A Tool for Testing Supercomputer Software

Software testing and debugging has long been a challenge for parallel and distributed systems. Testing is a tedious and time-consuming task, often requiring as much as much as two-thirds of the overall cost of software production. On today's DOE supercomputers with tens of thousands of processors, testing and debugging is further complicated by the number of places a fault can occur.

Sandia National Laboratories researchers have developed a software tool called APITest to evaluate systems software components for Teraflop-scale supercomputers. APITest is unique among testing frameworks because it was designed to meet the specific needs of large-scale systems. For example, APITest is capable of "isolation testing"–allowing the developer to evaluate a component without worrying about the correctness of other components. APItest also allows the user to provide arbitrary definitions of success, and it can pass conditional tests based on statistical results. For example, the user can declare a test successful if 70% of sub-tests succeed.

APITest was developed as part of a five-year project (ending in FY2006) to develop Scalable Systems Software (SSS) for Teraflop-scale systems. The SSS project was funded by the Office of Science under the Scientific Discovery for Advanced Computation (SciDAC) initiative and was a collaboration between eight DOE laboratories.
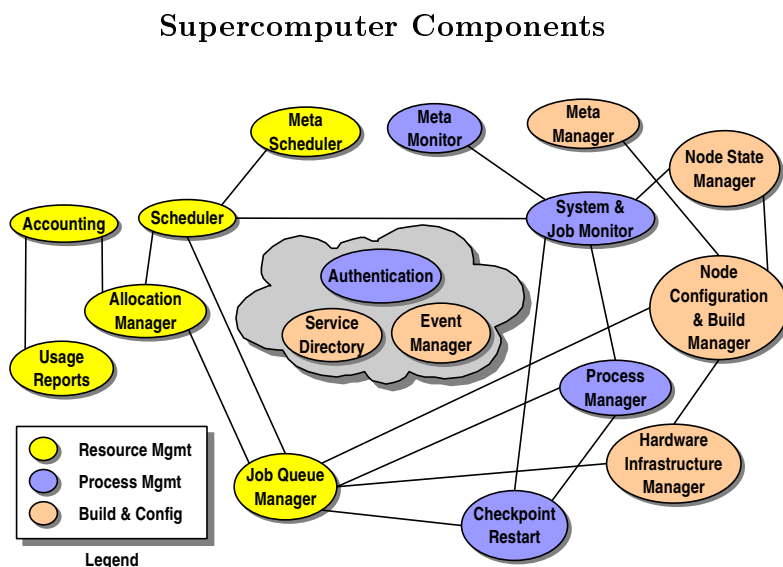
Supercomputer Components

Figure 1: Supercomputer components and their relationships. Components in the gray cloud are accessed by all components.

Although APITest was designed primarily to evaluate systems software, APITest is useful for the validation and testing of a wide range of software. For example, APITest is the primary test software for Cluster Resources Inc.–developer of the Moab cluster suite that includes software for scheduling, managing, and allocating resources for production computing clusters. APITest is also in consideration by MPICH, the premier open-source implementation of the Message Passing Interface (MPI) standard, made available by Argonne National Laboratory.

APITest represents a significant success of Sandia's efforts in the SciDAC project. We expect the use of APITest to grow as we evolve towards Petaflop systems.