David Kaeli
Department of Electrical and Computer Engineering
Northeastern University
Boston, MA
ABOUT NORTHEASTERN UNIVERSITY

- Northeastern University is located in Boston, MA
  - A research hub, silicon-valley of the east
  - Northeastern University is a leading cooperative education school
    - Over 600 industry partners
    - Many of these partners already support research @ NU
  - Northeastern University is ranked 40th of national universities, ranked 7th as the most innovative university, COE ranked 42nd (USNWR)
  - Northeastern University is a Carnegie R1 research university
  - Northeastern University has more >30 federally-funded research centers
    - The ECE Department (the primary department and home of the proposed site) received >$17M in funding in 2016
WHY NORTHEASTERN UNIVERSITY?

- Concentration of faculty working in relevant ES$^2$ technology areas
- Complement the existing faculty in ES$^2$
- Northeastern is a founding member of the Massachusetts Green High Performance Computer Center (MGHPCC)
  - 90,000 sq. ft., 15 megawatt
  - Supports thousands of researchers at Northeastern, Boston U., UMASS, MIT and Harvard
- John Goodhue is the Executive Director – here today
- Site Director Kaeli serves as on the MGHPCC research committee for Northeastern and the research co-lead for the consortium
WHAT CAN NU BRING TO THE ES2 CENTER?

- 9 ECE and 1 CCIS faculty – more will be encouraged to join in the future
- **Computer Architecture and Systems**
  - **Prof. Peter Desnoyers** (College of Computer and Information Sciences) - memory system design and performance
  - **Prof. Yunsi Fei** (Dept. of Electrical and Computer Engineering) – hardware security, power management and design
  - **Prof. David Kaeli** (Dept. of Electrical and Computer Engineering and Site Director) - accelerator power/performance, virtualization and power management, and system reliability
  - **Prof. Shelley Lin** (Dept. of Electrical and Computer Engineering) – near-threshold low-power systems, high performance computing
  - **Prof. Devesh Tiwari** (Dept. of Electrical and Computer Engineering) – data center power efficiency, capacity planning and reliability
WHAT CAN NU BRING TO THE CENTER?

Software Systems:

- **Prof. Stratis Ioannidis** (Dept. of Electrical and Computer Engineering) – data analytics, distributed systems and optimization
- **Prof. Ningfang Mi** (Dept. of Electrical and Computer Engineering) - data center scheduling and cloud system management, and emerging storage systems

VLSI/Circuit Technology:

- **Prof. Yong-Bin Kim** (Dept. of Electrical and Computer Engineering) - power/thermal design, analog and digital design
- **Prof. Marvin Onnabajo** (Dept. of Electrical and Computer Engineering) – analog/digital circuit design
- **Prof. Aatmesh Shrivastava** (Dept. of Electrical and Computer Engineering) – low-power interconnects, energy harvesting
WHAT CAN NU BRING TO THE CENTER?

- 5 NSF CAREER Awardees, 3 beginning faculty
- Extensive industry experience (over 35 years of combined)
- Existing/recent industry projects with AMD, Analog Devices, EMC/Dell, LTX, Massa Products, Qualcomm, Samsung, Seodu Logic, Techwin Corp., VMware
- Facilities
  - MGHPCC – 90,000 sq. ft. 15 megawatts, Holyoke, MA
  - NU Computer Architecture Research Lab
  - NU High Performance VLSI Lab
  - NU Energy-Efficient and Secure Systems Lab
  - NU Computer Systems Research Lab
WHAT CAN NU ADD TO THE CENTER?

- The existing ES I/UCRC is focused around four problem-oriented research thrusts that include:
  - Software systems that dynamically allocate workload and control energy consumption at multiple scales (device to multiple data centers);
  - Control systems that interface between the software systems and the physical infrastructure;
  - Thermal management protocols that are based on a wide range of analytical and empirical models and that get integrated into the software systems;
  - Implementation and assessment of prototype implementations of proposed systems, first in a lab environment, followed by full-scale implementation at partner industrial and end-user facilities.
WHAT CAN NU ADD TO THE CENTER?

- The addition of the Northeastern ES² Site will enhance the Software systems thrust, and add three new complementary thrusts to the Center:
  - Power effective design that evaluates hardware systems to provide for improved power, performance, security and reliability.
  - Storage System Design that evaluates the potential benefits of integration and configuration of emerging storage technologies in data center and HPC settings.
  - Accelerators that are increasing in number in data centers and HPC systems, considering both scheduling and hardware/software tradeoffs.
  - Evaluate of new power-effective technologies for the datacenter.
WHAT ARE THE BENEFITS OF AN IUCRC?

- Access to talented research faculty
- Access to potential future employees (students)
- Part ownership in a Center – participate in the governance and direction of the Center
- Access to Intellectual Property and early publications across the Center
- Access to a broad set of technologies
WHAT IS OUR PLAN GOING FORWARD?

- The goal of today’s is to present the research capabilities of the faculty involved and to explain the value proposition offered by an IUCRC Center
- To join ES2, the Northeastern team must secure four $50K/yr. grants, or the equivalent, and maintain this level of support through the next phase of the Center
- Our potential partners – some could not attend today
QUESTIONS?