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## **BU/UMass/Northeastern Collaboration awarded \$5M to Create New Cloud Computing Testbed**

*BU ECE Professors Orran Krieger and Martin Herbordt Awarded \$1.4M to Develop New Cloud Computing Platforms*

BOSTON, Mass. –Boston University Professors Orran Krieger and Martin Herbordt are among a team of researchers that will develop a testbed for research and development of new cloud computing platforms thanks to a grant from the National Science Foundation. The collaborative project includes UMass Amherst and Northeastern University and could reach a total of \$5 million if fully funded after a review by the NSF in three years. The funding for Boston University is expected to total \$2,050,000 over five years.

Cloud computing, the delivery of services over the internet, plays an important role in supporting most applications we currently use. Testbeds such as the one being constructed by the research team, are critical for enabling new cloud technologies and making the services they provide more efficient and accessible to a wide range of scientists focusing on research in the area of computer systems.

Krieger and Herbordt are both professors of electrical and computer engineering (ECE) at Boston University's College of Engineering. The project's leadership team also includes Michael Zink, associate professor of electrical and computer engineering (ECE) at UMass Amherst, Peter Desnoyers, associate professor at Northeastern University Khoury College of Computer Sciences, and Miriam Leeser, professor at Northeastern University, College of Engineering. Zink says, "This testbed will accelerate innovation in cloud technologies, technologies affecting almost all of computing today."

By providing capabilities that currently are only available to researchers within a few large commercial cloud providers, the new testbed will allow diverse communities to exploit these technologies, thus "democratizing" cloud-computing research and allowing increased collaboration between the research and open-source communities.

This project will construct and support a testbed for research and experimentation into new cloud platforms – the underlying software which provides cloud services to applications. Testbeds such as this are critical for enabling research into new cloud technologies. This is research that requires experiments that potentially can change the operation of the cloud itself.

The testbed will integrate capabilities developed in the CloudLab testbed with the Mass Open Cloud (MOC), an academic cloud hosted by Boston University's Hariri Institute for Computing and developed through a partnership of academia (Boston University, Harvard University, Northeastern University, Massachusetts Institute of Technology, and the University of Massachusetts), government (Mass Tech Collaborative, USAF), and industry (Red Hat, Intel, Two Sigma, NetApp, Cisco). Over the past six years, the MOC has grown into a community of thousands of users and provides the ideal environment for this purpose. The testbed and the

MOC are possible because of the Massachusetts Green High-Performance Computing Center, a 90,000 square foot, 15-megawatt facility located in Holyoke, MA and established as a joint venture between Boston University, Harvard University, the Massachusetts Institute of Technology, Northeastern University, and the University of Massachusetts. “An important part of the MOC has always been to enable cloud computing research by the academic community”, says Krieger. “This project dramatically expands our ability to support researchers both by providing much richer capabilities and by expanding from a regional to a national community of researchers.”

The new testbed will combine proven software technologies with the MOC and enhanced with new technologies including programmable hardware called Field Programmable Gate Arrays (FPGA). FPGAs provide capabilities not present in other facilities available to researchers today, enabling investigation into hardware acceleration techniques. “Field Programmable Gate Arrays (FPGAs) provide a new level of parallelization and acceleration in the cloud,” says Leeser. “This new infrastructure will be on the cutting edge and allow many research areas such as security and privacy, machine learning, bioinformatics, provide solutions faster, and process even greater amounts of data.”

The combination of a testbed and production cloud allows for work on a larger scale compared to isolated testbeds, reproducible experimentation based on realistic user behavior and applications, as well as a model for transitioning successful research results to practice. All of these features are currently not offered by commercial cloud providers to computer systems researchers. The community outreach portion of the project aims to identify, attract, and retain interested researchers, and to educate them in the use of the facility. Tutorials, workshops, and webinars will offer training in the use of the testbed. The project will support educating the next generation of researchers in this field, and existing relationships with industrial partners of the affiliated production cloud will accelerate technology transfer from academic research to practical use. The testbed also offers a unique sustainability model by allowing additional computing resources to be dynamically moved from institutional uses into the testbed and back again, providing a path to growth beyond the initial testbed.

Additional information on the project is available [here](#).