



# Adapting and Extending WeBWork for Use in the Computer Science Curriculum

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# Goals

- Assessing/improving programming fundamentals
- Enhance learning experience of students
- Enhance homework delivery
  - Customized problems
  - Immediate feedback



# Foundation

- WeBWorK (Gage & Pizer, U of Rochester, 1999)
  - CMS/assessment environment for math
  - Understands mathematical expressions
  - Highly flexible question authoring environment
  - High randomization in questions
  - Measured positive impact in teaching
  - Large problem library written by active community of users



# Customization

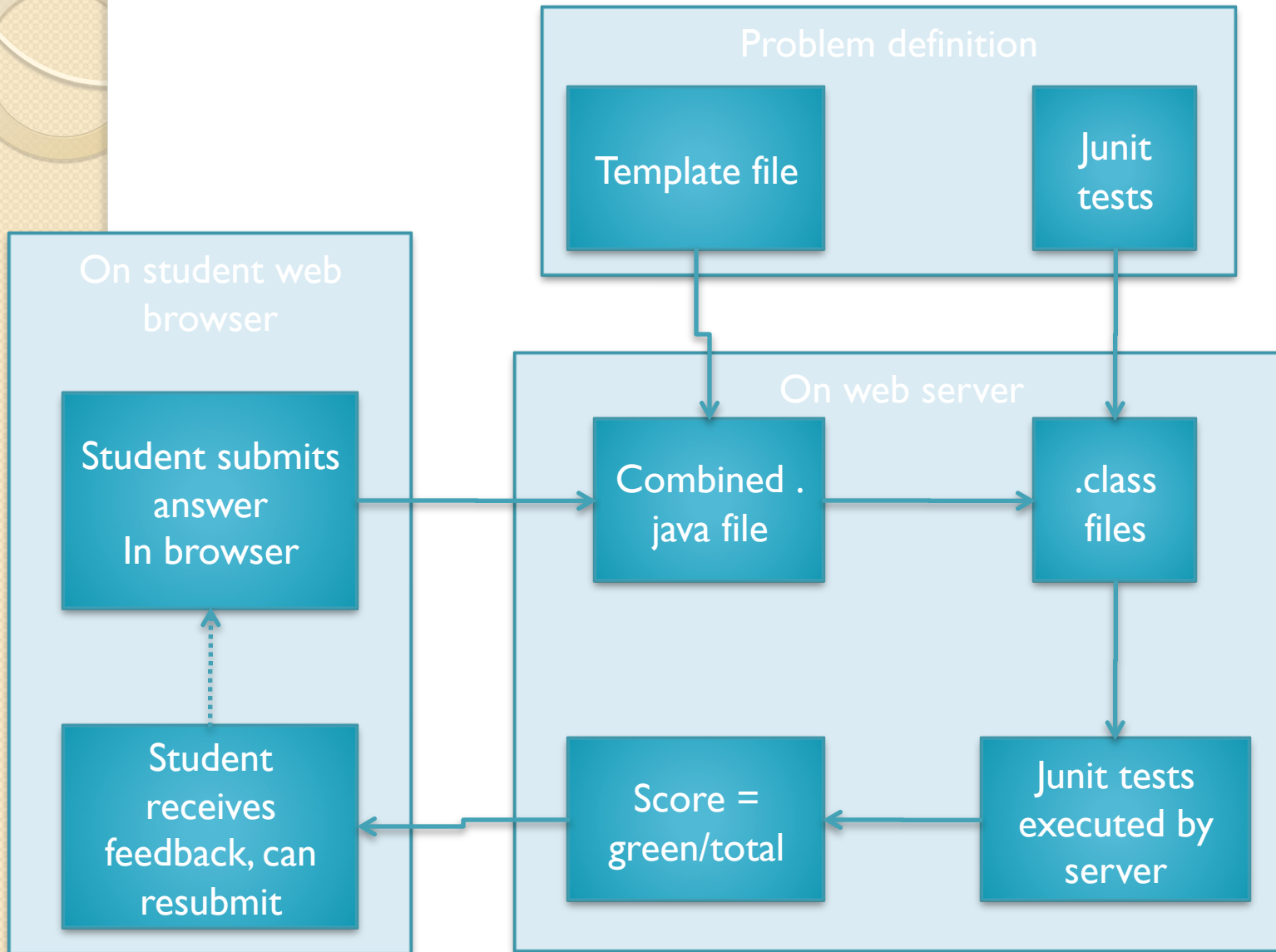
- Increased problem library
  - Questions for discrete mathematics
  - Questions for CSI (intro programming)
- Automated assessment of program fragments
  - WW-JAG (Java Auto Grader)



# WW-JAG (Java Auto Grader)

- Give students immediate feedback on correctness of program fragments
  - Individual lines/declarations
  - Code block
  - One or more methods
  - Entire class
- Based on Junit
- Currently attached to WeBWork
  - Designed to work with other CMSes

# WW-JAG diagram





# WW-JAG results

- Used in several CSI/CS2 courses
- Qualitative/perception responses mostly positive
  - Like immediate feedback
  - Feel questions more useful than mult. choice.
  - Blamed the computer for errors
- Questions difficult to author/debug
  - Question wording very important (esp. internationally)
  - Must use reflection to eliminate naming errors



# Teaching SQA by expanding library

- Teaching SQA is important and challenging
- Writing JAG questions is very labor intensive
- Pilot program to have students learn SQA by writing questions for program library
  - Formed small teams
  - Wrote questions, tested on classmates
  - Questions later refined, inserted into library

Teaching Software Quality Assurance by Encouraging Student Contributions to an Open Source Web-based System for the Assessment of Programming Assignments – ITICSE 08





# International perceptions of WeBWork

- CSI classes in Cambodia, India, Senegal, Thailand, USA
- Surveyed perceptions of students & faculty




# Perceptions

- Students & faculty liked system
  - Helped address high stud/faculty ratios
  - Students appreciated extra practice
  - Liked multiple attempts
    - Believed it taught mastery
  - Language issues seemed minor



# International Concerns

- Basic infrastructure
  - Access to internet
  - Access to wired labs
- Institutional impediments to adoption
  - Human cost of switching systems



# Conference/Workshop for Automated Grading in Math/CS

- Pace University, March 2008
- Participants
  - Developers for 5 similar systems
  - Faculty members using/considering use
- Program
  - Presentations by Developers
  - Hands-on by faculty
  - Discussions about future work, including collaboration between developers

# WeBWork in CS team

## Pace University

- Faculty
  - Christelle Scharff
  - Olly Gotel
  - Richard Kline
- Students
  - Tabitha Estrellado
  - Eileen Krupi

## Cornell College

- Faculty
  - Andy Wildenberg
- Students
  - Jackie Baldwin
  - David Baur
  - Robert Busby

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