Version Control

Lecture 7

Administrivia

- In order to do the homework and turn in the project, you *must* have registered your team. Do so today!
- Homework #2 handed out today on-line. Due next Monday.
- Programming contest 30 September (Sat).

The Problem

- Software projects can be large and complex.
- May involve many people, geographically distributed
- May require maintenance of several related versions
  - MacOS vs. Windows vs. GNU Linux
  - Stable release vs. beta release of next version
  - Commericial vs. non-commercial
- May require prototyping potential features while still maintaining existing ones.

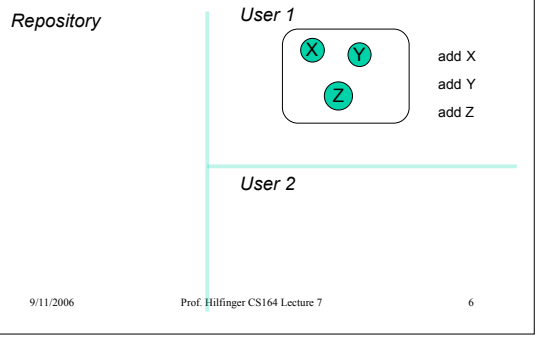
Version-Control Systems

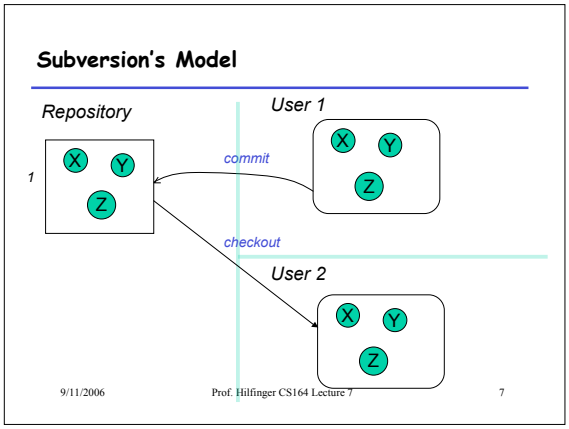
- Version-control systems attempt to address these and related problems.
- Allow maintenance and archiving of multiple versions of a piece of software:
  - Saving complete copies of source code
  - Comparing versions
  - Merging changes in several versions
  - Tracking changes

Subversion

- Subversion is an open-source version-control system.
- Successor to CVS
- Provides a simple model: numbered snapshots of directory structures
- Handles local or remote repositories

Subversion's Model




Subversion's Model
Repository
User 1
commit
checkout
User 2
1
X
Y
Z
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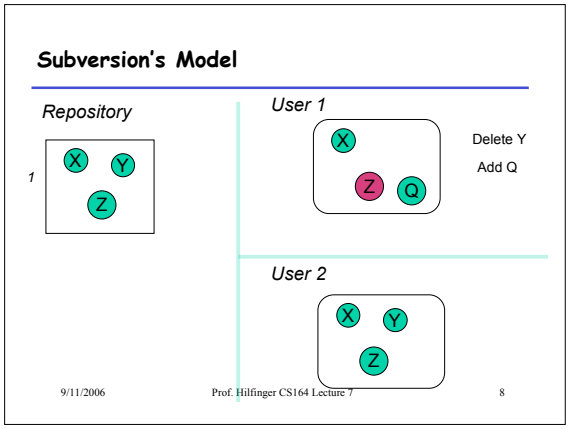
7


Subversion's Model
Repository
User 1
Delete Y
Add Q
User 2
1
X
Y
Z
Q
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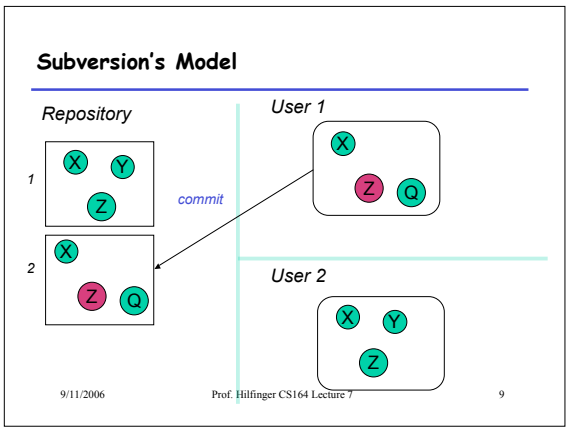
8


