# CSE 303
# Concepts and Tools for Software Development

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Winter 2010
Lecture 11 – Tools: Version control

# Version Control Systems: Motivation

- Alice, Bob, and Chuck are working on a large software system
  - Where should they keep their source code?
  - What if they want to work on their laptops? from home? disconnected from the network?
  - How should they manage concurrent modifications?
  - What if Bob needs to keep the code stable to give a demo while Chuck would like to try a new idea?
  - What if Chuck tries his new idea and breaks the code the day of the demo?

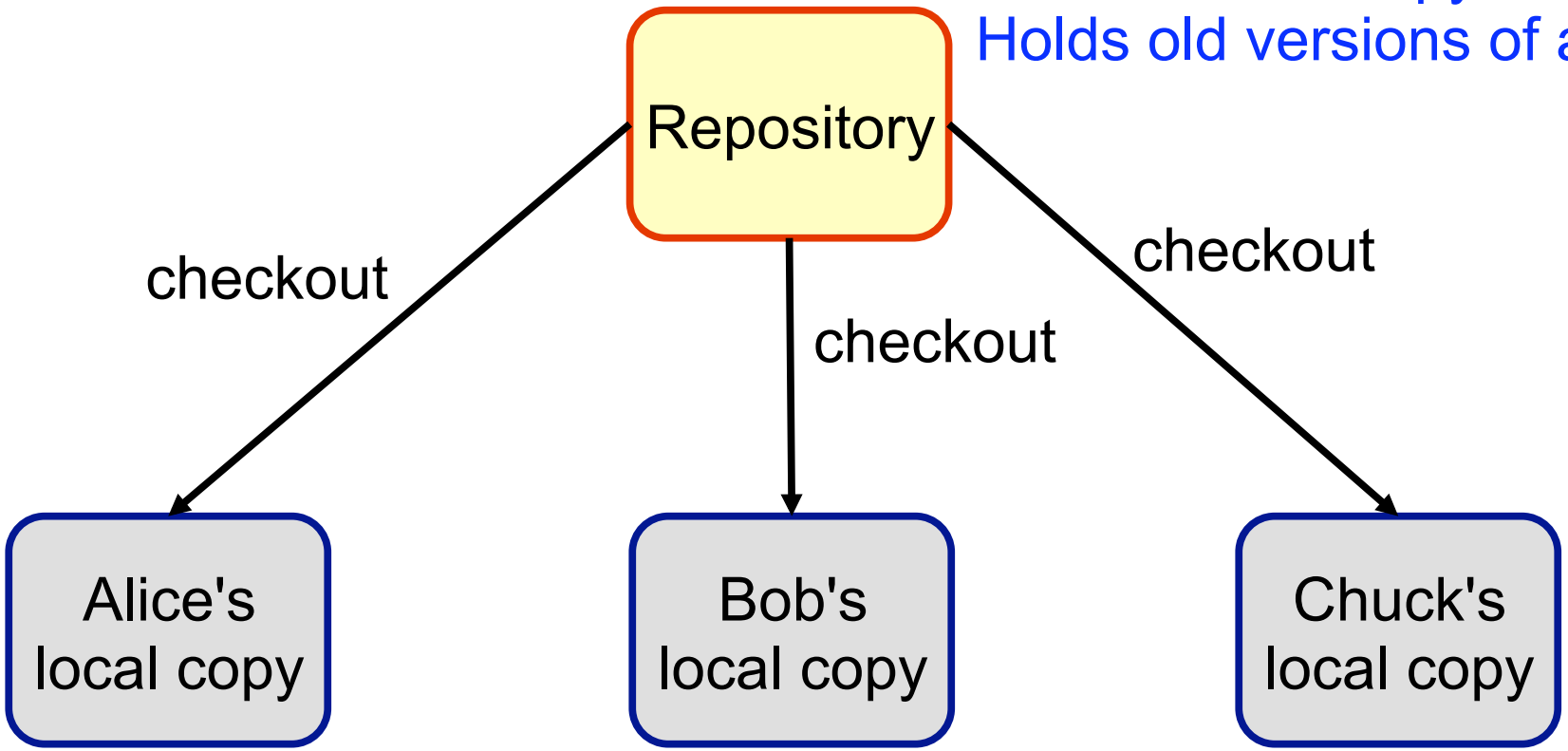
Solution: Use a version control system!

