COMPUTER SCIENCE & ENGINEERING
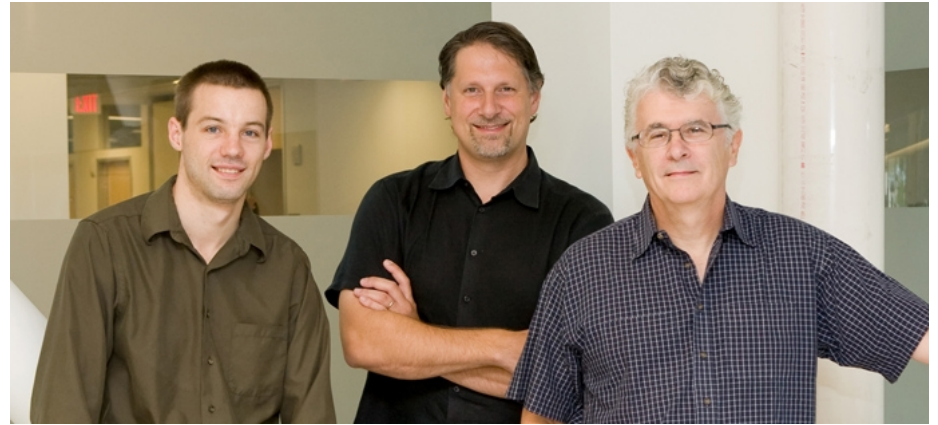## UNIVERSITY OF MICHIGAN

Graduate Students Information Webinar
March 10, 2017

Welcome to CSE @ Michigan!

Welcome to CSE @ Michigan!

- *Our Environment:*
  - Collaborative, collegial, and intellectually enriching

- *Our Research:*
  - Deep in addressing fundamental issues
  - Broad in interdisciplinary perspective

- *Our Alumni:*
  - Changing the World …

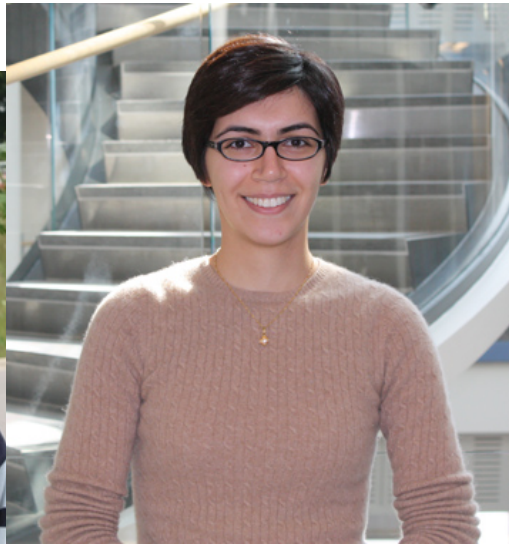# A Growing, Active, & Accomplished Faculty

- *74 Faculty:*

  - 11 ACM Fellows, 17 IEEE Fellows, 6 AAAI Fellows, 4 AAAS Fellows, 2 SIGCHI Academy, 1 CSS Fellow, 10 Sloan Fellows, 1 MacArthur Fellow

  - 37 National Science Foundation CAREER and PECASE Award winners

  - Numerous ACM, IEEE and USENIX national awards

- *17 Faculty with joint appointments in CSE:*

  - Electrical Engineering, School of Information, Medical School, Math…

Your Future Colleagues

- 337 graduate students, Fall 2016

- 79 MS and PhD degrees granted last year

An Abundance of Support for Research

Expenditures of **$25+ millions in FY16.**

Government Sponsors:

- National Science Foundation
- National Institute of Health
- Department of Homeland Security
- Department of Defense
  - AFOSR
  - ARO
  - DARPA
  - ONR
  - TARDEC
- Department of Energy
- Department of Interior
- NASA
- National Security Agency
- State of Michigan

Industry Sponsors:

- American Heart Association
- ARM, Boeing Company
- Cisco, Ford, General Electric
- General Motors
- Global Foundries, Google,
- Hewlett Packard, IBM, Intel
- Lockheed Martin, Micron
- Microsoft, NEC
- Northrop Grumman, Oracle
- Raytheon Samsung,
- SRC, Sloan Foundation,
- Soar Technologies,
- Texas Instruments,
- Toyota, VeriSign, Yahoo!

