Section 3!

Including, but not limited to,
some or all of the following…

Subversion **test coverage**

handling invalid input

CSE 331, 10/13/11 *TA: Krysta Yousoufian*

Bookkeeping:
Stuff you should know

- Krysta can't remember faces… ☹ (or names)
  - It's VERY awkward. But it's genetic.
  - I'm not being rude, just oblivious. I promise!
  - Yes, I want you to call me out if I forget we've met
- I also talk too fast… call me out on that too!
- Krysta's office hours policy
  - I'm in the labs pretty often, working on my own stuff
  - You can ALWAYS ask me for help!
  - If it's a bad time for me, I will say so – so don't be afraid to ask
  - (But do try to work through things on your own first… it will make you a better programmer)

Bookkeeping:
Stuff we want to know

- Piazza
  - Like? Dislike?
- Important announcements
  - Piazza OK? Mailing list? Both?
- Office hours
  - Would Thurs OH be useful?
  - (Good chance I'll be there anyway after 1pm… see previous slide)

Version Control

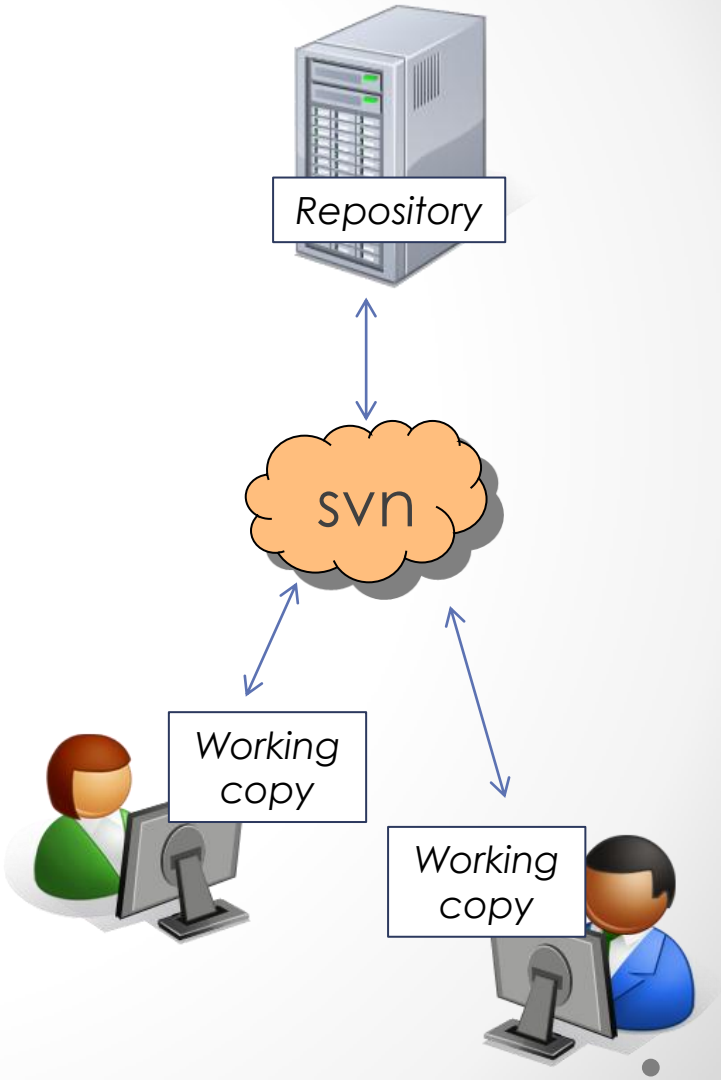
(in which we build big software without losing our sanity)

Overview

- System for tracking changes to code
- Essential for managing big projects
  - Learn it now – you WILL use it again and again!
- Makes it easy to:
  - Merge multiple developers' changes
  - Avoid overwriting each others' changes
  - Revert back to an older version of a file
  - See a history of changes
  - Back up your work
  - …and more!
- You'll use **Subversion** (SVN) this quarter
  - There are others: Mercurial, Git, CVS, …

