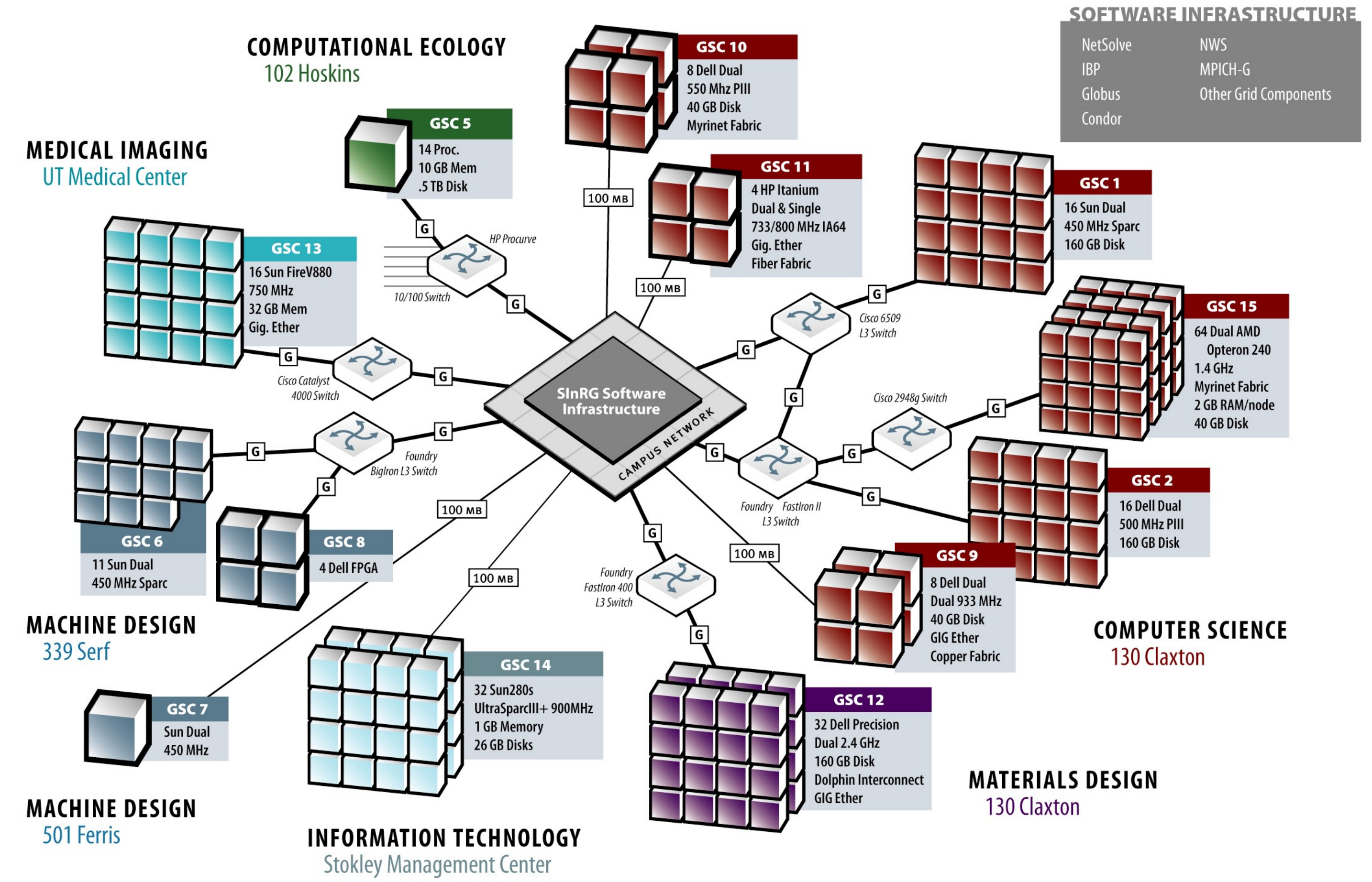
SInRG SCALABLE INTRACAMPUS RESEARCH GRID

The Scalable Intracampus Research Grid (SInRG) project will deploy a research infrastructure on the University of Tennessee, Knoxville campus that mirrors the underlying technologies and the interdisciplinary research collaborations of the emerging National Technology Grid. SInRG will provide a technological and organizational microcosm in which key research challenges underlying grid-based computing can be attacked with better communication and control than wide-area environments usually permit.



