Teaching Evolution of Open-Source Projects in Software Engineering Courses

Joseph Buchta, Maksym Petrenko,
Denys Poshyvanyk, Václav Rajlich

Department of Computer Science
Wayne State University

Course Outline

- CSC 6110 Advanced Software Engineering

- 10-20 students
  - Senior undergraduate and first-year graduate
  - Good working knowledge of C++ or Java

Course Goals

- Teach students how to evolve large software systems in a consistent, methodological way
  (Sobel and LeBlanc - "Computing Curricula", 2004)
- Give students an experience of industry-like setting
  (Sommerville - "Software Engineering", 2001)
  - Real, medium-to-big sized software
  - Real change requests
- Practice collaborative environment by using CVS

Related Work

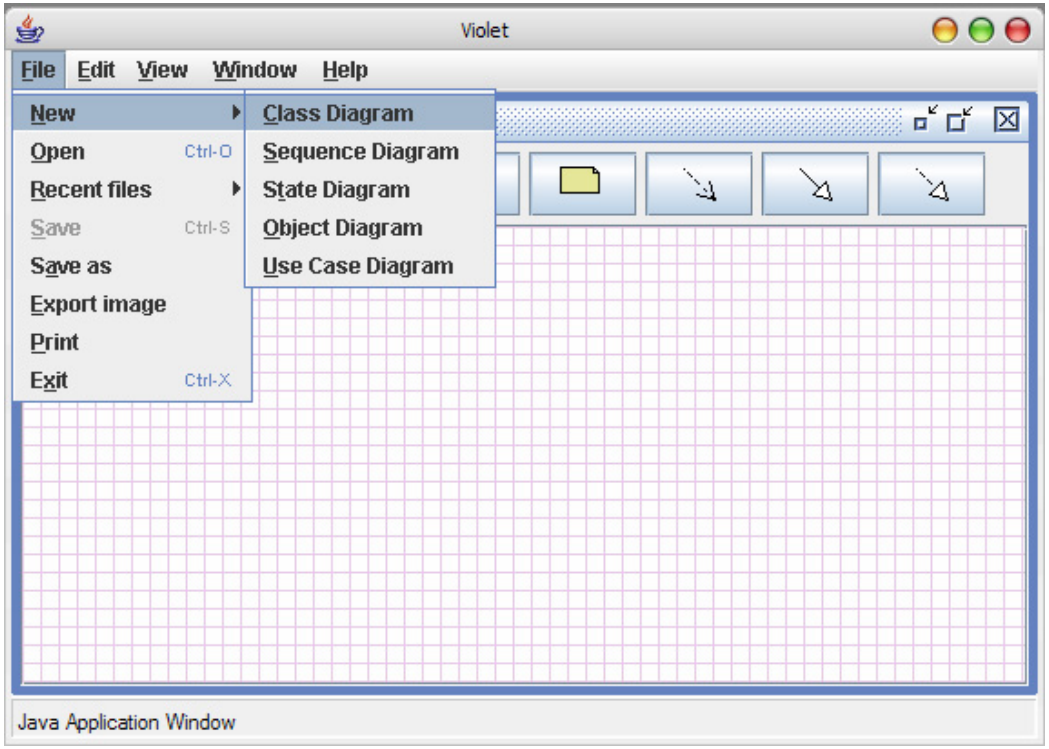
- Gnatz, Kof, Prilmeier and Seifert (2003)
  - Development + Evolution
  - Ran behind the schedule
- Postema, Miller and Dick (2001)
  - 2000 LOC software
  - Focus on maintenance
  - Change requests with known solutions

Open-Source Projects

- Free to use
- Can be selected to have
  - Easy, interesting and familiar domain
  - Familiar programming language (C++ or Java)
  - Big size
  - Good structure
- Contain
  - Source code
  - Wish list
  - Documentation
  - Test

