NSF Workshop on Designing Tools and Curricula for Undergraduate Courses in Distributed Systems

Boston, Massachusetts
July 8, 2012
Welcome!

- Thanks for coming!
- Acknowledgements
  - Organizing Committee
    - Jay Akait and Mark Berman
  - Funding and support
    - NSF
    - Jeff Forbes, Bryan Lyles, and Keith Marzullo
Logistics

• For reimbursement, please mail receipts to:
  Jeannie Albrecht
  47 Lab Campus Dr
  Williamstown, MA 01267
  by AUGUST 1, 2012.

• If you plan to stay for GEC, you must register

• Workshop webpage:
Wireless Access

- SSID: GlobalSuiteMeeting
- Meeting Room: Wireless
- Group/Company Name: GENI2012
- Password: GENI33
Why Distributed Systems?

• Distributed systems - collections of networked computers that function as single systems

• When designed correctly, distributed systems improve scalability, fault tolerance, response time of Internet applications

• Distributed systems are widely used by many major companies
Challenges

- Developing, debugging, deploying distributed systems introduces new challenges
  - Can be overwhelming to new developers
- Students benefit from the opportunity to design, implement, deploy, and evaluate real systems in real environments
  - Learn techniques for coping with common challenges

- Unfortunately undergraduate curriculums rarely offer Distributed Systems courses
  - Students are not fully prepared for jobs/grad school
Overcoming Limitations

• Until recently, many colleges and universities did not have the local computing resources required for large-scale experimentation

• Options were mainly emulation and simulation
Advancements in Technology

- New options have appeared in the last decade
- There are now many public testbeds available
  - Developers can “rent” Amazon, Google, and Microsoft resources
  - Shared platforms like GENI provide a variety of deployment options
- Role of MOOCs (Massively Open Online Courses)
Workshop Goals

• (Re)Define undergraduate distributed systems educational goals
• Integrate new technologies with classic concepts
• Leverage availability of public testbeds to give students hands-on experience with the development of distributed systems
Workshop Deliverables

- Written report
- Collection and aggregation of course-related resources for educators
- Community building
Draft Agenda

• 8:00 - 8:30: Continental Breakfast, Registration
• 8:30 - 9:00: Opening Remarks
• 9:00 - 10:30: Session 1 – Platforms
• 10:30 - 10:45: Coffee/Tea Break
• 10:45- 12:15: Session 2 – Educator Experiences
• 12:15 - 1:30: Lunch
• 1:30 - 3:00: Session 3 – Educator Experiences
• 3:00 - 4:00: Integrating classical and modern topics
• 4:00 - 4:15: Coffee/Tea Break
• 4:15 - 5:15: Panel/Round-table discussion and wrap-up
Opening Remarks

• Keith Marzullo
  • Division Director for the Computer and Network Systems Division (CNS) in the Computer and Information Science and Engineering Directorate (CISE) of the NSF

• Jeff Forbes
  • Program Director for the Education and Workforce Program for the CNS Division in the CISE Directorate of the NSF
Session 1 – Platforms

• Getting access, managing student accounts, how to use in classroom, etc.
  • Justin Cappos (NYU Poly) – Seattle
  • Gary Wong (Utah) – ProtoGENI
  • Armando Fox (UC Berkeley) – Amazon EC2 and other cloud-based educational technology
  • Jeff Chase (Duke) – ORCA
Session 2 – Educator Experiences

- Assignments, textbooks, etc., primarily used in small colleges
  - Jeannie Albrecht (Williams College) – Undergrad Distributed Systems
  - Joel Sommers (Colgate University) – Undergrad Computer Networks
  - Tia Newhall (Swarthmore College) – Undergrad Parallel and Distributed Computing
  - Zongming Fei (Kentucky) – Undergrad Networks and Distributed Operating Systems / Calvin College Emulab
Session 3 – Educator Experiences

- Assignments, textbooks, etc., primarily used in large universities
  - Armando Fox (UC Berkeley) – Massively open online courses (MOOCs)
  - Sonia Fahmy / Ethan Blanton (Purdue) – GENI-based classroom exercises
  - Anish Arora (The Ohio State) – Projects designed for local and remote testbeds
  - Mark Berman (BBN/GENI) – Sample assignments designed for GENI
Common Themes

• Breadth over depth; introduce students to a variety of technologies
• “Learn by doing”
• Debugging in wide-area is challenging
• Read/write papers in addition to code
• Expose students to low level details (i.e., sockets)
• Open-ended/Independent final project
• “Short”/well-defined labs early in semester
• Experimentation and analysis of systems
Specific skills/concepts:
  • Makefiles, revision control, debugging tools, scripting, latex, gnuplot, using threads, sockets

Combination of textbook and research papers

External resources critically valuable (for small and large universities)

Give students experience with “real” resources/environments
Discussion

• Any remaining unanswered questions?
• What is the best way to disseminate the material we’ve discussed today?
• Best way to share materials more generally?
• Final thoughts?