The Galactic Divide

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Storage Coursework

Graduate Students

Graduate Operating Systems

- Taken by many grads
- Many storage readings (11/30 papers)
- Many storage projects (9/15 projects)

Graduate Database and Architecture

- Taken by many, but real storage issues only covered in minor way

Graduate Storage Systems

- Taken by a few grads in the area

Undergraduates

Undergraduate Operating Systems

- Taken by many/most undergrads
- 1/4 of class on file systems + storage
- 1 project on file systems

Undergraduate Database and Architecture

- Taken by many, but... (same as before)

Undergraduate Storage

- Does not exist

Some Observations

Storage is taught “implicitly” in other areas

- Most students see it as a “sub area” of OS, DB, A

Many students are surprised: It’s not boring!

- “I didn’t know storage could be interesting”
- Problem of perception is a real one

Most still think storage is “too specialized”

- Even our own Ph.D.s!
- Problem in faculty hiring too

Some Simple Things To Help

A better OS textbook

- Today's OS textbooks are designed around our view of operating systems many years ago
- Not very interesting or accurate about storage
- Books are strong motivators ...

More professional courses in storage

- Master's level
- Storage administration too!

Teaching Paradigms

Undergraduate Courses

Focus on learning what's already "known"

- Reading + projects

Reading is from textbooks

- Given as truths
- Not for questioning

Projects are standard exercises

- Simple thread libraries, file systems, etc.
- No new problems or solutions,
  should always work out if done right

How is a grad class taught?

Focus on research process

- Reading + projects

Reading great papers, recent papers

- Learning to question them

Doing research projects under professor’s guid

- Focus on solving new and interesting problems
- Frequent meetings
- Room for creativity

Beyond the Class: Being an RA

RA's responsibility

- Do innovative, publishable research

Access to professor's individual time

- Frequent meetings/opportunities for feedback/mentoring

Access to interesting equipment too

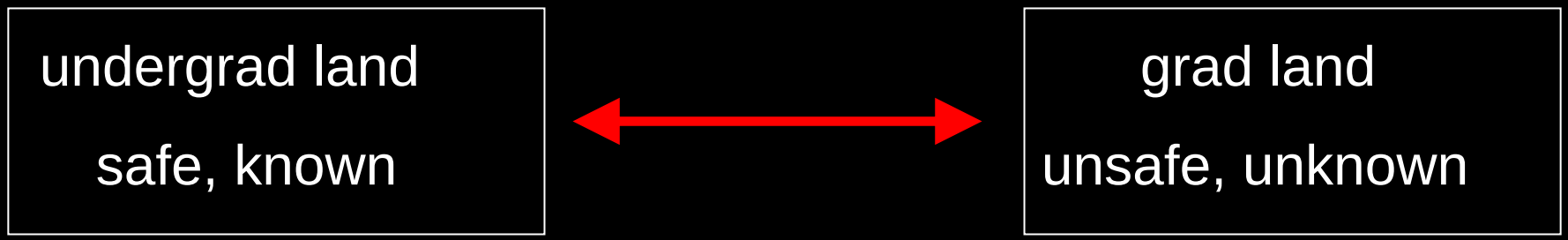
- "Latest" gear needed for research

Bottom line matters

- Ability to solve problems/overcome hurdles/etc.
- May be no good solution (no safety net)

Observations

The “Galactic Divide”



Graduate model works better

- Work on “real” problems
- Constant cycle of critique and feedback

A Different Approach

Making Undergrad More Grad-like

Old-style curriculum: Topic-oriented

- Based on “era of minicomputer”

New-style curriculum: Problem-oriented

- Based on “grand challenges” in CS, related fields

Example: The "Google" Course

"Organizing the world's information"

Students learn about and build all the pieces

- Crawler, search engine, etc.

Touches on many areas of CS, not just one

- Storage, databases, architecture, PL, AI, algorithms, ...

Other Ways to Help

New course formats

- Video-taped lectures -> download + watch
- Leave more time for human-human interaction

Interactive labs

- Sit and work *with* students, instead of lecturing *at* them

Benefits

Train undergrads to be independent problem s

- More ready to join workforce in “real” world
- More ready for graduate school too!

Make CS undergrad more attractive to student

- Not just a bunch of classes to take,
  but rather problems to solve

More people working on interesting problems

- More intelligence applied to real research questi
  not just wasted on toy exercises

Potential Drawbacks

Plenty, but why be negative now?

What We Need

A Calculus of Teaching

We need time

We know: time = money

Therefore, we need money

Resource Needs

Educational buyouts

- Give explicit time to faculty to work on educational needs

Technology

- Video-taped lectures -> video iPods for all

Equipment

- Research-class equipment for undergrads too

Evaluation Methods

Case Study: A Research Proposal

- Large research component
- Small (but serious) education component

How to determine whether to fund?

- Research: Examine previous work in area
- Education: ?

Need: Methods to evaluate success of education funding

Wrapping Up

Summary

The Galactic Divide exists

- Huge gap between undergrads/grads

Need to rethink undergrad teaching in a more "grad"-like manner

- Problem-oriented, adult-world

Need time -> need money

- and ways to evaluate if money is being spent we