Unique Research Ecosystem

Statistics

U-M Hospital

Data Science Initiatives

MICHIGAN INSTITUTE FOR DATA SCIENCE
UNIVERSITY OF MICHIGAN

Connections in CoE, Med School, LSA, ISR

COMPUTER SCIENCE & ENGINEERING
UNIVERSITY OF MICHIGAN

School of Info

Industry

intel
ARM
Ford
IBM
Google

Robotics Institute

MCity

Breadth, Depth, and an Interdisciplinary Perspective

- *5 Laboratories:*

  - Artificial Intelligence
  - Computer Architecture
  - Interactive Systems
  - Software Systems
  - Theory of Computation

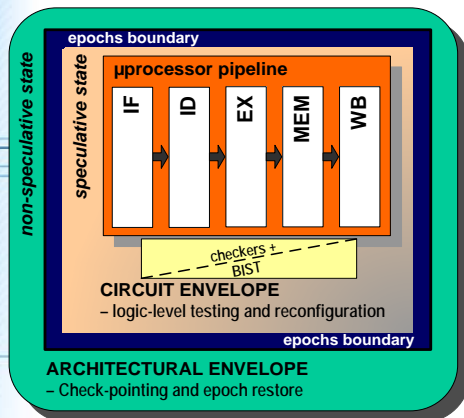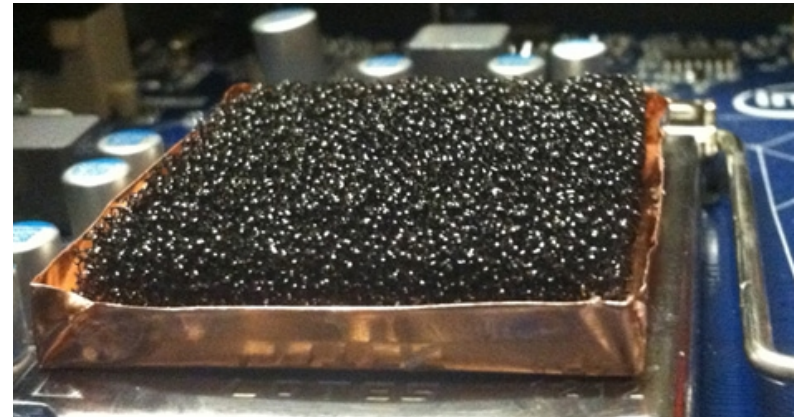- *Areas of Research:*

  - Bioinformatics & medical
  - Robust, low-power computing
  - Pervasive and mobile computing
  - Robotics
  - Security and privacy
  - Cognitive agents
  - "Green" & cloud computing
  - Self-healing systems
  - Quantum computing
  - Machine learning
  - Human computer interfaces
  - Socially relevant applications
  - Technology in performance arts
  - …

Computer Engineering Lab

Faculty:

Austin, Bertacco, Chen, Das, Dreslinski, Dutta, Fu, Hayes, Mahlke, Markov, Mars, Mazumder, Mudge, Narayanasamy, Papaefthymiou, Sakallah, Tang, Wenisch
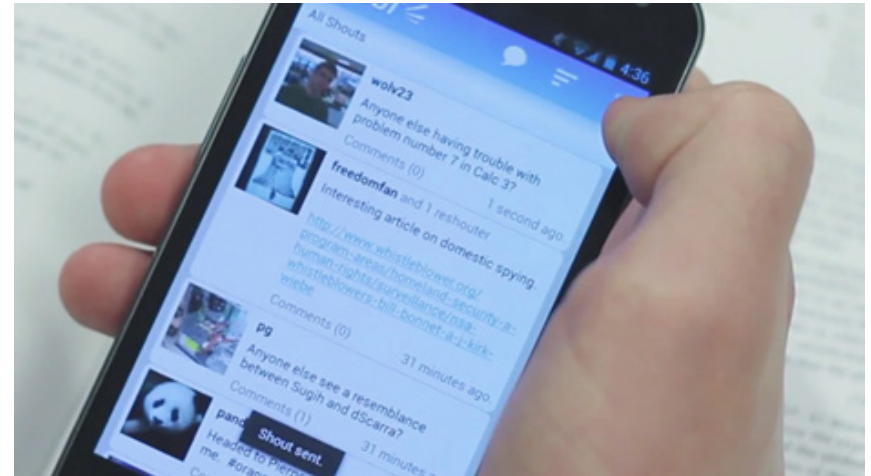
Software Systems Lab

