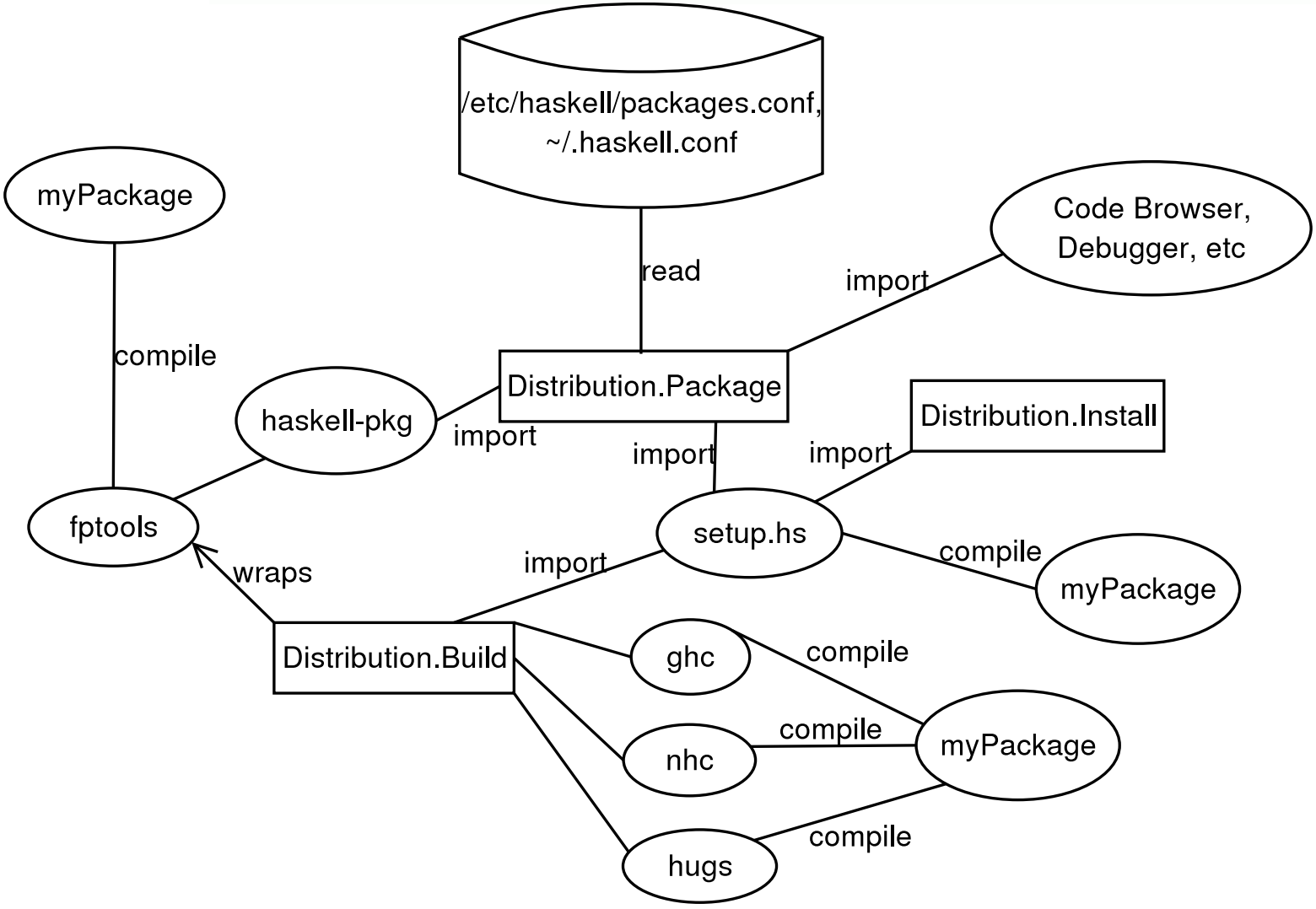
Outline

- Building: Strategies for build systems
- Installing: Setup.hs scripts to build and install Haskell libraries and Tools
- Packaging: How we can store and leverage what we know when we know it
- Tool Support: Tools which could be layered on top of a module

