OCaml: State of the Platform 2014

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with a vast amount of help from INRIA, OCamlPro, Jane
Street, Citrix, and the wider OCaml community
Recap: a Platform

• Tooling that works together beyond just a language, into the full dev lifecycle.

• Quantitative metrics to judge if we are healthy or not.

• Agility to judge the impact of language changes quickly to keep moving.

Ultimate Goal: grow a sustainable open-source community
OPAM Releases: 2013

- OPAM 1.0 released in March 2013
- OPAM 1.1 final released October 2013
  - Solid bug fixing and improvement released based on *lots* of feedback.
  - Over 100 contributors, 500+ packages, 1500+ unique versions.
  - Migrating to opam.ocaml.org (CC0) as a community-maintained effort.
OPAM Releases: 2014

• Feb 2014: OPAM 1.1.1  (RM: Thomas Gazagnaire)
  Bugfixes, solver stability and better interface to superior external solvers from Mancoosi, library interfaces for repository tools.

• July 2014: OPAM 1.1.2  (RM: Louis Gesbert)
  Switch to Makefiles for easier integration into binary packages for OS distros.

• August 2014: OPAM 1.2.0  (RM: Louis Gesbert)
  The "Platform Release"

Since 1.1.0 (2013-11-07): 318 PR merged, 331 issues closed, 367 new issues
1.0.0 (2013-03-14): 133 PR merged, 273 issues closed, 305 new issues
Before 1.0.0 (2012-02-17): 116 PR merged, 357 issues closed, 402 new issues
• Solver errors are explained in plain English rather than boolean formulae.

```bash
$ opam install mirage-www=0.3.0

The following dependencies couldn't be met:
- mirage-www -> cstruct < 0.6.0
- mirage-www -> mirage-fs >= 0.4.0 -> cstruct >= 0.6.0
Your request can't be satisfied:
- Conflicting version constraints for cstruct
```
$ opam list --depends-on cow --rec

# Available packages recursively depending on cow.0.10.0 for 4.01.0:
cowabloga 0.0.7 Simple static blogging support.
iocaml 0.4.4 A webserver for iocaml-kernel and iocamljs-kernel.
mirage-www 1.2.0 Mirage website (written in Mirage)
opam2web 1.3.1 (pinned) A tool to generate a website from an OPAM repository
opium 0.9.1 Sinatra like web toolkit based on Async + Cohttp
stone 0.3.2 Simple static website generator, useful for a portfolio or documentation pages
OPAM 1.2 : Features

• Clone the source code and repo file for any OPAM package.

$ opam source cow

Downloading archive of cow.0.10.0...
[...]
$ cd cow.0.10.0
$ make

$ opam show cow --raw

opam-version: "1"
name: "cow"
version: "0.10.0"
[...]
OPAM 1.2 : Total Packages

Since 1.1.0 (2013-11-07): 1178 merges, 2981 total
1.0.0 (2013-03-14): 660 merges, 1775 total
Before 1.0.0 (2012-02-17): 547 merges, 1762 total
OPAM 1.2 : Contributors
OPAM 1.2 : Unique Packages
OPAM 1.2 : New Workflow

- Let's build a new package for a brand new ocp-reloc package.

```bash
$ cd ocp-reloc
$ opam pin add ocp-reloc .
```

http://opam.ocaml.org/blog/opam-1-2-pin/
OPAM 1.2 : New Workflow

- You will be prompted to create a new package from scratch with it pinned.

```
$ cd ocp-reloc
$ opam pin add ocp-reloc .
```

Package ocp-reloc does not exist, create as a NEW package ? [Y/n] y

ocp-reloc is now path-pinned to ~/src/ocp-reloc

http://opam.ocaml.org/blog/opam-1-2-pin/
OPAM 1.2: New Package

- An editor is brought up with a sensible base template.

```opam
opam-version: "1.2"
name: "ocp-reloc"
version: "0.1"
maintainer: "Louis Gesbert <louis.gesbert@ocamlpro.com>"
authors: "Louis Gesbert <louis.gesbert@ocamlpro.com>"
hompage: ""
bug-reports: ""
license: ""
build: [
  ['./configure' '--prefix=%{prefix}%'],
  [make]
]
install: [make "install"]
remove: ["ocamlfind" "remove" "ocp-reloc"]
depends: "ocamlfind" {build}
```

New metadata fields now available for future

Build and test only dependency predicates

http://opam.ocaml.org/blog/opam-1-2-pin/
OPAM 1.2 : New Workflow

• Like other Unix tools, you get interactive error checking.