# Version Control System

- Goal of a version control system
  - Handle simultaneous concurrent changes
  - Manage multiple versions of a system
- Can manage any files, not just source code
  - I use it for everything... including course materials
- Many version control systems exist
  - CVS, RCS, **Subversion**, SourceSafe, ClearCase
- Just like any other tool that we study
  - All these tools have similar goals and similar basic features (but different ways to use these features)

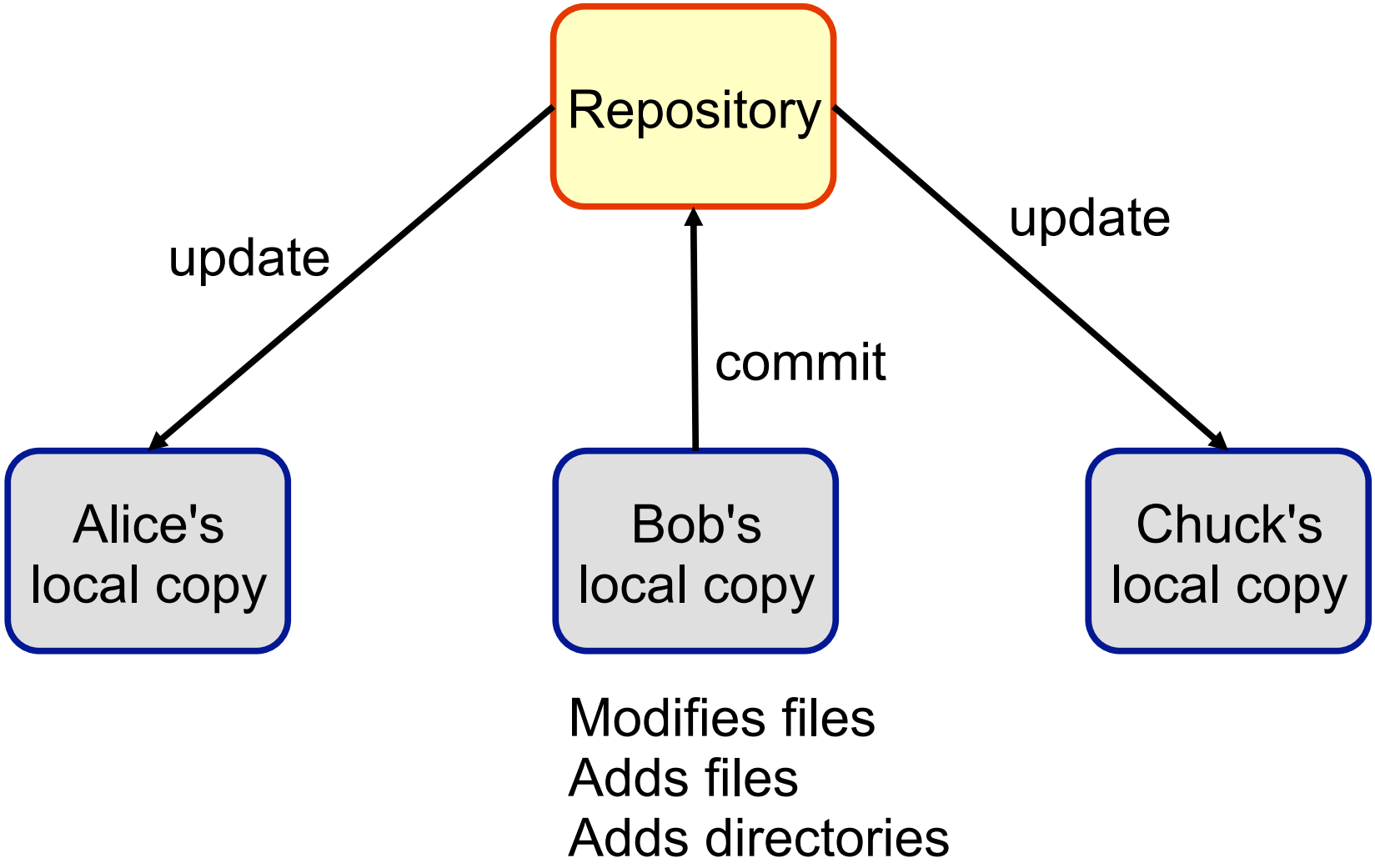
# Basic Idea

Holds master copy of all files
Holds old versions of all files




Developers should NOT modify the repository directly
Instead, each developer checks out and modifies a working copy

# Basic Idea


Repository
update
commit
update
Alice's
local copy
Bob's
local copy
Chuck's
local copy
Modifies files
Adds files
Adds directories