Module Hierarchy for Distribution

- Distribution.Build
  - dependencies :: [Package] -> Graph Packages
  - build :: Package -> Compiler -> IO ()
- Distribution.Package
  - data Package {...}
  - getSystemConfig :: IO SystemConfig
- Distribution.Installation
  - install :: Package -> Compiler -> IO ()
  - register :: Package -> IO ()
  - sourceDist :: Package -> IO ()
  - bdist_debian :: Package -> IO ()

System Overview



End of Overview

That is the end of the overview. At this point, I hope you understand:

- The motivation for this project
- Some implementation ideas for this project
- Who would use it and how

Building

Why building is hard:

- Several very different Haskell implementations
- A variety of operating systems and hardware architectures
- Lots of preprocessors and foreign libraries

Building: Basic strategy

- For simple tools like Haskell modules, leverage HMake's abilities and create a Haskell-based system (which may evolve to do more complex tasks.)
- Complex systems can use "fptools" or Yale's Make-based system, or their own build system.
- All systems will be wrapped in a common veneer (Haskell program) so they look the same to the average user, and to layered tools (like Debian).

Tasks for Distribution.Build

API For:

- Compiling for a particular Implementation (like hmake)
- Compiling for all installed implementations
- Abstracting some implementation-specific flags

Can be used for:

- Asking compilers to build Haskell code
- Dealing with some preprocessors
- Building higher-level tools on top (later slide)
- Recompiling when a new Implementation is installed
- Implementing a generic /usr/bin/haskell (like hi)

Installation

The main feature of the Installation Module is a script which imports Distribution.Build, and interfaces with the packaging mechanisms discussed below.

Setup.hs Strategies

- #!/usr/bin/env haskell (something haskell-interactive inspired?)
- Import Distribution.{Build,Install,Package} which can take care of major tasks
- main = distributionMain Package{...insert package meta info here...}
- Standard libraries may need richer OS operations
- ...but this is a good thing, it can help Haskell to get more market share in the scripting area

Command-line arguments

./Setup.hs

- install-{default,all,nhc,ghc,hugs}
- build-{default,all,nhc,ghc,hugs}
- bdist-{deb,rpm}
- sdist –makes a tarball on unix

Example Setup Program

```
#!/usr/bin/env haskell
import DistUtils.Core
import DistUtils.ToolInfo

toolInfo = (basicPackage (OtherTool "HUnit")
                         (Version 1 0 0))
   {haskellSources=[
    "HUnitLang98.lhs","HUnitLangExc.lhs",
    "Terminal.lhs", "HUnitTest98.lhs", ...],
    docs = ["Example.hs", "Guide.html", ...]}

main = distUtilsMain toolInfo
```