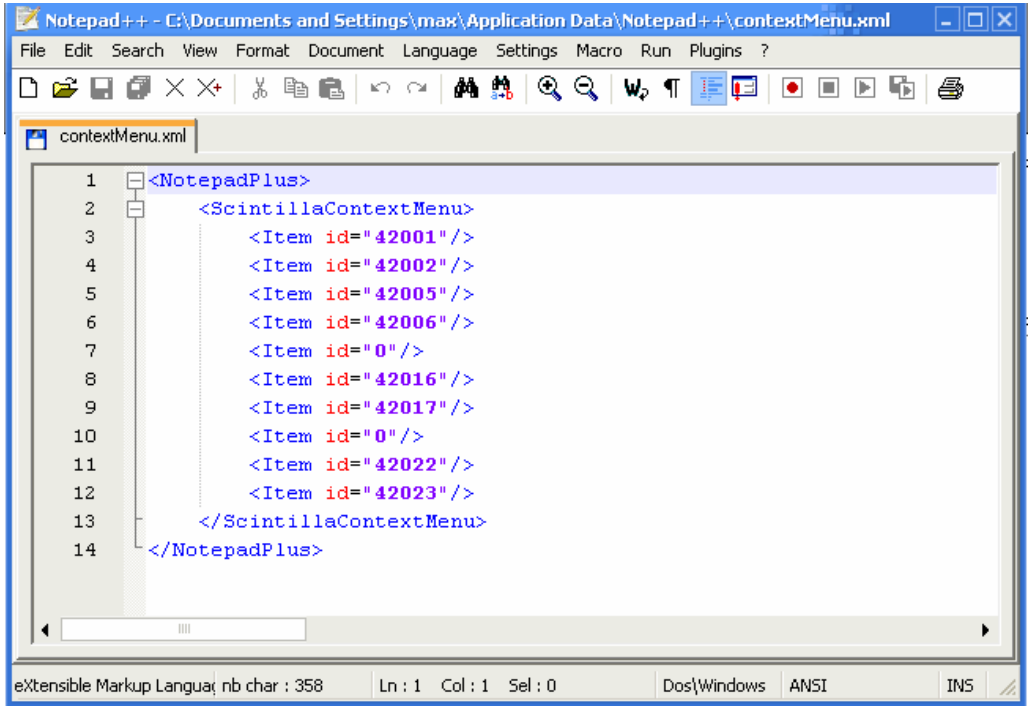
Sample Projects

- Violet (http://www.horstmann.com/violet)
  - UML editor
  - Java
  - 63 classes
  - 10,230 LOC



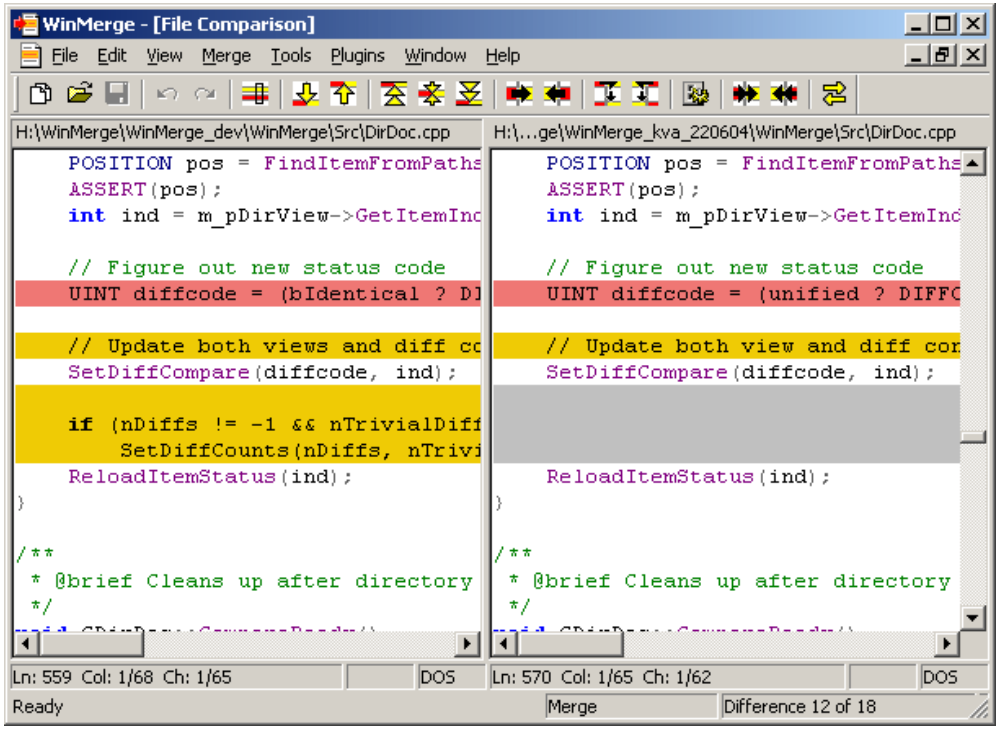
Sample Projects (cont.)

- Notepad++ (http://notepad-plus.sourceforge.net)
  - Text editor
  - C++
  - 42 classes
  - 31,798 LOC



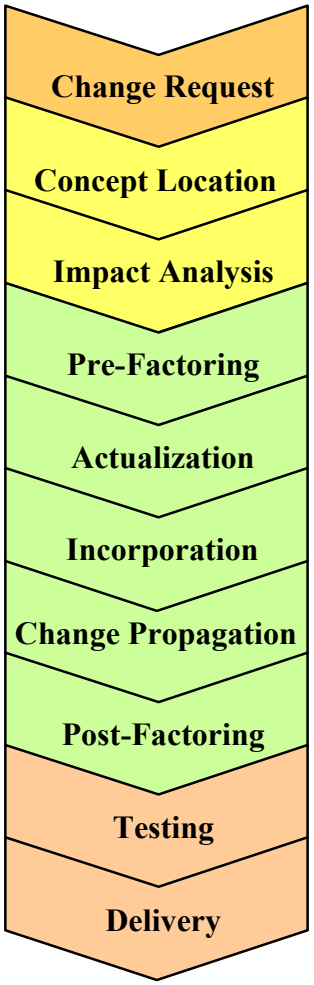
Sample Projects (cont.1)