[ERROR] File "/home/lg/.opam/4.01.0/overlay/ocp-reloc/opam", line 13, character 35-36: '.' is not a valid token.
Errors in /home/lg/.opam/4.01.0/overlay/ocp-reloc/opam, retry editing ? [Y/n]

http://opam.ocaml.org/blog/opam-1-2-pin/
OPAM 1.2 : New Workflow

• And any dependent packages automatically get upgraded.

ocp-reloc needs to be installed.
The following actions will be performed:
  - install cmdliner.0.9.5
    [required by ocp-reloc]
  - install ocp-reloc.0.1*

=== 1 to install ===
Do you want to continue ? [Y/n]

opam upgrade ocp-reloc

http://opam.ocaml.org/blog/opam-1-2-pin/
OPAM 1.2 : New Workflow

- Metadata maintained and detected from source repository directly.

```bash
cd ocp-reloc
git add opam
git commit -m 'Add OPAM metadata'
git push
```

- Other developers can pick up your development branches easily.

```bash
git clone git://github.com/OCamlPro/ocp-reloc.git
opam pin add ocp-reloc/
```

http://opam.ocaml.org/blog/opam-1-2-pin/
OPAM 1.2 : New Workflow

- Directly clone and pin development versions of existing packages.

```bash
$ opam source omd --pin
$ cd omd.0.9.7
...patch...
$ opam upgrade omd
```

- New dev-repo metadata lets you grab bleeding edge source.

```bash
$ opam source --dev-repo --pin
```

http://opam.ocaml.org/blog/opam-1-2-pin/
OCaml Platform
OCaml-OPAM Platform

Tools built around OPAM that provide a modular workflow for developing, publishing and maintaining OCaml source code, both online and offline.

Now with a blog at https://opam.ocaml.org
We want your articles!
OPAM 1.2: restructured

Data  Libs  Tools

opam-repository

OpamLib

opam
OPAM 1.2: restructured

Data  Libs  Tools

opam-publish

OpamLib

opam-repository

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opam
OPAM Publish

• Single step publication of new packages

• 1) opam-publish prepare

```
$ opam-publish prepare uucp.0.9.0 http://erratique.ch/software/uucp/releases/uucp-0.9.0.tbz
[uucp-0.9.0.tbz] Downloading http://erratique.ch/software/uucp/releases/uucp-0.9.0.tbz
Template metadata generated in uucp.0.9.0/.
* Check the 'opam' file
* Fill in or check the description of your package in 'descr'
* Check that there are no unneeded files under 'files/'
* Run 'opam publish submit ./uucp.0.9.0' to submit your package
```

• 2): opam-publish submit

```
$ opam-publish submit uucp.0.9.0/
[uucp-0.9.0.tbz] Downloading http://erratique.ch/software/uucp/releases/uucp-0.9.0.tbz
Please enter your github name: samohi
Enter host password for user 'samohi':
```

```
OPAM 1.2: restructured

Data    Libs    Tools

OpamLib

Opam-repository

opam

OpamLib

opam-publish

OpamLib
OPAM 1.2: restructured

Data  Libs  Tools

- opam-repository
- opam-published
- opam-doc
- xml-repository

OpamLib

To o l s

Opam

Libs

Data

OpamLib

opam-units
OPAM Documentation

• **Goal:** documentation unified *across* packages, that handles cross-referencing and module inclusion well.

• **Why it’s hard:**
  - not all packages can be installed simultaneously (solved via OPAM)
  - Resolving module inclusion statically leads to combinatorial explosion.
  - Need to integrate with the whole toolchain
• Use only the Typed AST (cmt, cmti)

• Comments are transformed into attributes in the typed AST.

• Attributes are used by external tools (to generate XML / HTML docs).

• Comment attributes can be generated by ppx preprocessors.

• Need to resolve OCaml names to linkable URIs (across universe of packages)

opam remote add platform git://github.com/ocaml/platform-dev
OPAM Documentation

preview: http://ocaml.github.io/platform-dev

ocaml.org integration

findlib packages

module docs
**OPAM Documentation**

preview: https://ocaml.github.io/platform-dev