Faculty:
Cafarella, Chen, Chesney, Chowdhury, Compton, Dutta, Flinn, Fu, Halderman, Honeyman, Jagadish, Jamin, Koutra, Lasecki, Lee, Madhyastha, Mao, Mozafari, Narayanasamy, Noble, Prakash, Shin, Stout
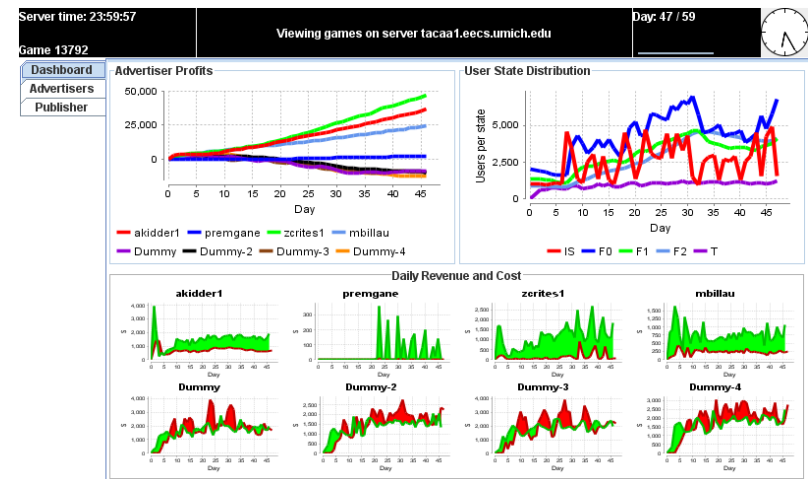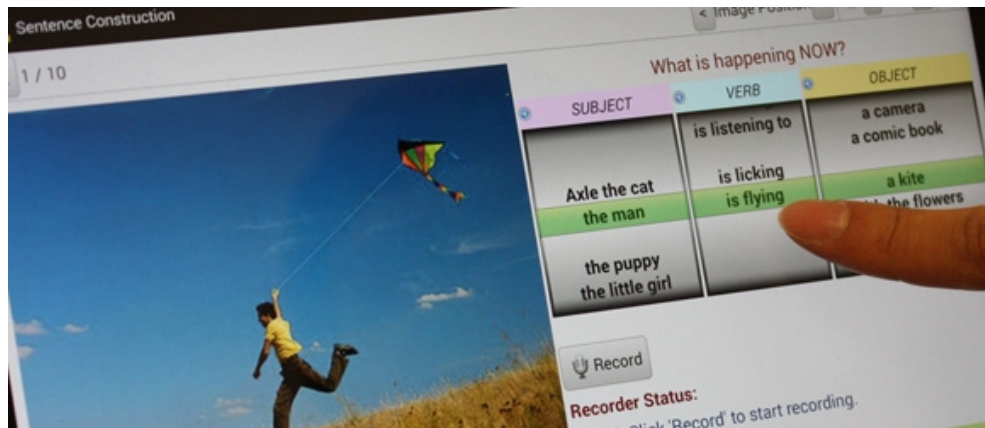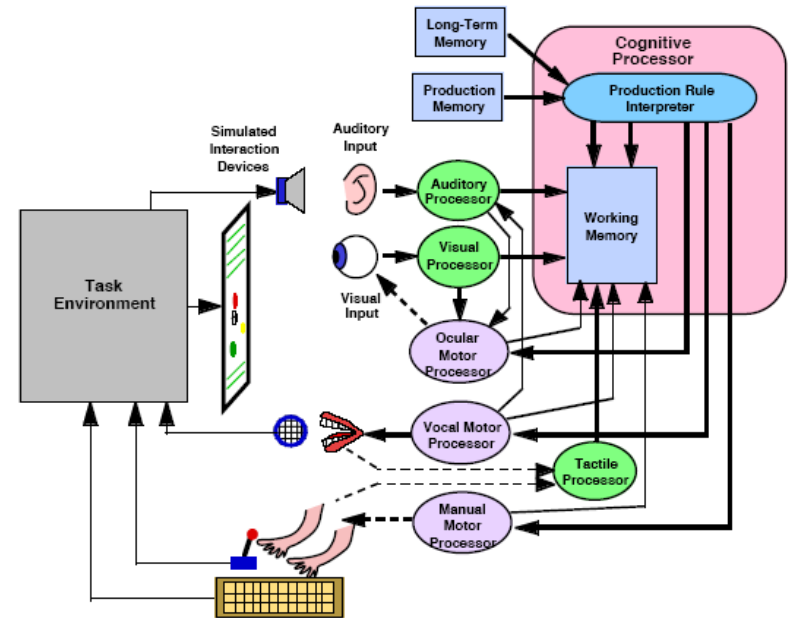
Big Data

