Employing FOSS Tools to Improve Learning and Increase Opportunities

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Employing FOSS Tools to Improve Learning and Increase Opportunities

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Outline

• Problem overview
• The ClassDB solution
  – Improve learning
  – Reduce cost
  – Increase opportunities
• Discussion
CS205@WCSU

• CS205 is an intro course to data management
  – Required course, teaches relational data and SQL
  – ~50% programming, requiring students to practice queries
  – Term project: many cycles of DB design & implementation
  – 20 students each section; at times, 2 sections same term
  – Classroom (which is also a lab) has 20 computers

• Software infrastructure
  – Need a DBMS “server” installed and administered centrally
  – Need specific client tools on individual computers
  – Traditional programming courses do not use central server
  – **DBMS is a powerful+expensive tool: needs careful admin**
CS205 Infrastructure up to Fall 2016

Oracle “server” administered by IT&I

Network magic

20 classroom/lab computers have “client” installed

The discussion about CS205 applies to at least three other courses, chief of which is CS305.
CS205 Infrastructure up to Fall 2016

- Oracle DBMS server, run somewhere by IT&I
  - University-licensed due to 3rd party systems using Oracle
  - Managed by an in-house DBA (not specific to CS205)
- Oracle client installed on 20 lab computers
  - Connect to Oracle server using specific client software
- Shared governance
  - DBA creates student account each semester using roster
  - Faculty has server account, but is a general user: cannot see student activity; students dump data for faculty to see
  - DBMS is locked down for good reason: IT&I involved in course-related operational matters
Fall 2016 Questions

• What if the university stops using Oracle?
  – Banner system moved off-premise in early 2018

• What if IT&I is unable to support CS205?
  – DBA retired in 2017 (?); position eliminated (?)

• What about the learning part?
  – Many cases of students not/never using the system, but faculty is unaware (because they have no way of knowing)
  – DBMS locked down for ops reason, means students cannot try/practice many concepts
  – Teaching needs not the same as ops needs: ops can afford to use an older DBMS; teaching cannot, should not
Overview

• ClassDB is a free and open-source software (FOSS) developed at DASSL
  – Has fully replaced the Fall 2016 CS205 infrastructure

• Runs completely inside a DBMS
  – Presently implemented for PostgreSQL (also FOSS), but can be implemented for any DBMS brand (MSSQL planned)

• **Unobtrusive by design**: students use DBMS as always
  – Faculty use the API to easily create and manage student sandboxes, analyze user activity, *etc.*
  – Students have access to API parts, *e.g.*, analyze their own activity
ClassDB Environment

Client can be run off a network folder from any wired computer on campus without installation

The DBMS server presently runs in a virtual machine provided by Dr. Coffman, a CS faculty member: should be moved to an IT&I server
### Summary: Before and After ClassDB

<table>
<thead>
<tr>
<th>Before ClassDB</th>
<th>With ClassDB</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Commercial system, $$$</td>
<td>• Free and Open Source, $0</td>
</tr>
<tr>
<td>• Managed by IT&amp;I</td>
<td>• Managed by faculty</td>
</tr>
<tr>
<td>• Use from 20 specific computers</td>
<td>• Use from any campus comp.</td>
</tr>
<tr>
<td>• Only for students in a course</td>
<td>• For any university student</td>
</tr>
<tr>
<td>• Student activity unknowable</td>
<td>• Student activity always knowable</td>
</tr>
<tr>
<td>• Many cases of students falling behind</td>
<td>• Almost no case of students falling behind (as far as usage goes)</td>
</tr>
<tr>
<td>• Learning limited by ops security</td>
<td>• Secure but can try most features</td>
</tr>
<tr>
<td>• Limited to course content</td>
<td>• Many co-curricular opportunities</td>
</tr>
<tr>
<td></td>
<td>• Publication opportunities for faculty and students</td>
</tr>
</tbody>
</table>
People

• Built and maintained in collaboration with students
  – These are not CS205 students, but students interested in learning to build real-life system
  – CS205 students only use the ClassDB system deployed

• Contributors, contributions
  – Concept, design, architecture: Murthy
  – Implementation: Murthy, Figueroa, Rollo, Kelly
  – Documentation: Murthy, Figueroa, Rollo
  – Testing: Murthy, Figueroa, Rollo, Kelly
  – Maintenance: Murthy, Figueroa, Rollo, Kelly
ClassDB Timeline

• ClassDB 1.0
  – Concept and design: Fall 2016, Spring 2017
  – Initial implementation: May 21 2017 – July 5 2017
  – Initial use: Summer DASSL 2017 by 8 students
  – Maintenance: August 2017
  – Initial CS205 use: Fall 2017

• ClassDB 2.0
  – Major maintenance: Winter intersession 2018
  – Second CS205 use: Spring 2018

• ClassDB 2.x, planned maintenance: Summer 2018
• Third CS205 and first CS305 use: Fall 2018
• Adoption elsewhere: in discussion; introductions welcome
ClassDB Development Process

• Developing ClassDB and other systems at DASSL is not part of any course work
  – Students voluntarily participate in order to learn and practice modern data and software engineering

• DASSL emphasizes producing high-quality software using professional methods and teamwork
  – Not just programming, but engineering, including testing and documentation throughout the process
  – Prefer using FOSS tools at every step

• Goal is to help students build an online portfolio for potential employers (and grad school admin) to see
Outcome Summary

• All source code, documentation, and test scripts are in a public repository: [http://bit.ly/ClassDBRepo](http://bit.ly/ClassDBRepo)

• 3 students have gained experience developing and maintaining a high-quality system that has real users
  – *No course combination can teach this experience*; hard even at graduate level
  – Students have practical understanding of many Agile and DevOps processes and toolchain

• 3 peer-reviewed papers (2 with student co-authors)
DISCUSSION

Employing FOSS Tools to Improve Learning and Increase Opportunities
Does the ClassDB Experience Translate?

• Is the ClassDB experience unique?
• Is the use of (opportunity for) FOSS CS-specific?
• Does using FOSS require software development?
  – Many FOSS items ready for use off the shelf
• Not in CS, not a programmer, does it still translate?
  – Most faculty use some discipline-specific software
  – Collaborate with CS faculty students to research, adapt, deploy FOSS for non-CS: adds to CS people’s portfolio and advances non-CS cause
Some Discussion Points

- Criteria for FOSS selection
- Means of adopting FOSS in teaching
- Factors that aid/impede student success
- Opportunities for and means of student engagement
- Opportunities for faculty
- Effort and quality considerations
- Publishing and documenting FOSS tools
- Shared governance
  - Who does what, when? Who takes the initiative?