Mancoosi tools for the analysis and quality assurance of FOSS distributions

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Joint work with the Mancoosi team at Paris-Diderot

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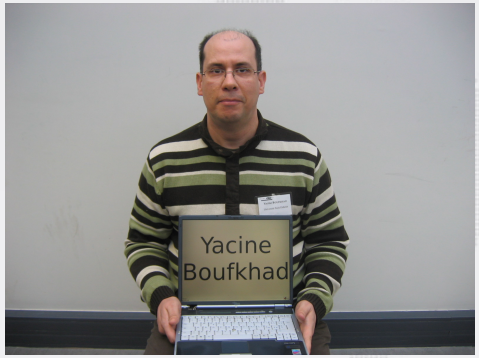

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Our (Paris-Diderot) focus in EDOS and Mancoosi

Meta-data of packages

- Core inter-package relationships :
  - Dependencies
  - Conflicts
  - Provides
- Optionally, less central relationships (recommends, etc.)

Global analysis

- Looking at a *complete distribution*
- E.g.: take into account dependency *chains*
- In contrast to looking checks (existence of mentioned packages)

Why is this interesting for FOSS distributions?

Dependency solving

- Which packages do I have to install/deinstall/upgrade in order to satisfy an installation request ?
- Important task of package managers
- One focus of the Mancoosi project (2008 – 2011)

Quality assurance

- Which packages in a distribution need care?
- Only judging from meta-data, but analysis all over the distribution
- One focus of the EDOS project (2004 – 2007)

Why is this interesting for scientists?

Software Engineering

- Component-Based Software Engineering
- FOSS distributions are (afaik) the largest existing component-based systems
- FOSS systems are available for everybody to scrutinize

Combinatorial Problem Solving

- These are very challenging problems:
- Even basic problems are NP-complete (in theory computationally unfeasible)
- Due to logical relations between packages: conjunctions, disjunctions, and conflicts (explicit or implicit).

Just one word about dependency solving

- We need dependency solvers for many different component models.
- There are many different promising techniques for combinatorial problem solving.
- We advocate a modular approach, using CUDF as an interface language
- MISC international competition for dependency solvers: talk to us when you are interested!!

At the beginning: a quite basic problem

- Given a repository R of packages and a package $p \in R$, is p installable w.r.t. R?
- That is: Does there exist $I \subseteq R$ such that
  - does the job: $p \in I$;
  - is *in peace*: no conflicts inside R;
  - is *abundant*: all dependencies in R satisfied.
- That means: installable in a completely empty environment.
- 2005: Tools `edos-debcheck` and `edos-rpmcheck`
- Very efficient, using SAT-solver technology, and caching of results obtained for various packages in the distribution.
- Time for a demonstration ...

Debian weather

- Running on `edos.debian.net` (today hosted by Mancoosi)
- Daily summary of uninstallable packages
- Differences between successive days
- Distinction between `arch=all` and arch-specific
- Date since when package uninstallable
- Explanation of uninstallability
- Demo ...

Usage of the Debian Weather in Debian

- Since Debconf 2010 (august 2010): bugs are filed against packages that are not installable, however only when
  - package reported as non-installable everywhere
  - uninstallable since some time ($\sim$ 1 month)
- List of reported bugs: See `edos.debian.net`

More uses of distcheck in debian

- `emdebian`: check installability of package before uploading new (versions of) packages to the archive
- Build-dependencies:
  - turn a build-dependency (conflict) into a normal dependency (conflict) of a dummy package
  - `edos-builddepcheck`: (currently) a wrapper that generates a new repository, then runs `edos-debcheck` on it
  - Used by debian autobuilders to avoid useless attempts to create build environments.

Detecting file conflicts

- Goal: detect cases where two packages can be installed at the same time, but doing so causes an error since one package tries to highjack a file owned by another package.
- Algorithm:
  - Look at the debian `Contents` file, compute all pairs of packages that contain a common file (debian sid: $\sim$ 1000 pairs)
  - Use `edos-debcheck` to select pairs that are installable together (debian sid: $\sim$ 170 pairs)
  - Test in a `chroot`

Statistics about detecting file conflicts

- Analysis done since april 2008, several times per week, on sid main+contrib+nonfree
- Bugs are reported with severity `serious`, against both packages (the debian BTS allows to file one bug against two packages)
- 290 Bugs found and reported (or simply reproduced)
- 286 of them are resolved. In most cases these bugs are closed very rapidly, however there are some hairy cases.
- See the list of bugs on `edos.debian.net`

