Programming Languages in a Time of Technical Disruption

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The Rapidly Expanding World of Computing

- Medicine and Global Health
- Energy and Sustainability
- Security and Privacy
- Technology for Development
- Interacting with the Physical World
- Scientific Discovery
- Transportation
- Neural Engineering
- Elder Care
- Accessibility

CORE

CSE

- Natural language processing
- mobile
- HCI
- machine learning
- cloud computing
- big data
- sensors

Graphic: Lazowska

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Implications of CS + X...
Questions to Consider:

• How much does your life depend on software being correct?
• What’s the trend?
• Do governments have the understanding and/or ability to regulate this trend?
• When do you start worrying?
Every object is a computer
Every company is a software company

Towards the social media enabled jet engine

"What if my jet engine could talk to me and what would it say?" Asked Beth

Monsanto Is Using Big Data to Take Over the World

The GMO giant wants to help you beat climate change...with your phone.
—By Tim McDonnell | Wed Nov. 19, 2014 6:00 AM EST

Zorn, PNEPLSE 2016
Everything you do is recorded.
Isn’t this a Programming Languages Workshop?!
Programming languages have impact

• Financial modeling: Spreadsheets
• Mini computers/PCs: C / Unix
• Web: Java / WWW
• Web 2.0: HTML + JavaScript + CSS
• Statistics: S, R, ...

However...
• How many companies showing interest in PLDI?
• Why is industry attendance at SPLASH/OOPSLA reduced?
How will programming languages take us forward?

• Understanding verticals better
  • Cyber-physical systems
  • Health, energy, transportation, ... 

• How would you prevent Stuxnet?
  • Computer Scientist: “Reduce attack surface in software...”
  • Mechanical engineer: “Put a limit switch in the centrifuges!”

• Go where the problems are...
Public health is important...

What does this...

...have to do with this?

Four Zika virus cases reported in Bay Area

By Tracy Seipel, tseipel@mercurynews.com

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Safe Cyber Physical Systems Expedition

Safe and complex autonomy interacting with the physical world at scale and without failures.

Ranveer Chandra
Alex Ching
Ethan K. Jackson
Chris Hawblitzel
Ashish Kapoor

Mobility and Networking Research
Hardware lab
Research in Software Engineering
Systems Research Group
Adaptive Systems and Interaction Group

Mike Chieh-Jan Liang
Shaz Qadeer
Patrick Therien
Feng Zhao
Benjamin Zorn

Mobile and Sensing Systems Group
Research in Software Engineering
Hardware lab
Mobile and Sensing Systems Group
Research in Software Engineering

Slide courtesy of Jeannette Wing
Call to Action

• **Smart objects** will replace dumb objects

• The software embedded in this objects
  will be written in the next 5 years, but
  will have implications for the next 50 years

• **Our lives will depend on** these objects...
  • “I BOUGHT SOME AWFUL LIGHT BULBS SO YOU DON'T HAVE TO”
  • By Matthew Garrett, [https://mjg59.dreamwidth.org/40397.html](https://mjg59.dreamwidth.org/40397.html)
  • (via Jonathan Protzenko)

• **We need languages, tools, and processes** to make these objects safe
The Cathedral and the Skyscraper

Heroic effort, amazing engineering, one of a kind...

Stronger materials, reusable components, mathematical analysis...

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To ensure appropriate spectrum planning and interagency coordination to support the Internet of Things.

IN THE SENATE OF THE UNITED STATES

MARCH 1, 2016

Mrs. Fischer (for herself, Ms. Ayotte, Mr. Booker, and Mr. Schatz) introduced the following bill; which was read twice and referred to the Committee on Commerce, Science, and Transportation