Distributed versioning for everyone

Nicolas Pouillard

Nicolas.Pouillard@inria.fr

March 20, 2008
Outline

1 Introduction

2 Principles of Distributed Versioning

3 Darcs is one of them

4 Conclusion
SCM: “Source Code Manager”

- Keeps track of changes to source code so you can track down bugs and work collaboratively.
- Most famous example: CVS
- Numerous acronyms: RCS, SCM, VCS
- DSCM: Distributed Source Code Manager
Purpose

What’s the purpose of this presentation
- Show the importance of the distributed feature
- Enrich your toolbox with a DSCM
- Exorcize rumors about darcs
- Show how DSCM are adapted for personal use

What’s not the purpose of it
- A flame against other DSCMs
- A precise darcs tutorial
- A real explanation of the Theory of patches
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Distributed rather than centralized

**Centralized**

Examples: CVS, Subversion, Perforce

**Distributed**

Examples: darcs, Git, Bitkeeper, monotone, arch
Principles

Unify Repositories and Working copies
- Working copies with full history
- Repositories with local changes

Users record/commit in a local branch
- Local branches can be then merged with remote ones
- Branching/Merging is then **forced** to work
Local branches

Branching in a centralized system is morally flawed

- People use branches only when they must
- Branches are public (not discreet)
- That’s considered as an advanced usage

Distributed systems make them easy

- Offline commit (no need to be connected)
- Try out an idea (cheap and discreet)
- Polish your work / amend a patch
- Publish with a delay (e.g. end of the work-day)
DSCM are often lighter

- No server to setup
- Make a repository is as easy as ”darcs initialize”
- There is no need to ”wait for” a center
- No commit rights management needed
Distributed versioning for everyone

Principles of Distributed Versioning

DSCM for open source projects

Collaborating to an open source project

- Local branches is a "must have"
- Help to publish only clean and working changes
- Send your patches under your name

Work with user contributions

- Maintain an auto-gratification principle
- No need for commit rights (was really a pain)
- Commutation is essential
- Delaying user contributions if needed
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   - Darcs branching, merging, tagging
   - Darcs for working with others
   - Conflicts and concerns

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Why focusing on one of them

- Treat each system in details is too long
- Abstract over DSCM would be too obscure
- Darcs is conceptually simple
- Darcs is certainly the smarter of them
Ideas behind darcs

**Distributed**
- A simple “egalitarian” distributed model
- “Cherry picking” of changes
- Avoidance of “merge points” (no merge history)

**Interactive**
- Efficient and easy to learn
- Improved work flow (e.g. partial records, code review, ...)

**Smart**
- Based on a unique algebra of patches
- Spontaneous branches
- Commutation of changes
Distributed versioning for everyone

Darcs is one of them

Darcs overview

Change-based rather than version-based

Examples: Git, Bitkeeper, Monotone, CVS, Subversion

Examples: darcs
Darcs terminology

- A change is a logical entity
- A patch is a description of a change
- The state of a repository is defined by its set of changes
- A set of changes is stored as a sequence of patches

Notation

- A change is represented as a capital letter: $A$
- A patch is represented by a capital letter with possibly primes and/or a subscript: $A, A', A_1$
- Sometimes the state (or context) before and after a patch is represented by lowercase superscripts: $oA^a$
The state of a repository is defined by a set of changes.
The repository is represented by a sequence of patches.
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Some primitive patches

- **addfile** $f$: Create the empty file $f$
- **rmdir** $d$: Remove the empty directory $d$
- **move** $x$ $y$: Move/rename the file/directory $x$ into $y$
- **hunk**: Change the contents of a file
  
  ```hunk
  "foo.txt" 42
  - the old lines has been
  - removed.
  + and replaced by this one
  ```

However the theory is independent of its primitives
Each patch is invertible

**Definition**

$\text{invert} \circ A^a = a A^{-1} \circ$

**Property**

$\forall x. \text{invert} (\text{invert} x) = x$

**Examples**

- $\text{invert} (\text{addfile} f) = \text{rmfile} f$
- $\text{invert} (\text{move} x y) = \text{move} y x$
- $\text{invert} (\text{hunk} f \text{ line old new}) = \text{hunk} f \text{ line new old}$
- $\text{invert} (A :> B) = (\text{invert} B) :> (\text{invert} A)$

**Consequence:** While move is easy, copy hardly make sense
Independent changes ⇒ commuting patches

\[ o A^a B^b \leftrightarrow o B_1^c A_1^b \]

Examples

- Hunks on different files trivially commute
- Hunks commute with moves
- Hunks on different parts of a file commute (output patches have different line numbers)
Illustrated naive merging...
Distributed versioning for everyone
Darcs is one of them
Darcs Theory of patches
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Darcs for small projects