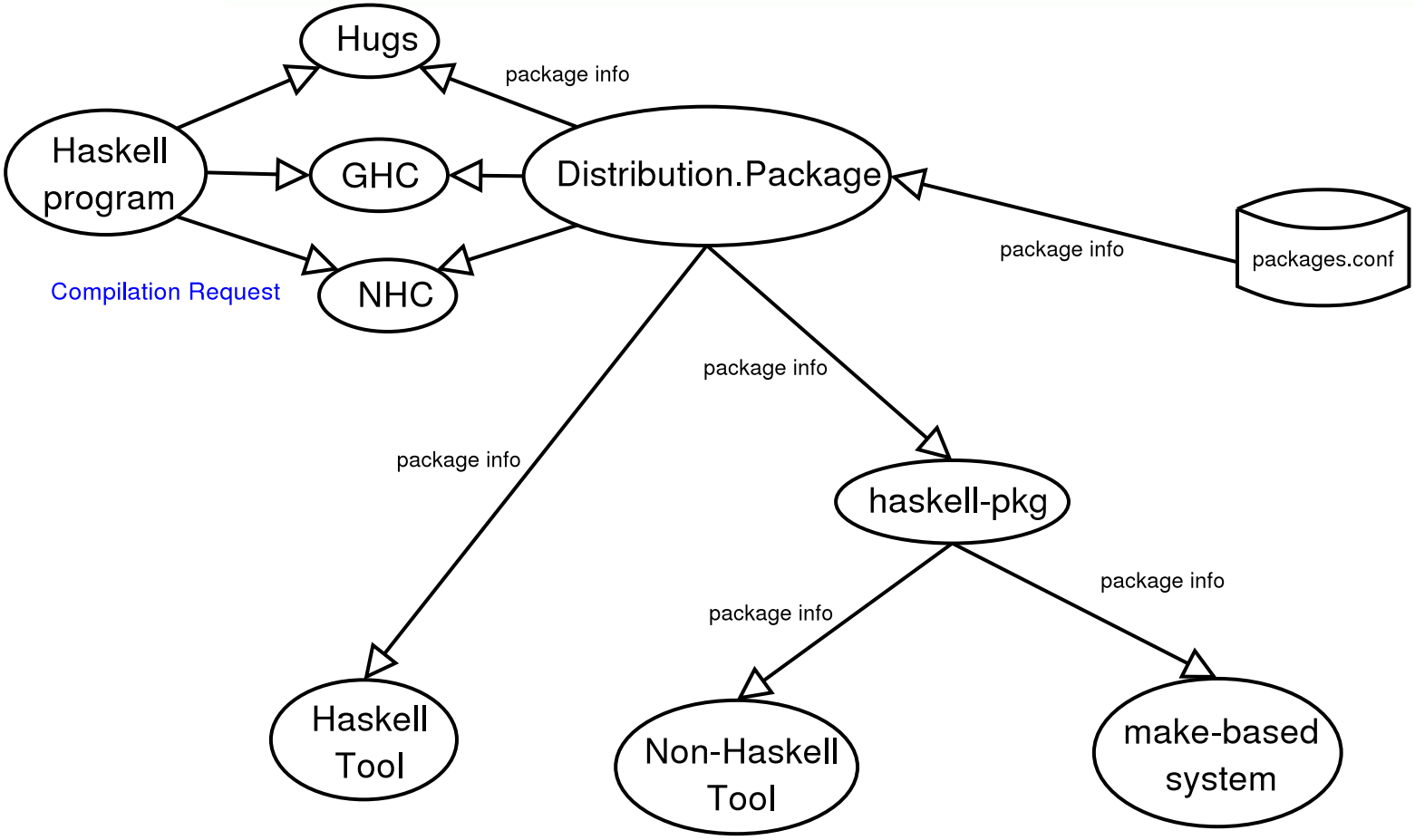
Packaging

Much of this becomes easier with a more generic package system, which has benefits outside of this project.

Jobs of a Packaging System

- Track which Haskell Implementations are installed
- Track which preprocessors are installed
- Track which libraries and tools are installed
- Find the source code for modules when needed