Subversion's Model
Repository
User 1
commit
User 2
1
2
X
Y
Z
Q
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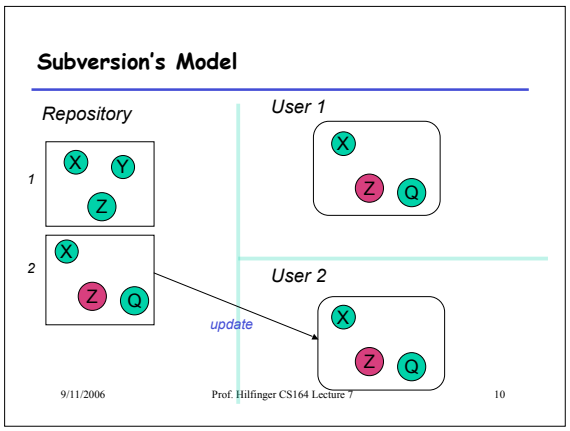
9


Subversion's Model
Repository
User 1
update
User 2
1
2
X
Y
Z
Q
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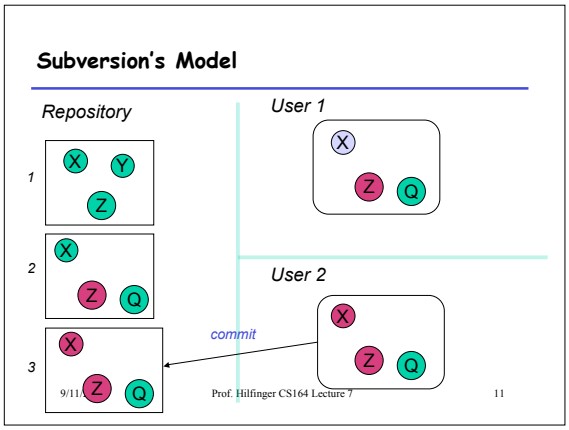
10


Subversion's Model
Repository
User 1
commit
User 2
1
2
3
X
Y
Z
Q
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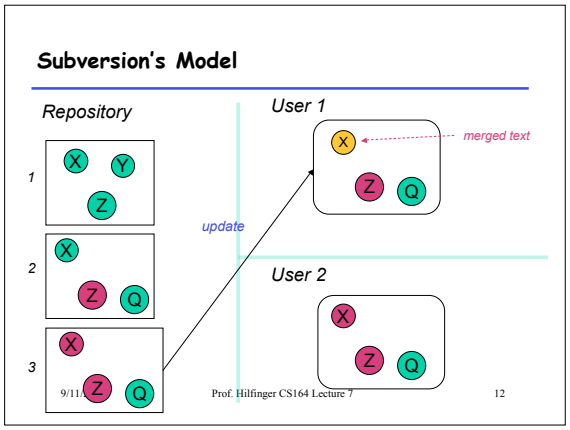
11


Subversion's Model
Repository
User 1
merged text
update
User 2
1
2
3
X
Y
Z
Q
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12

Terminology

- Repository: Set of versions
- Revision: A snapshot of a particular directory of files
- Revision number: A sequence number denoting a particular revision
- Working copy: A directory or file initially copied from a revision + administrative data

A Useful Property

- In the previous example, Subversion does not really keep 3 complete copies of the files.
- Instead, it maintains *differences* between versions: if you change little, your revision takes up little space.
- Copying an entire file or directory in the repository is very cheap
  - "Directory foo in revision 110 is the same as directory bar in revision 109"

Some Basic Commands

- We'll be using "ssh tunnels" to access our Subversion repositories.
- We created an ssh key pair for you when you first logged in.
- In the following, we consider login cs164-xx and team Ursa; we'll use nova as a convenient host.