From dose2 to dose3

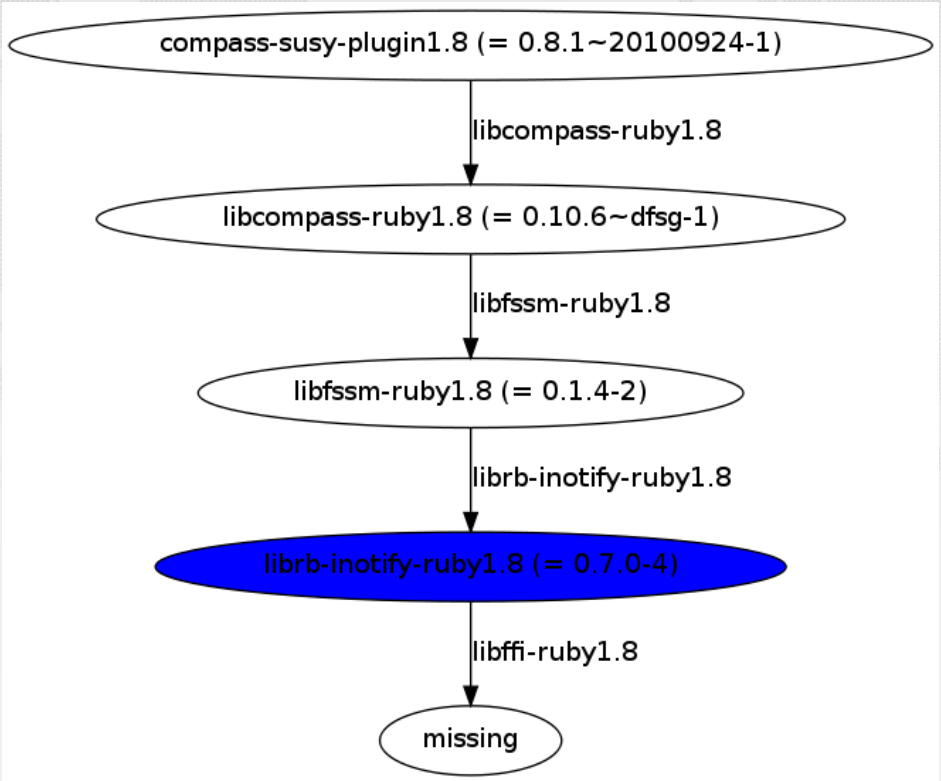
- dose2: library that contains the basic building blocks of edos-debcheck
- Problems with dose2:
  - Debian and rpm package formats hard-wired: not very easy to add new package formats
  - Preprocessing (like for build-dependencies) requires ugly and inefficient wrappers
  - Output format not easily parsable

New in dose3

- CUDF as an intermediate format: new component models can easily by added, by writing a translator to CUDF.
- The new design of the library makes it much easier to integrate various preprocessing tasks.
- New output format based on YAML: human readable and machine parsable.

Coming soon: weather.mancoosi.org

Graphical representation of dependency problems:



Predicting the future of a distribution (?)

Two different questions that we have worked on:

- If we upgrade a particular package p, what are the other packages that (in their current version) become uninstallable? These are the packages that will have to upgraded together with p
- If the current version of a package p is found uninstallable w.r.t. the current repository: can this be solved by upgrading *other* packages in the distribution? If not, that means that p has to upgraded!

And this is done with *distcheck* too!

What's the future of a distribution?

- New packages may be created
- Packages may be removed
- Infinitely many possible future versions of packages
- Future versions of packages may change their dependencies/conflicts in an arbitrary way

Relations of future versions of packages

- It is sufficient to consider futures where all new versions of packages have **no** dependencies.
- Justification : If I is an R-installation, and R' is obtained from R by removing dependency or conflict relations, then I is also an R'-installation.

A further problem: clustering

- In a distribution, binary packages do not evolve in isolation.
- They a updated in clusters that are identified by source packages.
- Consider only futures where all binary packages from the same source have moved together
- That deliberately ignores: auto-build failures, packages that change source
- Version numbers of packages with the same source may still have different version numbers: can be handled in restricted cases (binNMU, difference in epoch only)

Predicting the future

- Computing the consequences of updating on package: we have, for every relevant future of the package, run `distcheck` on that repository (takes around 10 hours)
- Analyzing which packages *must* be upgraded in order to become installable: we can just fold all relevant future versions of all package into one repository (sid: $\sim$ 70.000 packages), plus conflicts between packages of different version and the same source (takes about 1 minute)

Results: upgrading by cluster

Source	Version	Target Version	#(BP)
python-defaults	2.5.2-3	≥ 3	1079
python-defaults	2.5.2-3	$2.6 \leq . < 3$	1075
e2fsprogs	1.41.3-1	any	139
ghc6	6.8.2dfsg1-1	$\geq$ 6.8.2+	136
libio-compress-base-perl	2.012-1	$\geq$ 2.012.	80
libcompress-raw-zlib-perl	2.012-1	$\geq$ 2.012.	80
libio-compress-zlib-perl	2.012-1	$\geq$ 2.012.	79
icedove	2.0.0.19-1	$>$ 2.1-0	78
iceweasel	3.0.6-1	$>$ 3.1	70
haskell-mtl	1.1.0.0-2	$\geq$ 1.1.0.0+	48
sip4-qt3	4.7.6-1	$>$ 4.8	47
ghc6	6.8.2dfsg1-1	6.8.2dfsg1+ $\leq . <$ 6.8.2+	36

The Mancoosi Project

- Mancoosi: Managing the Complexity of the Open Source Infrastructure
- European Research Project in the 7th Framework
- Duration: Feb 2008 $\longrightarrow$ Jan 2011
- Successor of the EDOS European project (Jan 2004 $\longrightarrow$ Jun 2007)

Mancoosi Project Partners