- A research paper
- A prototype implementation
- A small module/library
- Configuration files
- Personal web page
- More to imagine...
## The bare minimum

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<tr>
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<tbody>
<tr>
<td>initialize</td>
<td>Initialize a new source tree as a darcs repository</td>
</tr>
<tr>
<td>add</td>
<td>Add one or more new files or directories</td>
</tr>
<tr>
<td>record</td>
<td>Save local changes as a patch</td>
</tr>
<tr>
<td>mv</td>
<td>Move/rename one or more files or directories</td>
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<tr>
<td>whatsnew</td>
<td>Display local/unrecorded changes</td>
</tr>
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Handy operations

- **revert**: Revert to the recorded version (not always doable)
- **unrevert**: Undo last revert (unless if changes after the revert)
- **rollback**: Record a new patch reversing some changes
Handy operations

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revert ; unrevert $\approx$ id
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darcs

- amend-record ≈ unrecord ; record
- obliterate  ≈ unrecord ; revert
Towards advanced patch types

replace  Replace a token with a new value for that token
## Looking in the past

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<td><code>changes</code></td>
<td>Give a summary of the repository history</td>
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<td><code>annotate</code></td>
<td>Display which patch last modified something</td>
</tr>
<tr>
<td><code>diff</code></td>
<td>Create a diff between versions of the repository</td>
</tr>
<tr>
<td><code>dist</code></td>
<td>Create a distribution tarball</td>
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<tr>
<td><code>trackdown</code></td>
<td>Locate the most recent version lacking an error</td>
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<td><code>show</code></td>
<td>Show information which is stored by darcs</td>
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- get $src$ $dst$ ≈ initialize $src$ ; cd $src$ && pull $dst$
- put $dst$ ≈ initialize $dst$ ; push $dst$
- push $dst$ ≈ send $dst$ ; cd $dst$ && apply
Branching and merging

Branching is as easy as copying all patches

$ darcs get foo-stable foo-with-feature-A

Merging is as easy as \{pull,push\}ing things

$ cd foo-with-feature-A
$ darcs pull ../foo-stable
Tagging your repository (darcs tag)

A "tag" patch is:

- A change with no effect
- Transitiveely depends on all patches
- Really depends only on non tagged patches

Tagging quite often is a good practice

- Tag (some/only) versions that pass all tests
- Tag pre-releases and releases

Drawback of tagging

Freeze commutations (patches under a tag cannot cross the tag)
Distributed versioning for everyone
Darcs is one of them
Darcs branching, merging, tagging

darcs + tagging like crazy \( \approx \) git

\[
\text{\$ git commit} = \text{darcs record ; darcs tag -m <SHA1>}
\]

- Enforce the history
- Enforce the order of patches
- Loose commutativity (manually hacked with git rebase)
Fancy features

- Take the union: pull another repository
- Extract a sub part: pull interactively only what's needed
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Working with others

- Just replace pathnames by URLs (http, ssh)
- Use send/apply for email based contributions
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When conflicts happen

### Two patches conflicts
- They are parallel patches ($A \lor B$)
- They don’t commute ($A B^{-1} \leftrightarrow B' A'^{-1}$)

### Conflict example

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<thead>
<tr>
<th>Hunk</th>
<th>Line</th>
<th>Original</th>
<th>Modified</th>
</tr>
</thead>
<tbody>
<tr>
<td>foo.txt</td>
<td>42</td>
<td>- # TODO</td>
<td>+ # FIXED</td>
</tr>
<tr>
<td>foo.txt</td>
<td>42</td>
<td>- # TODO</td>
<td>+ # DONE</td>
</tr>
</tbody>
</table>
Resolving conflicts

- When two patches conflicts one add a third one
- By depending on the conflicting patches it tells what to do
- Resolutions patches should be shared as much as possible
Avoiding conflicts

Typical DVCS usage

Recipe
- Pull often
- Amend local patches to resolve conflicts
- Push/send clean patches
Is darcs slow?

- Performances are due to its algorithms not its implementation
- Darcs algorithms provide more power/flexibility
- Completely usable for day to day commands
- Can be really slow on hard requests
- Darcs2 has made great progress
- Darcs2 reports progress to the user
- Darcs2 handles the conflict resolution problem
Are DSCM slow or greedy?

- Full history means bigger/slower copies/gets
- Hard links in the repository
- More network friendly than CVS/SVN
- Darcs2 partial repositories could help
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Conclusion and questions

So, convinced?
Resources

- "The Monad Reader", issue 9 by Jason Dagit
- "Implementing the darcs patch formalism ...and verifying it" by David Roundy
- The darcs website http://darcs.net
- The darcs help