# Basic Idea Summary

- There exists one repository
  - Holds the master copy of all files for **all projects**
- Each software developer
  - Checks-out a local copy of the files for a project
  - Modifies the files in the local copy
  - Commits his/her changes periodically
  - Updates his/her local copy periodically
    - To see changes made by other developers
  - Adds new files that he/she creates
- Developers use a program (e.g., svn) to interact with the repository and perform the operations listed above

# What Goes Into The Repository

- In general: keep in repository ONLY what you need to build the application
  - Never add files that are generated automatically
  - Yes: .cc, .c, .h, Makefile
  - No: .o files or executable
- Think before you add a file to the repository
  - Although you can always remove it later if you make a mistake or if you change your mind

When adding a directory, svn adds all the files inside it automatically, which may include all your executables, etc.!

# Basic SVN Commands

- Set-up a repository (this is done only once)

`svnadmin create` ***`path`***

- Add a new project to the repository (once per project)

`svn import` ***`projectname foldername`***

- Working on a local copy (frequent commands)

Create local copy: `svn co` **`files`**

Commit changes: `svn ci` **`[files]`**

Update local copy: `svn update` **`[files]`**

Add a new file or directory: `svn add` **`files`**

# Additional SVN Commands

| command | description |
|---|---|
| `svn add files` | schedule files to be added at next commit |
| `svn ci [files]` | commit / check in changed files |
| `svn co files` | check out |
| `svn help [command]` | get help info about a particular command |
| `svn import directory` | adds a directory into repo as a project |
| `svn merge source path` | merge changes |
| `svn revert files` | restore local copy to repo's version |
| `svn resolve source path` | resolve merging conflicts |
| `svn update [files]` | update local copy to latest version |
| others: `blame`, `changelist`, `cleanup`, `diff`, `export`, `ls/mv/rm/mkdir`, `lock/unlock`, `log`, `propset` | |

# Log Messages

- Commit messages are mandatory
  - -m “short message”
  - -F filename-with-long-message
  - Else an editor pops up
    - Write your message
    - Save and quit
- Specify editor with SVN_EDITOR
  - For example, add the following to your .bashrc

    EXPORT SVN_EDITOR=emacs

Possible to setup SVN to send out email (with the log message) after each commit

# Example: Setting-up Repository

Assume that we are team “team0” working on **attu**

Each team will get a shared directory of the form

/projects/instr/10wi/cse303/team0/

- First, we need to create a repository in our shared directory

```
$ svnadmin create /projects/instr/10wi/cse303/team0/svn
(you can name it something else than “svn”)
```

- Second, give read/write permissions to your `cse303` group

```
$ chgrp -R mycse303group repofoldername
$ chmod -R g+rwx,o-rwx repofoldername
```

# Example: Starting a New Project

- Add initial files into the repo:

  Execute the following from your **home directory on attu**

  ```
  $ mkdir hw3
  $ svn import hw3 file:///projects/instr/10wi/cse303/team0/svn/hw3
  $ svn import projectname foldername
  ```

- Check-out a working copy of the new project

  On attu (move the old hw3 used for the import and then):

  ```
  svn co file:///projects/instr/10wi/cse303/team0/svn/hw3
  ```

  On your laptop

  ```
  svn co svn+ssh://attu.cs.washington.edu/projects/instr/10wi/
    cse303/team0/svn/hw3
  ```

# Example: Typical Work Session

- Start by getting any updates from the repository

  Execute the following from within your working copy of the project

  ```
  $ svn update
  ```

- Edit the files
- If you add a file, add it also to the repository

  ```
  $ svn add filename
  ```

  *common error*: people forget to add files  (won't compile for others)

- Finally, commit your changes (note: this is when files get added)

  ```
  $ svn ci
  ```

# Conflicts

- When many people edit the same files at the same time, conflicts can occur
- SVN tries to merge changes automatically
  - Merging is **line-based for text files**
- If cannot merge, svn will ask you to resolve conflict
  - One possible strategy is the following
  - When asked what to do, choose "**postpone**"
  - Edit file in your favorite editor to remove conflicts
    - Search for <<<< signs
  - Tell svn that you are done:
    - **svn resolve --accept working filename**

# Summary

- Version control system such as SVN
  - One of the key software development tools
  - All companies use them!
- Advantages
  - Much better than manually emailing files, adding dates or version numbers to files, etc.
  - Handles concurrent changes
  - Manages multiple versions
  - Remembers old versions
  - Useful for software but works on any files!

# Readings

- Online SVN documentation
  - `http://subversion.apache.org/`
  - `http://svnbook.red-bean.com/`