Research is a Social Process

What Programming Languages Researchers Do and How

Kathryn S McKinley
Google

About me

Research

Mentors

prove the programmability, correctness,
curity, performance, and energy efficiency of
mputer systems

Career

RICE Unconventional Wisdom

UMASS

Microsoft Research

MINES ParisTech

TEXAS

Google

life

Family

Research is a Social Process

Research takes a village …

You create your own research village

Creating your research village

All villages need elders

All villages need regular Joes and Stephanies

All villages need diversity

Learn different strokes from different folks

All villages need uniformity

Similar folks have similar issues

John S. Davis, IBM, 20

Building a village requires

Making professional connections
and using them wisely

Systematically seeking out new and sustaining relationships with people in the service of professional goals

Networking

- Makes you known
- Makes your work known
- Source of new research ideas, research feedback, & advice
- Collaborators
- Letters of recommendation
- Professional opportunities

Networking is not

using people

or a substitute for high quality research

Meet New People

Go places and volunteer!

But I am terrible at small talk…

Networking is not genetic

It is a skill

Have a plan Practice

Networking at conferences

Plan a Research Elevator talk

- 1 & 3 minute versions
- Why is it an important problem?
- Why is your solution unique?

Plan

- Who will be there? Who do you want to meet
- What do you want to ask them? Read the papers.

Fallback What are you working on?

What to talk about?

- Where are you in graduate school? Undergraduate studies?
- What research problem(s) are you working (right now)?
- What attracted you to CS? to programming languages?
- What course did you like best? Professor?
- What is your greatest (professional or personal) challenge right now?
- What is your biggest concern about graduate school?
- What kind of career path do you want to pursue?
- What do you enjoy doing when you're ***not*** doing CS?

5 Minute Speed Networking x 2

Partner up

1 minute quick intros

- Shake hands, *look person in eye & smile*
- "Hi, I am ***Kathryn McKinley.*** I am a researcher at Google Seattle workin on cloud performance"

Take turns (2 minutes each)

- Ask a question
- Listen *actively*, make eye contact, *respond on topic*

Record her/his name

What Programming Languages Researchers Do and How

Researchers solve problems & ask questions

My undergraduate & graduate research

1983 What is the bottleneck in a local area network?

1984 TED A Text EDitor to help Fortran programmers produce correct programs

1992 Interactive and automatic parallelization

Performance

Programmer Tools

Optimization

Programming language researchers

Help people make computers do stuff

Classic topics I

- Design programming languages
  - Correctness, expressiveness, efficiency
- Specify semantics for languages & programs
- Prove properties about languages & programs
- Programming language implementation

Programming languages timeline

https://www.levenez.com/lang/lang.pdf

Classic topics II

- Compilers & interpreters
  - map high level to low level languages
  - correct, secure, etc.
- Finding bugs in programs
- Performance of programs
  - Profiling, benchmarks, measurements

Classic topics III

Classic topics III

Tools for programmers, users, & PL researchers

- writing programs
- writing programming languages
- proving things about programs
- compiling & optimizing programs
- debugging programs
- profiling programs

Techniques PL researchers use

Language grammars & tools
Lambda calculus
Type theory
Data flow analysis
Static analysis
Dynamic analysis
Simulation

