

Position Statement

Open Cloud Testbed: A Testbed for the Research Community Exploring Next-Generation Cloud Platforms

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Cloud testbeds are critical for enabling research into new cloud technologies - research that requires experiments which potentially change the operation of the cloud itself. Several such testbeds have been created in recent past (e.g., Chameleon, CloudLab, etc.) with the goal to support the CISE systems research community. It has been shown that these testbeds are very popular and heavily used by the research community [1]. Testbed utilization often reaches 100%, especially ahead of deadlines for major systems conference, while there are also periods of modest (<40%) testbed usage.

Based on these findings the goal of our NSF “Open Cloud Testbed” (OCT) project is to enable elastic cloud testbed for systems research. Eventually, OCT will allow cloud testbeds to grow and shrink by allocating and deallocating additional resources from compute facilities like production clouds and HPC clusters. Within the OCT project we will create a prototype elastic cloud testbed. OCT will combine proven software technologies from both the CloudLab and the Massachusetts Open Cloud (MOC) projects. It will also combine a research cloud testbed (CloudLab) with a production cloud (MOC) through OCT’s tight integration with the latter and federation with CloudLab. In addition, OCT will provide programmable hardware (FPGAs) capabilities not present in other facilities available to researchers today. The combination of a testbed and production cloud allows a) larger scale compared to isolated testbeds, b) reproducible experimentation based on realistic user behavior and applications, as well as c) a model for transitioning successful research results to practice. The programmable hardware will be a unique resource enabling investigation into hardware acceleration techniques, research not possible on testbeds available to cloud researchers today, and the community outreach portion of the project aims to identify, attract, and retain these researchers, and to educate them in the use of the facility. The testbed offers a unique sustainability model, by allowing additional compute resources to be dynamically moved from institutional uses into the testbed and back again, providing a path to growth beyond the initial testbed.

In providing capabilities that today are only available to researchers within a few large commercial cloud providers, we believe that OCT will allow diverse communities to exploit these technologies, “democratizing” cloud computing research, and allowing increased collaboration between the research and open source communities. To achieve this goal our activities will also include community outreach activities targeted to researchers who explore complex distributed systems and cloud platforms, spanning a diverse range of backgrounds, institutions, and regions. Software tools will be developed to provide easy and efficient access by these researchers; tutorials, workshops, and webinars will offer training in the use of these tools and the testbed itself. The project will support educating the next generation of researchers in this field, and existing relationships with industrial partners of the MOC will accelerate technology transfer from academic research to practical use.

While OCT will initially be available for CISE systems researchers in the US, we seek international collaborations to extend the vision of an elastic cloud testbed by involving the international research community. We seek international collaborations with providers of cloud research testbeds. We would like to use the opportunity at GEFI to introduce our new approach for elastic cloud testbeds with the goal to identify partners for potential international collaborations. We are also eager to collect feedback from the international research community about the proposed testbed and the features they would like to see enabled in such research infrastructure. We especially look forward to discuss our project with communities that already operate cloud testbeds and/or are interested in including new accelerator technologies (i.e., FPGAs) in their testbeds.

- [1] Dmitry Duplyakin, Robert Ricci, Aleksander Maricq, Gary Wong, Jonathon Duerig, Eric Eide, Leigh Stoller, Mike Hibler, David Johnson, Kirk Webb, Aditya Akella, Kuangching Wang, Glenn Ricart, Larry Landweber, Chip Elliott, Michael Zink, Emmanuel Cecchet, Snigdhaswin Kar, and Prabodh Mishra. 2019. The design and operation of cloudlab. In Proceedings of the 2019 USENIX Conference on Usenix Annual Technical Conference (USENIX ATC '19). USENIX Association, Berkeley, CA, USA, 1-14.