Artificial Intelligence Lab

Faculty:
Abernethy, Baveja, Deng, Durfee, Jenkins, Koutra, Kieras, Kuipers, Laird, Lasecki, Lee, Mihalcea, Mower Provost, Olson, Radev, Syed, Wellman, Wiens
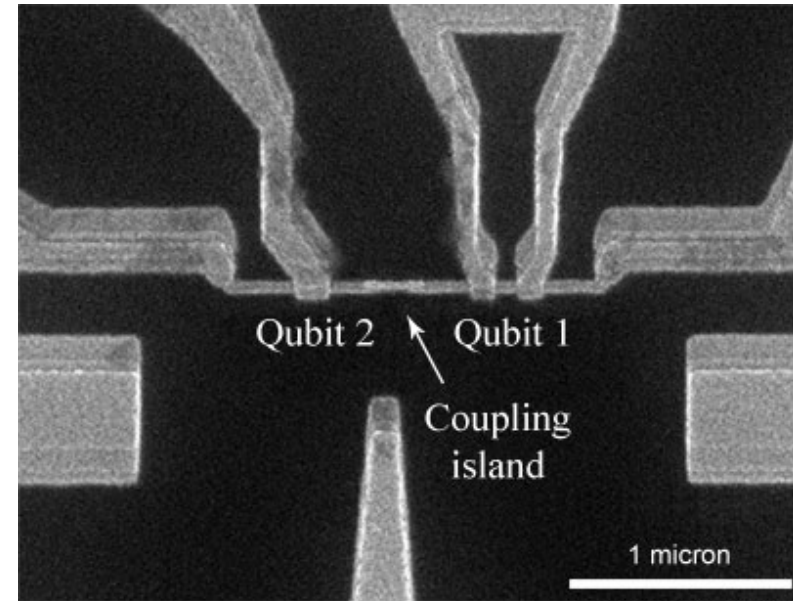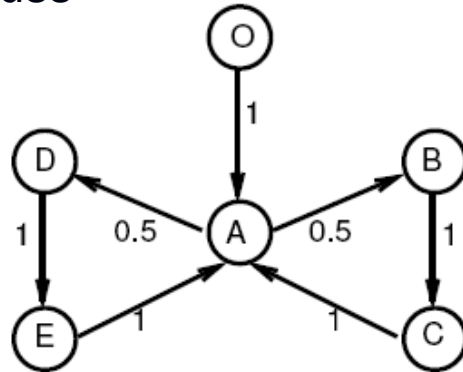
Interactive Systems Lab

Faculty:
Ackerman, Adar, Essl, Kieras,
Lasecki, Mihalcea, Mower
Provost, Soloway, Wakefield

Theory of Computation Lab

Faculty:

Compton, Hayes, Miller,
Markov, Peikert, Pettie,
Schoenebeck, Shi, Stout,
Strauss

Qubit 2   Qubit 1

Coupling
island

1 micron

Source: NEC Research

$$\|T\|_\diamond = \min \left\{ \|\sum_t A_t^\dagger A_t\| \cdot \sqrt{\|\sum_t B_t^\dagger B_t\|} \; : \; A_t, \; B_t \in \mathbf{L}(\mathcal{N}), \; T = \sum_t A_t \cdot B_t^\dagger \right\}$$
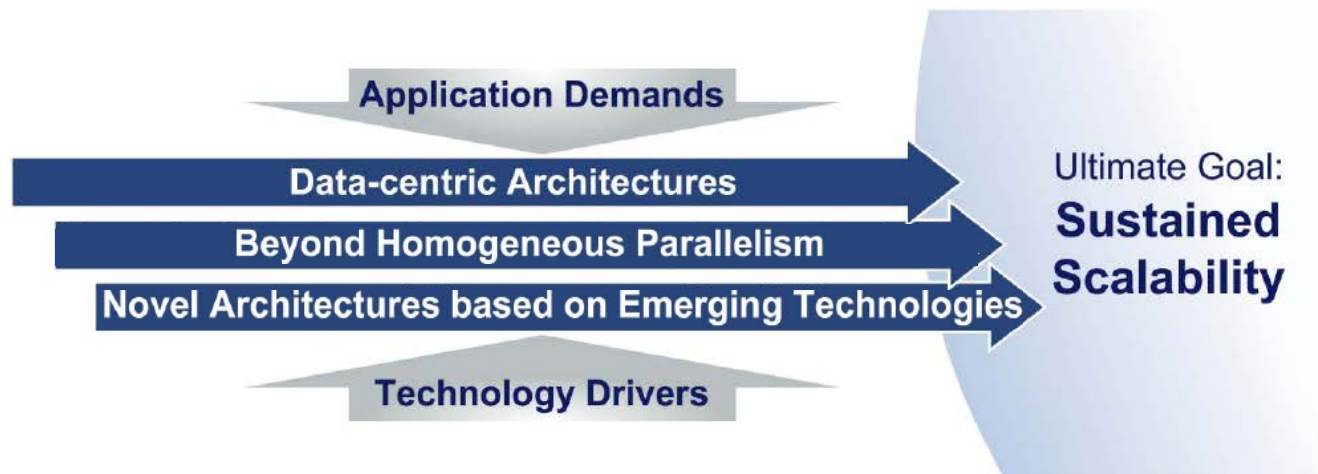
CSE trends