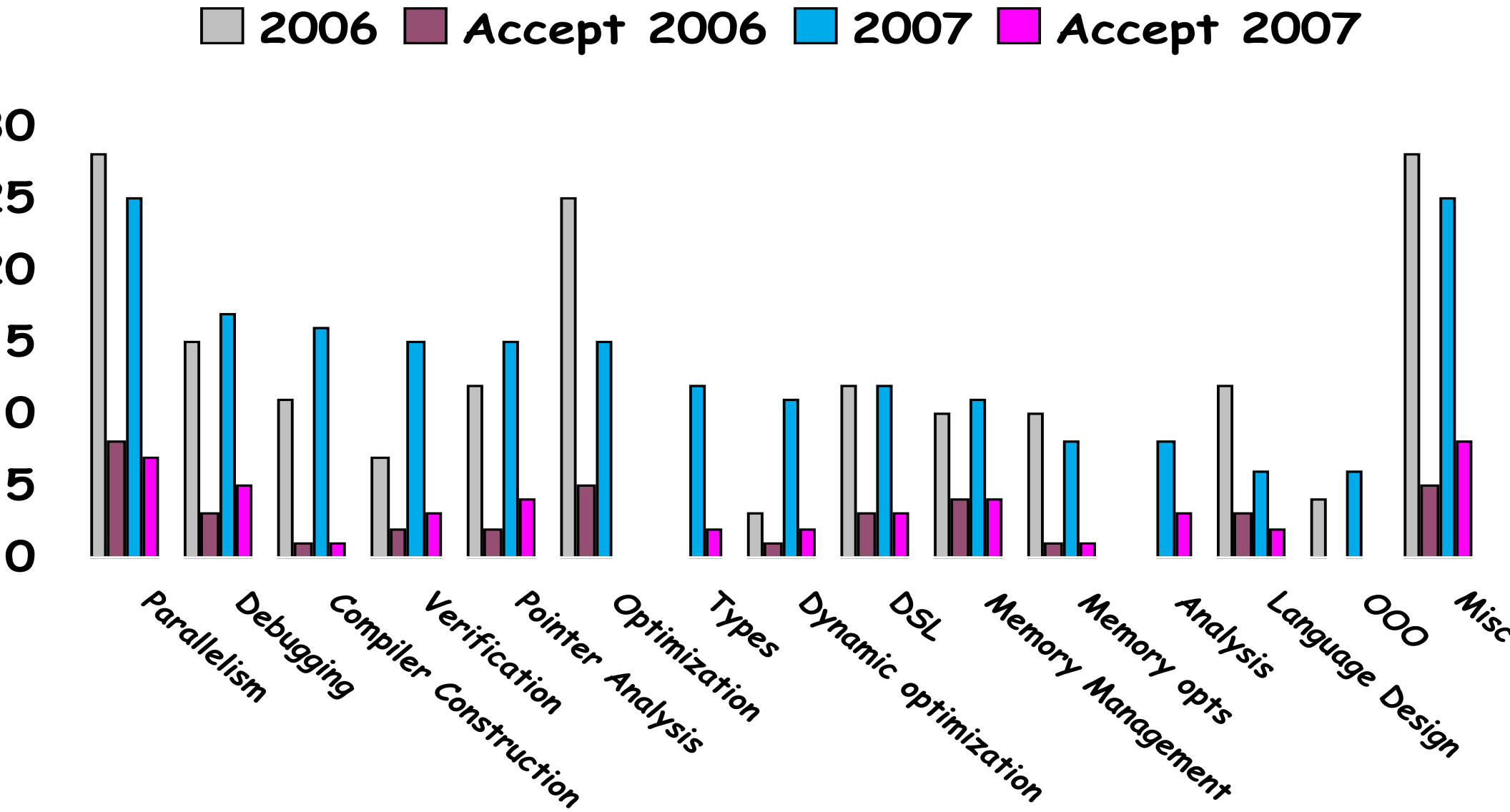
Proof languages
Model checking
Proof assistants
SMT solvers
Synthesis

Applications & Hardware Change

but… they always need a

programming language and implementation

PLDI 06 & 07 Topics Submitted/Accepted



Hot Topics in CS become PL topics

Big data & streaming

Approximation

Machine learning

Probabilistic programming

Human computation

Spreadsheets as programs

Hardware

- Multicore
- GPUs, accelerators
- Non volatile memo

Exploring new topics

Enhancing Server Availability and Security Through Failure-Oblivious Computing

OSDI 2004

Martin Rinard, Cristian Cadar, Daniel Dumi
Tudor Leu, and William S. Bee
Computer Science and Artificial Intelligen
Massachusetts Institute of Technol
Cambridge, MA 02139

Rejected for 3 years from PL venues

Abstract

We present a new technique, *failure-oblivious computing*, that enables servers to execute through memory errors without memory corruption. Our safe compiler for

1 Introduction

Memory errors such as out
invalid pointer accesses are a
failures. Safe languages such

ses and
of program
and Java use dy-

First paper

failure oblivious ➔ approximate computing

Exploring new topics

Uncertain<*T*>: A First-Order Type for Uncertain D

ASPLOS 2014

James Bornholt Todd Mytkowicz

Expressing and Verifying Probabilistic Ass

PLDI 2014

Sampson Pavel Panchekha Todd Mytkowicz Kathryn S. McKinley Dan

University of Washington Microsoft Research Univ

Rejected next papers for 3 years from PL & ML venu

Two papers

probabilistic programming for the rest of us

Sample reviews

... damage the field ....

This is utter nonsense.

t seems heavily based on Uncertain<T>

Researcher characteristics

thick skin

growth mind set

persistence

PL is fundamental to CS

Resources

Want to try out research?

www.cra-w.org

Are you considering graduate school?

http://conquer.cra.org

Need support in graduate school and beyond?

www.cra-w.org