Creating a working copy of a repository

- To get the latest revision:

  svn checkout svn+ssh:cs61b-tb@nova/Ursa
- Or just one directory:

  svn checkout svn+ssh:cs61b-tb@nova/Ursa/project
- A particular revision:

  svn checkout -r100 svn+ssh:cs61b-tb@nova/Ursa
- Symbolic revisions:

  svn checkout -rHEAD svn+ssh:cs61b-tb@nova/Ursa

Add, Delete, Rename Files, Directories

- When you add or remove a file or directory in a working copy, must inform Subversion of the fact:
  - svn add *NEW-FILE*
  - svn delete OLD-FILE-OR-DIR
  - svn move OLD-PLACE NEW-PLACE
- These forms *don't* change the repository.
- Must commit changes

Committing Changes

- The command

  svn commit -m "Log message"

  in a working directory will create a new revision in the repository
- New revision differs from previous in the contents of the current directory, which may only be part of the whole tree.
- Message should be informative. Can arrange to use your favorite editor to compose it

Updating

- To get versions of files from most recent revision, do this in directory you want updated

  svn update
- This will report files Subversion changes, adds, deletes, or *merges*
- Merged files are those modified both by you and (independently) in the repository since you updated/checked out.

Merges and Conflicts

- Reports of changes look like this:

  U foo1 foo1 is *updated*

  A foo2 foo2 is new

  D foo3 foo3 was deleted

  R foo4 foo4 was deleted, then re-add

  G foo5 foo5 had mods from you and in repository that did not overlap

  C foo6 Conflicts: overlapping changes

Notating Conflicts

- When you have a conflict, you'll find that the resulting file contains *both* overlapping changes:

  <<<<<<<<< .mine

  My change

  ========

  Repository change

  >>>>>>>>>> .r 99 (gives revision #)

Resolving Conflicts

- You can either choose to go with the repository version of conflicted file, or yours, or do a custom edit.
- Subversion keeps around your version and the repository version in foo6.mine, foo6.99
- Personally, I usually just edit the file.
- When conflicts are resolved, use

  svn resolved foo6

  to indicate resolution; then commit.

Branches and Tags

- Suppose Bob wants to make some changes to his project, checking in intermediate steps, but without interfering with partner Mary.
- Good practice is to create a *branch*, a copy of the project files independent of the trunk.
- Copy command does it:

  cd TeamMaryAndBob/project

  svn copy trunk branches/Bobs-branch

  svn commit -m "Create Bob's branch"

  cd branches/Bobs-branch

  and go to work.

Branches and Tags

- The use of the branches directory is convention; could put it anywhere.
- Again, this copy is cheap in the repository.
- Bob's changes in branches/Bobs-branch are completely independent of the trunk.
- Rather elegant idea: no new mechanism!

Tags

- A *tag* is the same as a branch, except that (by convention) we don't usually modify it once it is created.
- Conventional to put it in the tags subdirectory, as in the instructions for turning in your project.
- Tags are usually intended as names of particular snapshots of the trunk or some branch (e.g., a release).

Comparing Revisions

- One great feature: ability to compare versions, branches.
- Simple case: what local changes have I made to this working directory?

  svn diff
- How does this working directory compare to revision 9?

  svn diff -r 9
- How do revisions 9 and 10 of directory differ?

  svn diff -r 9:10

More Comparisons

- I'm in branches/Bobs-branch. How does it compare to revision 100 of the trunk?

  svn diff --old ../../trunk@100 --new .

Merging

- To *merge* changes between two revisions, *R1* and *R2*, of a file or directory into a working copy means to get the changes that occurred between *R1* and *R2* and make the same changes to the the working copy.
- To merge changes into current working copy:

  svn merge SOURCE1@REV1 SOURCE2@REV2

  where SOURCE1 and SOURCE2 are URLs (svn+ssh:…) or working directories and REV1, REV2 are revision numbers.

More Merging

- For short, when sources the same:

  svn -r REV1:REV2 SOURCE
- To merge in changes that happened between two tagged revisions:

  svn tags/v1@HEAD tags/v2@HEAD\
  branches/Bobs-branch
- Here we assume we are in project directory

After Merging

- After merging, as for update, must resolve any conflicts.
- Then we commit the merged version.