News from EDOS: Finding Outdated Packages

Ralf Treinen

PPS, Université Paris Diderot

Debconf 12, July 14, 2012
Joint work with

Pietro Abate  Roberto Di Cosmo  Zack
Starting point: Edos-debcheck

- Find packages that are not installable
- by looking only at package relations (Depends, Conflicts, …)
- Use a complete solving algorithm (search through all possible alternatives)
- Edos-\{dist,deb,rpm\}check: fast implementation based on a SAT solver.
Let’s run distcheck on the Debian sid

<table>
<thead>
<tr>
<th>Date</th>
<th>amd64</th>
<th>armel</th>
<th>ia64</th>
<th>i386</th>
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<td>564 (352)</td>
<td>497 (236)</td>
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<td>+ 3 / -51</td>
<td>+ 2 / -58</td>
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<td>+ 3 / -0</td>
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<td>620 (343)</td>
<td>1377 (301)</td>
<td>421 (320)</td>
<td>880 (245)</td>
<td>845 (216)</td>
<td>571 (355)</td>
<td>559 (292)</td>
<td>569 (314)</td>
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</table>
Why are there so many not installable packages in sid?

Easy cases

1. Transient problems that go away when dependencies are built
2. Packages with Architecture=all that do not have their dependencies satisfied on all architectures.

Not so easy cases

3. Not p’s fault: the packages that p depends on must be fixed.
4. p’s fault: p has to fix its own dependencies/conflicts in the metadata of a package.

Goal

Distinguish (3) and (4): Who is to blame when a package is not installable?
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How to be sure when it is \( p \)'s fault?

**Idea**

When is it the fault of package \( p \) in version \( n \) that it is not installable in a repository \( R \)?

- if \((p, n)\) is not installable in \( R \), and
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- if \((p, n)\) is not installable in \( R \), and
- no matter how all the *other* packages evolve, if package \( p \) stays at version \( n \) then it will never be installable.

**Definition**

A package \((p, n)\) is *outdated* in a repository \( R \) iff \((p, n)\) is not installable in all possible futures of \( R \).
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A package $(p, n)$ is *outdated* in a repository $R$ iff $(p, n)$ is not installable in all possible futures of $R$. 
Example 1: Is \((\text{foo},1)\) installable?

**Package**: foo  
**Version**: 1  
**Depends**: baz \((= 2.5)\) \| bar \((= 2.3)\),  
bar \((> 2.6)\) \| baz \(< 2.3)\)

**Package**: bar  
**Version**: 2

**Package**: baz  
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Example 1: Is \((\text{foo}, 1)\) outdated?

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**Package:** bar  
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Example 2: Is (foo,1) outdated?

Package: foo
Version: 1
Depends: baz (\(= 2.5\)) | bar (\(= 2.3\)),
bar (\(> 2.6\)) | baz (\(< 2.3\))

Package: bar
Version: 2.3

Package: baz
Version: 2.5
Conflicts: bar (\(> 2.6\))
What are possible futures of \( R \)?

Possible Evolutions of a Repository

- Packages may be removed.
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### Possible Evolutions of a Repository

- Packages may be removed.
- Packages can move to newer versions.

ATM: packages evolve independently of each other.

Consequence

There are infinitely many possible futures.
What are possible futures of $R$?

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Futures: do we have to care about package removals?

Reasoning

If \((p, n)\) not installable in any future where we do not have removed packages, then \((p, n)\) not installable in any future.

Since: Package removal from the repository may not make stuff installable.

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If (p, n) is not installable in any future where new versions of packages have no depends/conflicts, then (p, n) is not installable in any future.

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Consequence

We may assume that all future versions of packages behave as nicely as possible: no dependencies, no conflicts.
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yes: introducing new packages may make stuff installable, but that may happen only if its name is mentioned in a dependency of an existing package.

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We only have to consider new packages that are mentioned in dependencies.
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What we have so far

When looking at all possible futures . . .