- 20 new tenure-track faculty since 2011
- Fully-funded 5-year offers to all incoming graduate students
- Student enrollment and research continues to grow

Research Centers in Computer Engineering

- **Center for Future Architectures Research**

- $28.5M, 5-year center funded by SRC
  with support from DARPA

- Led by Todd Austin; investigators include
  Bertacco, Das, Mahlke, Narayanasamy

- Goal: To create future generation scalable computing systems

Application Demands

Data-centric Architectures

Beyond Homogeneous Parallelism

Novel Architectures based on Emerging Technologies

Technology Drivers

Ultimate Goal:
**Sustained
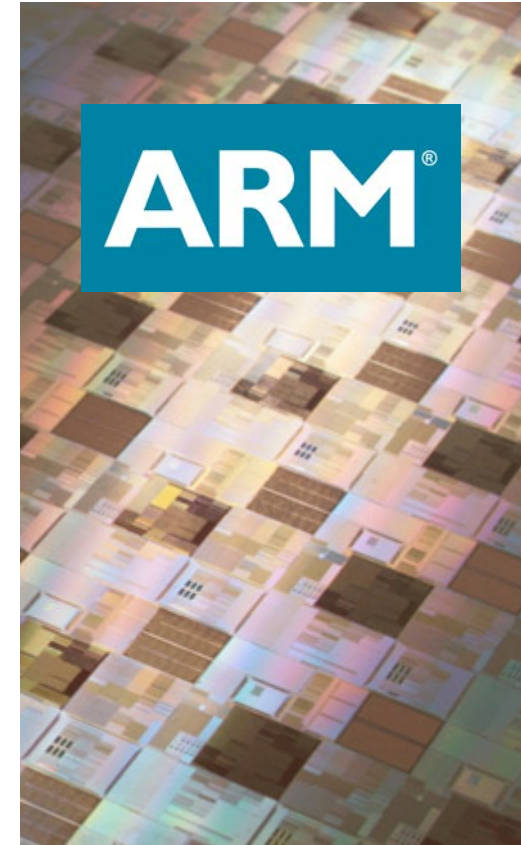Scalability**

Research Centers in Computer Enginering

- ## ARM Research Center

  - $10M relationship over 10 years funded by ARM - has been renewed for 2 more years

  - Led by Trevor Mudge; investigators include Das, Dreslinski, Mahlke, Sakallah, Sylvester, Wenisch

- Goal: To research enabling technologies for ultra-low energy and sustainable computing

- Application areas: cloud computing, wearable medical and lifestyle devices, energy-efficient trusted computing, and ubiquitous sensor networks
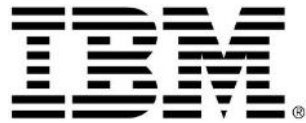
Where Do Our PhD Grads Go?

- *Faculty - Academia*

Where Do Our PhD Grads Go?

- *Industrial R&D Labs*

Where Do Our PhD Grads Go?

- *Startups*

Some of Our Alumni

- Larry Page – Co-Founder of Google
- Jennifer Rexford – Professor at Princeton University
- Kunle Olukotun – Professor at Stanford University
- Rob Malan – CTO at Arbor Networks
- Thomas Knoll – Inventor of Photoshop
- Dick Costolo – CEO of Twitter
- Bob Muglia – President of Server & Tools at Microsoft
- Usama Fayyad – VP at Barclays
- Greg Joswiak – VP of iPod & iPhone Marketing at Apple
- Kevin O'Conner – Founder of DoubleClick
- Tim Howes – LoudCloud, HP, and RockMelt
- Mark Abel – Director of Solutions Architecture at Intel
- Michael Stonebraker – Professor at MIT
- Sid Meier – Creator of Civilization / Co-Founder of Firaxis
- Tony Fadell – Inventor of iPod
- Bill Joy – Co-Founder of SUN