```ocaml
type solution = (Cudf.package, ActionGraph.t) OpamTypes.gen_solution

type conflict
  Abstract type that may be returned in case of conflicts

val dependencies : Cudf.universe -> Cudf.package list -> Cudf.package list
  Return the transitive closure of dependencies of set, sorted in topological order

val reverse_dependencies : Cudf.universe -> Cudf.package list -> Cudf.package list
  Return the transitive closure of dependencies of set, sorted in topological order

val check_request : ?explain:bool -> version_map:int OpamPackage.Map.t -> Cudf.universe -> Cudf_types.vpkg OpamTypes.request -> (Cudf.universe, conflict)
  Check if a request is satisfiable and return the reasons why not unless explain is set to false

val get_final_universe : version_map:int OpamPackage.Map.t -> Cudf.universe -> Cudf_types.vpkg OpamTypes.request -> (Cudf.universe, conflict)
  Compute the final universe state using the external solver.

val actions_of_diff : Diff.universe -> Cudf.package OpamTypes.action list
  Compute the list of actions to match the difference between two universe. Remark: the result order is unspecified, i.e. need to use solution_of_actions to get a solution which respects the topological order induced by dependencies.

exception Cyclic_actions of Cudf.package OpamTypes.action list list

  Computes the actions to process from a solution, from the actions obtained by a simple universe diff. The 'simple' universe should not contain build dependencies and will be used for resolution; complete_universe should include build-deps, it's used for ordering of actions and, together with the requested set of package names, for computing the reasons of the actions.

  May raise Cyclic_actions.
```
OPAM Documentation

```bash
opam remote add platform git://github.com/ocaml/platform-dev
```

- **Current status:** working prototype. Need to improve the tooling, the style and polishing the integration

- **Timeline:**
  - **September:** online release, automatic builds triggered from GitHub pull requests.
  - **November:** use it locally in an OPAM switch (needs a patched OCaml compiler).
  - **December:** Build custom website for other repositories (Jane Street, Citrix, Mirage, my personal homepage, ...)
OPAM 1.2: restructured

Data  Libs  Tools

opam-repository

opam-publish
OpamLib

opam-doc
OpamLib
opam-units

xml-repository

opam2web
OpamLib

opam.ocaml.org

opam
OpamLib

OpamLib

Ocamlary
cow
OPAM 1.2: restructured

Data

Libs

Tools

platform-blog
ocaml.org
opam-wiki
opam-repository

OpamLib
opam-pUBLISH
OpamLib
opam-doc
OpamLib
opam-units
xml-repository

OpamLib
opam2web
OpamLib
OpamFu

opam.ocaml.org

ocamlary
cow
**Tooling: OCamlJS**

- Now supports complete compiler REPL in JavaScript with a IPython toplevel (source: Andrew Ray, uJamJar)

```bash
$ opam remote add andy-opam-dev git://github.com/andrewray/opam-dev.git
$ opam update
$ opam switch install 4.02.0+improved-errors
$ eval `opam config env`
$ opam pin add iocamljs-kernel \
   git://github.com/andrewray/iocamljs.git#improved-error
$ opam install iocaml

$ iocaml -js min my_notebook.ipynb
```

[https://andrewray.github.io/iocamljs/](https://andrewray.github.io/iocamljs/)
Tooling: GDB + types

