Towards Sustainable Computing:
Innovative Design and Management Strategies Across the Computing Stack

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1. New modeling methods and tools for 3D-stacked systems
   - Supported (partially) 3 PhD theses: Dr. J. Meng, Dr. T. Zhang, and Dr. F. Kaplan.
   - 2 book chapters and a number of journal and conference papers, including IEEE TCAD’17, DATE’16, ACM JETC’15, DATE’14, TCAD’13, DAC’12, others.
   - 3D prototype design: 3D MMC (DATE’13).
   - Software release: 3D detailed thermal modeling tool (integrated into HotSpot v6.0).
   - Outreach: undergraduate projects, high school interns, lectures/labs at summer sessions for high school girls, 20+ invited talks at academia and industry.

2. Advancing architecture and system management
   - Outcomes:
     - Encapsulate dynamics of cutting-edge cooling methods into compact thermal models.
     - Mix and match the best-fit cooling methods with the computing system.
     - Localize placement of advanced cooling over hot spots.
     - Optimize design and runtime decisions (computing and cooling systems).

3. Heterogeneous integration with new devices and advanced cooling
   - Sample focus research projects enabled:
     - Localized cooling co-design for carbon nanotube processors.
     - Designing a heterogeneous computer with a hybrid cooling system.
     - Next-generation energy efficient data centers.
     - Thermal side-channel proof systems.

4. Sustainable IT and IT for Sustainability: Data Centers in the Smart Grid
   - Collaborators: M. Caramanis and Y. Paschalidis @ BU, S. Reda @ Brown.

5. Automated Analytics for Improving Efficiency, Safety, and Security of HPC Systems
   - Collaborators: M. Egele and A. Turk @ BU; V. Leung and J. Brandt @ Sandia Labs.

6. Scalable Software and System Discovery in the Cloud
   - Collaborators: A. Turk @ BU; C. Isci, S. Duri, N. Bila @ IBM Tj Watson.

7. 3D Stacked Systems for Low-Power High-Performance Computing
   - (NSF CAREER 2012-2017)

8. Hybrid Cooling Co-Design:
   - Collaborators: S. Reda @ Brown, E. Wang @ MIT.

Figure: LSM, EPFL

Performance and Energy Aware Computing Laboratory
www.bu.edu/peaclab

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