Organization

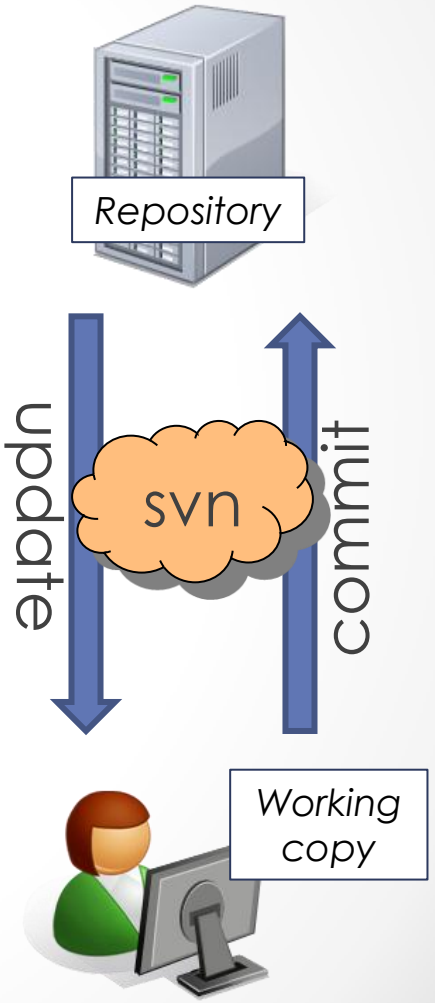
- A *repository* stores the master copy of the project
  - Someone creates the repo for a new project
  - Then nobody touches this copy directly
  - Lives on a server everyone can access
- Each person checks out her own working copy
  - Makes a local copy of the repo
  - You'll always work off of this copy
  - The version control system syncs the repo and working copy (with your help)



Common Actions

Everyday commands:

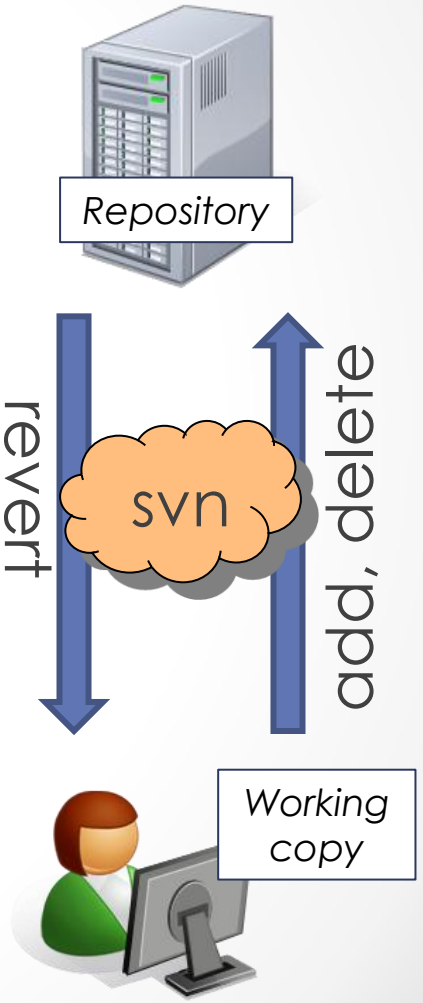
- Commit / checkin
  - integrate changes *from* your working copy *into* the repository
- Update
  - integrate changes *into* your working copy *from* the repository



Common Actions

Less frequent commands:

- Add, delete
  - add or delete a file in the repository
- Revert
  - wipe out your local changes to a file
- Resolve, diff, merge
  - Handle a conflict – two users editing the same code



Getting Started

- Multiple ways to use SVN
  - **Subclipse:** plugin for Eclipse
  - Can also use command-line, TortoiseSVN/NautilusSVN (GUI)

1. Create repository (command-line):

   Run the following on attu (Linux lab machine or SSH):

   ```
   > svnadmin create /projects/instr/11sp/cse331/GROUPNAME
   > chmod -R g+rw /projects/instr/11au/cse331/GROUPNAME
   ```

   to turn your shared group directory into a repository. Totally lost? *That's OK!!* Email me to meet for a 5-minute intro to Linux.

1. Install Subclipse
   - Should already be installed in labs
   - See section handout and http://www.cs.washington.edu/education/courses/cse331/11sp/groups.shtml

3. Create or checkout project
   - See http://www.cs.washington.edu/education/courses/cse331/11sp/groups.shtml (again)

Using Subclipse

- "Team Synchronization" perspective
  - Can use to perform updates, commits, etc.
  - Eclipse will ask you if you want to use this, or go to Windows -> Open Perspective -> Other…
  - For most commands, right-click in "Synchronization" tab
  - Updates: may need to click "Synchronize SVN" button first
- Ordinary Java perspective
  - Team Sync view not great while you're busy coding (Sync tab only shows certain files, etc.)
  - Restore "regular" perspective from Windows -> Open Perspective -> Other… -> Java (Default) or icons in top-right corner
  - In Package Explorer, right-click on your project and choose "Team" to do updates ("Update to HEAD"), commits, etc.