Genuine Grid

- Geographically distributed across metropolitan networks
- Heterogeneous architectures among the nodes
- Federated ownership and administration

Interdisciplinary Research

Computer Scientists collaborating with application teams in Computational Ecology, Machine Design, Medical Imaging, and Materials Design

International Collaboration

SInRG leadership is participating in the national and international Grid movement, including NPACI, NCSA, the Teragrid, and Global Grid Forum.

Industry Partnerships

SInRG has received contributions from Sun Microsystems, Dell Computers, Microsoft, Cisco, and Foundry.

SInRG

The Innovative Computing Laboratory (ICL) is leading a large collaboration of faculty members from Computer Science and other UT departments in the creation of an experimental technology Grid on the Knoxville campus. The purpose of the Scalable Intracampus Research Grid (SInRG) is to support leading-edge research on technologies and applications for grid computing, which is the new paradigm for high performance, distributed computing and information systems. A computational power grid like SInRG uses special system software, sometimes known as network middleware, to integrate high performance networks, computers, and storage systems into a unified system that can provide advanced computing and information services (e.g., data staging, remote instrument control, and resource aggregation) in a pervasive and dependable way for an entire community.

A national technology Grid is now growing out of the convergent efforts of NSF's Partnerships for Advanced Computational Infrastructure (PACI) and several other government agencies, including NASA, DOD, and DOE; a similar collective effort is currently underway in the European research community. As SInRG is deployed over the next few years, it will mirror within the boundaries of the Knoxville campus both the underlying technologies and the interdisciplinary research collaborations that are characteristic of the national and international technology grid. SInRG's primary purpose is to provide a technological and organizational microcosm of this effort so that key research challenges of grid-based computing can be addressed using the advantages of local communication and local control.

SInRG is supported by a $2 million, five-year grant from the Research Infrastructure Program of the Computer and Information Science and Engineering directorate of the National Science Foundation and is currently at the end of its third year of development. The vast majority of SInRG's funding will go to purchase special Grid Service Clusters (GSCs), which are hardware ensembles specifically designed and configured to fit SInRG's multifaceted research agenda. While each GSC has been designed from the ground up to be a node on a Grid, they are also assigned to one of the collaborating teams and customized to meet their special needs. For example, the two newest GSCs deployed this year, have unique features that were determined by the computational demands of the research:

A collaboration between a team lead by Lou Gross (Computational Ecology) and Mike Berry (Computer Science) is exploring such phenomena as the optimal spatial patterns of utilization of antibiotics to control the spread of resistant bacteria, and the sensitivity of the Spatially Explicit Species Index (SESI) Models for Everglades restoration to changes in rainfall patterns and associated hydrologic controls.

The image processing research being pursued by the SInRG application team led by Don Bouldin (Electrical and Computer Engineering) and Mike Langston (Computer Science) involves the use of cluster nodes containing special Field Programmable Gate Array (FPGA) chips that can be configured on the fly to implement application-specific computations.

These research applications reflect another aspect of the national effort, via the fact that it is based on interdisciplinary collaboration between computer scientists and researchers from other domains with extremely challenging computational problems to solve. The Grid community recognizes that, in order to make rapid progress, the requirements of advanced applications must drive the development of grid technology. The fact that SInRG has such well-established research collaborations to build on and that all the collaborators are on the same campus is a major advantage for the project.

Along side these application groups, SInRG has a basic research group in computer science focused on research for grid middleware. The CS researchers who make up the middleware group, Jack Dongarra, James S. Plank, Micah Beck, Rich Wolski (now at UCSB), bring complementary research interests and component software to the task at hand, including software for remote scientific computing (NetSolve), distributed scheduling (AppLeS), resource monitoring and performance prediction (Network Weather Service (NWS)), and flexible management of distributed storage (IBP). The latest release of NetSolve, which is currently being deployed on SInRG, integrates support for IBP and for NWS into the system. The researchers are also leveraging the work of the PACI's and other grid technologies, such as Globus.

Like the national Grid, SInRG will be a geographically distributed system. By the end of the five years, there will be at least seven GSCs spread among six different locations around the campus, including one across the Tennessee River at the UT Medical Center. Each will be managed with some degree of autonomy by these groups, with oversight and coordination from the CS co-PIs who collaborate with them. The campus network will provide the underlying fabric that makes it possible to use all this distributed hardware as a single collective resource, a unified computational power grid.

http://icl.cs.utk.edu/sinrg/