```
$ gdb --args ocamlopt.opt -g -g-full -o test test.ml
GNU gdb (GDB) 7.6
Copyright (C) 2013 Free Software Foundation, Inc.
...
Reading symbols from ocamlopt.opt...done.
(gdb) break Selectgen.name_regs
Breakpoint 1 at 0x50dc40: file asmcomp/selectgen.ml, line 95.
(gdb) run
Starting program: ocamlopt.opt -g -g-full -o test test.ml

Breakpoint 1,
   Selectgen.name_regs (rv=\[\ldots\]) : Reg.t array, id=\{\ldots\} : Ident.t)
at asmcomp/selectgen.ml:95
95    let name_regs id rv =
(gdb) print rv
$1 = \[\ldots\] { raw_name = 0;
   stamp = 29;
   typ = Addr;
   loc = Unknown;
   spill = false;
   part = None;
   is_parameter = false;
   interf = \[\ldots\];
   prefer = \[\ldots\];
   degree = 0;
   spill_cost = 0;
   visited = false;
} : Reg.t |] : Reg.t array
(gdb)
```
OPAM 1.2 : Polish

• Easier to package and install.
  Seems minor, but is vital for upstream adoption in OS distros so OPAM is always available.

• Binary releases now available on:
  Debian/Ubuntu, RHEL/CentOS/Fedora, Arch, OpenSUSE, FreeBSD, OpenBSD, 0install.

• Documentation rewritten
  User-centric workflows instead of a flat feature list. More tips and tricks on new blog:
  http://opam.ocaml.org
Tooling: bulk builds

- **Docker + Xen**
  
  https://github.com/avsm/docker-opam
  
  Automate installing any OPAM package inside an isolated(ish) Linux container.

- **Parallel bulk builds of all packages**
  
  - Outputs tracked in Git so developers can checkout logs to triage failures
  
  - https://github.com/ocaml/opam-bulk-logs

- **Status:** adding auto-triage and keeping OCaml 4.03 running continuously instead of occasionally.
And just one more thing...
Assemblage ALPHA

- eDSL to describe OCaml projects
- Declarative approach: a project is a set of libraries and binaries, which are composed of compilation units.
- Use OCaml as an host language (with Merlin auto-completion)
- Introspect the project description to generate build rules (Makefile, ...)

Assemblage
open Assemblage

;/* OCamlfind packages */
let lib_pkgs = [
  pkg "opam-lib",
  pkg "opam-lib.client",
  pkg "compiler-libs.common",
  pkg "compiler-libs.optcomp",
  pkg "ocamlgraph",
  pkg "findlib",
  pkg
]

pkg

pkg_c

pkg_pp

;/* Compilation units */
let opamUnitsConfig = unit "opamUnitsConfig" ("Path ["src"])
let opamlibrary = unit "opamLibrary" ("Path ["src"])
let opamUnit = unit "opamUnit" ("Path ["src"])
let opamUnitsgetState = unit "opamUnitsgetState" ("Path ["src"])
let main = unit "main" ("Path ["src"])

;/* Binary and library */
let l = lib ~deps:lib_pkgs "opam-units" ("Units [opamLibrary; opamUnit; opamUnitsConfig; opamUnitsgetState]

let b = bin ~deps:(l ++ bin_pkgs) "opam-units" ("Units [main])

let () = assemble (project "opam-units" [b; l])
Assemblage

ALPHA

• Generate files to build, install, use a project

```
$ assemblage setup
  Loading
  opam-units b4b9c3
  → write Makefile
  → write META
  → write opam-units.install
  → write .merlin
```

• Timeline
  • today: alpha (use as your own risk)
  • end of september: beta-release
  • 1.0 release criteria: the Buzenzli test
Conclusions

• Platform is an ongoing effort to build a modular set of tools, libraries and data.

• OPAM provides the workflow interface to the package universe (e.g. Jun Furuse's Camlspotter can be integrated more easily!)

• Contributors extremely welcome:
  • Mailing List: platform@lists.ocaml.org
  • http://lists.ocaml.org/listinfo/platform