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Using Subclipse

Demo!

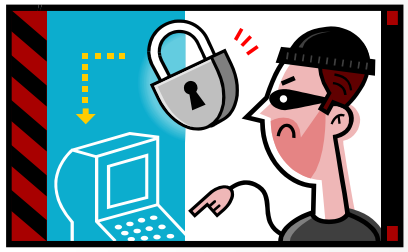
By the way, http://svnbook.red-bean.com/ is a great resource for SVN

Handling Invalid Input

(a.k.a. expecting the unexpected)

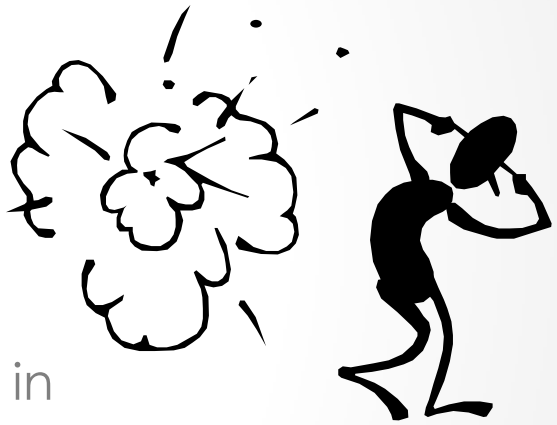
Invalid Input (Callee)

- Reference: *Effective Java*, pg. 181
- Note: confusion around Assignment 1…
  - Replace anything I said earlier with what I'm saying now
  - Because of GUI design, you couldn't always follow these recommendations
- **Assume nothing**: many reasons preconditions violated
  - Buggy code, malicious code, sloppy code



Invalid Input (Callee)

- **Fail early and often:** easier to locate bugs
- **Fail friendly:** make the caller's job easier
  - Throw an exception, document with `@throws`
  - e.g. `IllegalArgumentException`, `IndexOutOfBoundsException`, `NullPointerException`
  - Don't leave data structures or operations in intermediate states
- But remember: fancy input validation might be expensive
  - E.g. binary search: verifying that the list is sorted defeats the point of doing binary search



Invalid Input (Caller)

- Know what might cause unexpected values
  - User input
  - Data access: failure to open file, connect to database, etc. (null values?)
- Validate parameters before calling …
  - User input especially!
- … or be prepared to catch exceptions
  - Use a try…catch block
  - Are you sure the method validates input?

Test Coverage

(knowing what to test and when to stop)

Input Categories

- Classes of input that could be expected to cause different behavior
  - Negative integers, positive integers, zero
  - Reversing a string: odd, even length
- Run at least one test from each class
- Sometimes multiple ways to categorize
- Example: testing that Item.toString() prints two digits after decimal point

Input Categories

Example: testing that Item.toString() prints two digits after decimal point: what if…

- Price is an integer? ($10.00)
- Price has one digit after decimal point? ($10.50)
- Price has two digits after decimal point? ($10.99)
- Price has 3+ digits after decimal point? ($10.895)
- Price is negative? Zero? Positive?
- Price has zero/one/two digits before decimal? ($0.05, $1.05, $10.05)

Boundary Conditions

- Values on the edges between input categories
- Example: ShoppingCart discounts total if cart contains at least *q* items
- What if cart contains exactly *q* items? *q*-1 items? *q*+1?
- (Not really a boundary condition, but… what if cart contains q items and then one is removed?)

Edge Cases

- The uncommon case: extreme or unexpected values
- Empty/null/zeros: search an empty list, reverse an empty string
- Ones: search a one-element list, one-element string
- Minima/maxima
- Unusual patterns
- Sorting algorithm: list already sorted, reverse-sorted
- Strings: non-alphabetic characters? non-ASCII characters?

Invalid Input

- What should happen with invalid input?
- Make sure the program doesn't crash, at least
- JUnit: use `@Test(expected=ExceptionName.class)` to test that exception is thrown

Where to stop?

- You can never test all possible inputs
- With each new test, ask: "What is this testing that has not been covered in a previous test?"
  - A different input category?
  - A boundary condition?
  - An edge case?

SDET Test Buckets

- DON'T need to know for this course
- DO need to know for job interviews (SDET, also SDE)
- Test buckets:
  - Input categories
  - Boundary conditions
  - Edge cases
  - Internationalization
  - Accessibility
  - Security
  - Performance
  - Stress/load testing
  - Possibly more…