- WinMerge (http://winmerge.sourceforge.net)
  - Compare files
  - C++
  - 69 classes
  - 62,990 LOC



Incremental Change (IC)

- IC initiation
  - Change Request
- IC design
  - Concept Location
  - Impact Analysis
- IC implementation
  - Pre-factoring
  - Actualization
  - Incorporation
  - Change Propagation
  - Post-factoring
- Testing
- Delivery



Course Structure

- Teams of 4-6 students
- 3 Phases

Course Teams

- For each team
  - Separate open-source software
  - Change requests
  - Team manager
  - Team meetings
  - CVS folder

CVS

- Supports collaborative environment
- Facilitates teamwork
- Provides accountability
  - Lessens cheating
  - Project history
  - Individual performance assessment
  - Helps to find who broke the system

Course Phases

- 1st Phase
  - The simplest phase
  - Easy change requests
  - Students learn IC methodology, software structure, CVS etc.
- 2nd and 3rd phases
  - Change requests designed to include all the steps of IC
  - Changes implementations often overlapped
  - Some changes were done in pairs
  - Change requests were estimated to take 25 to 40 hours

Sample Change Requests

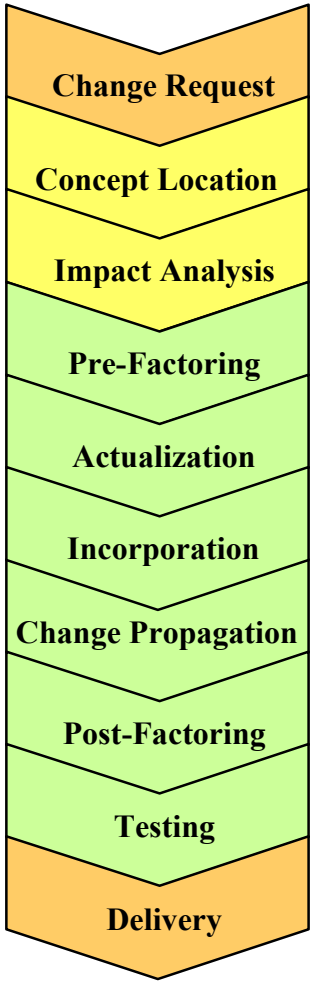
- Phase 1
  - Implement “About” box with names of your team members (all projects)
- Phase 2 and 3
  - Design and implement plug-ins functionality for JCDSee image viewer
  - Integrate an open-source spell checking project into the Notepad++ application

Change Requests

- Source
  - Feature request lists of the projects
  - Suggested by project manager
- Can be adjusted as a student progresses through the change

Course Grading

- Report
  - Justified description of undertaken IC steps
  - Time log
- Solution
  - Completeness
  - Correctness
- Organization of solution
  - Refactoring
  - Interfaces
  - Comments
- Use of CVS
- Short presentation



Time Logs

- Provide source of statistics for assessing
  - Student's performance
  - Actual change request complexity
  - Student's learning process
- Help to adjust
  - Future change requests
  - Lectures agenda

Course Performance

- Time logs indicate that students by the end of the Phase 3 were able to implement more complex change requests in less time then simple ones during Phase 1

Course Survey

- Students' survey indicates increase in students' satisfaction
  - Same instructor
  - 5 points maximum

Course Format	Year	How would you rate the course?	How much did you learn in this course?
Waterfall	Fall 2002 Mean	3.4	3.4
	Fall 2002 Median	3	3
Evolution	Fall 2004 Mean	3.7	3.8
	Fall 2004 Median	4	4
	Fall 2005 Mean	3.9	4
	Fall 2005 Median	4	4

Project Managers' Workload

- Choosing projects and change requests, setting up CVS
  - 40-60 hours before the classes begin
- Managing a team
  - 6-7 hours a week
  - 10-12 hours during phases' due dates

Conclusions

- Proposed course gives students
  - An opportunity to work on realistic programs and change requests
  - An experience of industry-like setting
- Course increases
  - Students' motivation
  - Students' satisfaction
- Gives instructors project management experience

Current Work

- IC process techniques improvement and expansion to incorporate into future courses
  - Concept location
  - Impact analysis
  - Change propagation
- Tools to facilitate IC process and guide student through it
  - JRipples
  - IRiSS

Future Work

- Long-term follow-up studies
- Textbook

Thank you!