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Remaining problem

Infinitely many future versions of packages, hence infinitely many future repositories!
How to get finitely many versions

Example

We have package $p$ in version 5. Other packages have conflicts/dependencies on $p$:

$p(\leq 9), p(\neq 12)$
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Representative versions

- It is sufficient to consider all the versions that explicitly mentioned:
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- plus one between two versions, plus one that is greater than all
  $$5, 6, 9, 10, 12, 13$$
In the example:

- Conflicts/dependencies on $p$:
  
  $$p(\leq 9), p(\neq 12)$$

- Finitely many versions:
  
  $5, 6, 9, 10, 12, 13$
Further reduction: observational equivalence

In the example:

- Conflicts/dependencies on $p$:
  
  $p(\leq 9), p(\neq 12)$

- Finitely many versions:
  
  5, 6, 9, 10, 12, 13

Observational Equivalence

10 and 13 behave the same, as do 6 and 9:

  5, 9, 10, 12
Are we done, now?

In theory, yes

- We have a finite set (but huge) set $F$ of possible futures.
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**Idea**
- Put all present and future versions in *one big repository* $U$.
- Size: $2 \times 35,000$
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- There is one problem with that solution ...
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- Binary packages coming from the same source are synchronized!
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- When considering $U$: we have to exclude installations that mix binary packages coming from the same source but different version.

Solution: add (versioned!) provides and conflicts:

If $(p, n)$ has source $s$:

- Provides: src:s ($= n$)
- Conflicts: src:s ($\neq n$)

We do this only when packages of the same source currently have "similar" version numbers.

Finally: One single distcheck run on a large repository.
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Experiment: sid/main/i386 of 2011/10/06

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- 34444 binary packages
- Not installable: 431 packages
- After adding dummies: 82075 package
- Runs 1m41s
- Reports 119 outdated packages
What packages do we find?

- pkg: zhone-illume-glue
  version: 0-git20090610-7
  source: zhone (= 0-git20090610-7)

unsat-dependency: python (< 2.7)
Ignoring the python transition

Just add to the repository a dummy package

Package: python
Version: 2.6-1
Example: a very old python dependency

```
package: salome
version: 5.1.3-9
source: salome (= 5.1.3-9)
reasons:
  -
    missing:
      pkg:
        package: salome
        version: 5.1.3-9
        unsat-dependency: python (< 2.6)
```
Example: outdated dependency

package: asterisk-chan-capi
version: 1.1.5-1
source: asterisk-chan-capi (= 1.1.5-1)
reasons:
- missing:
  pkg:
    package: asterisk-chan-capi
    version: 1.1.5-1
    unsat-dependency: asterisk (< 1:1.8)
Example: needs binNMU

package: nitpic
version: 0.1-12
source: nitpic (= 0.1-12)
-
  missing:
    pkg:
      package: nitpic
      version: 0.1-12
      unsat-dependency: binutils (< 2.21.53.20110923)
Example: wrong dependencies

package: cyrus-admin-2.2
version: 2.4.12-1
source: cyrus-imapd-2.4 (= 2.4.12-1)
-
  conflict:
  pkg1:
    package: cyrus-admin-2.4
    version: 2.4.12-1
    source: cyrus-imapd-2.4 (= 2.4.12-1)
    unsat-conflict: cyrus-admin-2.2
  pkg2:
    package: cyrus-admin-2.2
    version: 2.4.12-1
    source: cyrus-imapd-2.4 (= 2.4.12-1)
  depchain1:
    package: cyrus-admin-2.2
    version: 2.4.12-1
    depends: cyrus-admin-2.4
EDOS, Mancoosi, Dose

- EDOS European project: Jan 2004 → Jun 2007
- Mancoosi European project: Feb 2008 → May 2011
- New implementation: dose
- This tool: debian package dose-outdated
- Also has a much improved debcheck: debian-package dose-distcheck
What remains to do

Better classification of results:
- Cruft (packages no longer built from source)
- Packages that just need a recompilation
- Packages that are involved in an official transition

Improve the analysis itself:
- A more precise model how packages may evolve?
- Improve explanations
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