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Employing FOSS Tools to Improve Learning and Increase Opportunities

Item Type	Presentation
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DOI	10.7275/4v28-2002
Download date	2026-05-15 05:06:49
Link to Item	https://hdl.handle.net/20.500.14394/37150

Employing FOSS Tools to Improve Learning and Increase Opportunities

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<http://dassl.github.io>



Outline

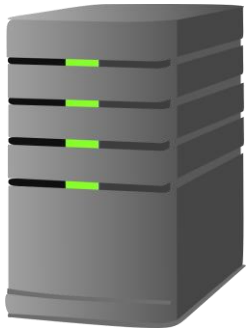
- Problem overview
- The ClassDB solution
 - Improve learning
 - Reduce cost
 - Increase opportunities
- Discussion

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

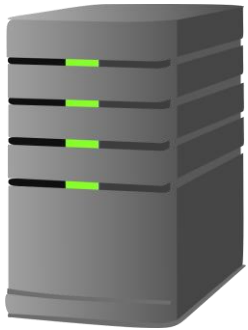
CLASSDB

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

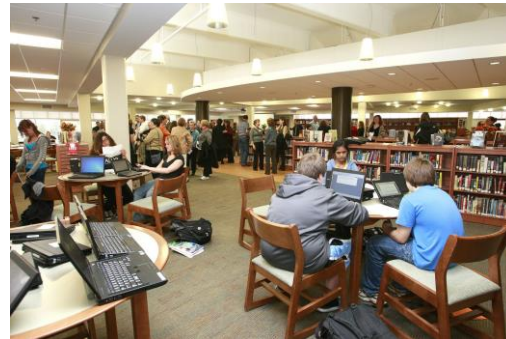
DBMS server (Postgres) in the CS department



Network magic

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

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



Summary: Before and After ClassDB

Before ClassDB

- Commercial system, \$\$\$
- Managed by IT&I
- Use from 20 specific computers
- Only for students in a course
- Student activity unknowable
- Many cases of students falling behind
- Learning limited by ops security
- Limited to course content

With ClassDB

- Free and Open Source, \$0
- Managed by faculty
- Use from any campus comp.
- For any university student
- Student activity always knowable
- Almost no case of students falling behind (as far as usage goes)
- Secure but can try most features
- **Many co-curricular opportunities**
- **Publication opportunities for faculty and students**

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>
- 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

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?