Packaging

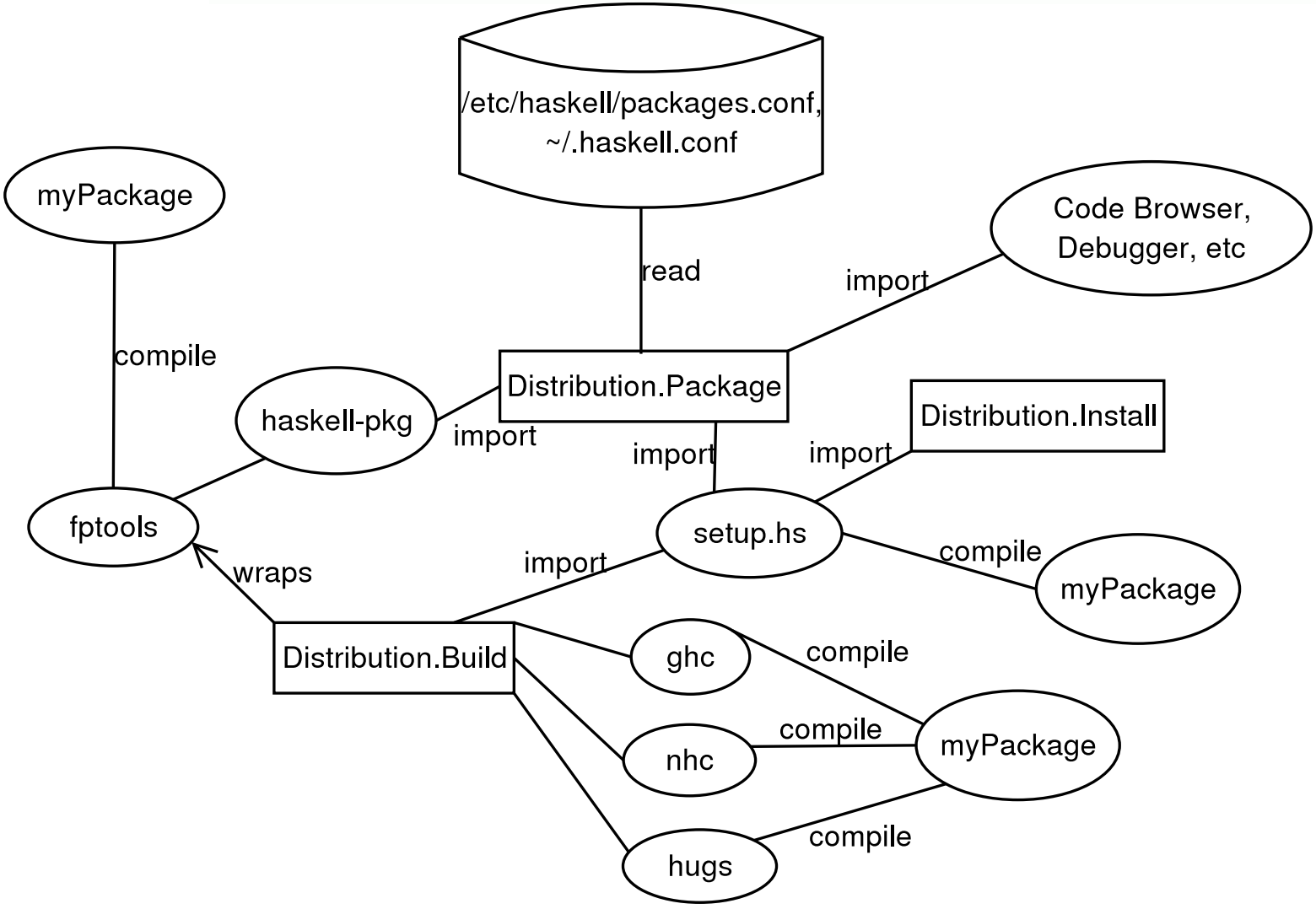

Hugs
package info
Haskell program
GHC
Distribution.Package
NHC
Compilation Request
package info
packages.conf
package info
package info
haskell-pkg
package info
package info
Haskell Tool
Non-Haskell Tool
make-based system

Package Meta Information

Think of debian/control combined with Package.conf

- *Things the build system cares about:* Source Files, Build Flags, Build Dependencies
- *Things the build system doesn't care about:* Name, Dependancies, Description, Version, License Information, Home Page

System Overview



Tools layered on Packaging System

- Build & Install system
- Debuggers which need to instrument code
- Source code browsers
- The Glorious Glasgow Haskell Compiler Source Code Deleter (find other versions of software and “repair” any possible type errors)

Layered Tools

- Creating distribution packages (Debian, FreeBSD, Windows, etc.)
- Web database of Haskell tools
- Installation (usually already there)
- Removal (often not there)
- Package registering and rebuilding
- Downloading and installing dependancies (job of parent system?)
- Verifying authenticity of packages (via cryptographic signature)

Conclusions & Directions

- I have implemented a prototype (which interfaces with Debian's build system), but its blocked on a packaging system
- After HIM I will write a new proposal and try to create consensus
- But where do you think I should direct my attention (make-based system? CPAN-type archive? Distribution module?)
- My opinion: Packaging decisions, then Distribution module

Discussion

(Assuming that we haven't run overtime and everyone is ready to go to lunch)