

FutureGrid is a national-scale Grid, Cloud and HPC computing test-bed service of modest size that includes a number of computational resources at five distributed locations. FutureGrid systems total 4700 cores and provide totally reconfigurable generic nodes with some featuring special hardware or software. Special capabilities provided include large memory (up to 384 GB per node), large disk (up to 12 TB per node), GPU's, SSD disk and ScaleMP virtual shared memory software. The FutureGrid network is unique and can lend itself to a multitude of experiments specifically for evaluating middleware technologies and experiment management services. This network can be dedicated to conduct experiments in isolation, using a network impairment device for introducing network latency, jitter, loss, and errors to network traffic within FutureGrid. All network links within FutureGrid are dedicated (10GbE lines for all but to Florida, which is 1GbE), except the link to TACC. The significant number of distinct systems within FutureGrid provides a heterogeneous distributed architecture and are connected by high-bandwidth network links supporting distributed system research. One important feature to note is that some systems can be dynamically provisioned, e.g. these systems can be reconfigured when needed by the FutureGrid RAIN environment, with proper access control by users and administrators.

We continued an active portfolio of projects with (August 15 2013) a total of 325 approved in the major usage areas: Computer Science and Middleware (50.6%), Interoperability (3.1%), Computer Systems Evaluation (8.8%), Domain Science Applications (22.4% divided equally between life sciences and other) and Training Education and Outreach (15%). Our registered users at end of reporting period was 1887. We see a growing interest in OpenStack cloud environment where we recently added the Grizzly release. Note that FutureGrid has now been operational for three years. We now support project and user requests through the XSEDE portal.

We continued our support of educational applications as the flexible interactive usage mode of FutureGrid is well suited to education. Here we added MOOC's (Massively Online Open Courses) describing both the use of FutureGrid and the 2012 Science Cloud Summer School. FutureGrid has supported over three years: 28 Semester long classes (with 563+ students) covering Cloud Computing, Distributed Systems, Scientific Computing and Data Analytics; 3 one week summer schools (with 390+ students) covering Big Data, Cloudy View of Computing (for HBCU's), and Science Clouds; 7 one to three day workshop/tutorials with 238 students.

FutureGrid has developed novel tools to support "“Computing Testbeds as a service” where RAIN can dynamically deploy both cloud and bare metal environments on demand. This software is still dependent on some components like the IBM xCAT and Moab that we are augmenting with more general open source systems. Our RAIN system integrates an image repository that can store images as templates so they can be deployed on bare metal or different commercial or academic virtual machine management environments. This is being exploited by a new tool CloudMesh which has an advanced Cloud metrics support that can be integrated with XSEDE tools. Further it supports "Resource (Cloud/HPC) Shifting" or dynamic resource provisioning allowing one to add more resources to a cloud or HPC capability from resources that are not used or are underutilized. This extends a core "cloud/HPC bursting" feature that moves workload (images/jobs) to other clouds (or HPC Clusters) in case your current resource gets over utilized. The initial open source release of CloudMesh is August 2013.