support from Microsoft Research, Dell Computer, & Sun Microsystems

The Scalable Intracampus Research Grid for Computer Science Research: SInRG

Computer Science Department
University of Tennessee

Principal Investigators:

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Jim Plank
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Michael Thomason
Robert C. Ward
Rich Wolski

UTK's Grid Research Effort

- **Create a Grid prototype on one campus and leverage locality of all resources to produce *vertical integration of research* elements:**
  - **Human collaborator (application scientist)**
  - **Application software**
  - **Grid middleware**
  - **Distributed, federated resource pool**
- **On site collaborations with researchers from other disciplines will help ensure that the research has broad and real impact.**
- **Interaction, validate research, test bed, try out ideas**

2

Research Projects

- **Approach:**
  - **Build a computational grid for Computer Science research that mirrors the underlying technologies and types of research collaboration that are taking place on the national technology grid.**
- **Leverage Collaborative Research Projects:**
  - **Advanced Machine Design**
    - » Bouldin, Langston, Raghavan
  - **Medical Imaging**
    - » Smith, Gregor, Thomason
  - **Computational Ecology**
    - » Gross, Hallam, Berry
  - **Molecular Design**
    - » Cummings, Ward
  - **JICS and HBCU**
    - » Halloy, Mann
  - **Projects within Dept.**
    - » Beck, Dongarra, Plank, Wolski

3

SInRG's Vision

- **SInRG provides a testbed**
  - **CS grid middleware**
  - **Computational Science applications**
- **Many hosts, co-existing in a loose confederation tied together with high-speed links.**
- **Users have the illusion of a very powerful computer on the desk.**
- **Spectrum of users**

4

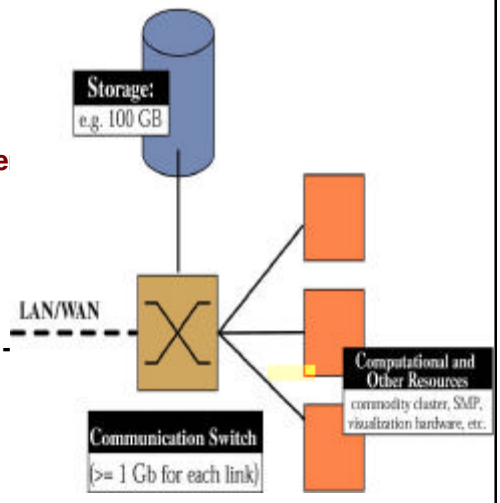
Properties of SInRG at UTK

- Genuine Grid
  - realistically mirroring the essential features that make computational grid both promising and problematic
- Designed for Research
  - support experimental approach by allowing PIs to rapidly deploy new ideas and prototypes
  - complements PACI focus on hardening & deployment
- Communication between researchers leveraging locality
  - centered in one department but collaborative across campus
- Used as part of normal research and education
  - must be scalable in users and resources

5

in the Grid Fabric

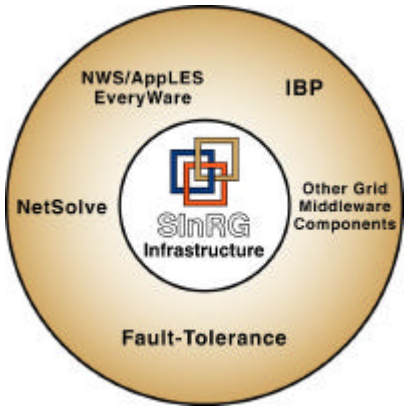
- Computation
  - used to run Grid controlware
  - schedulable to augme other CPUs on Grid
- Storage
  - State management
    - » data caching
    - » migration and fault-tolerance
- Network
  - allows dynamic reconfigutation of resources



6

Challenges

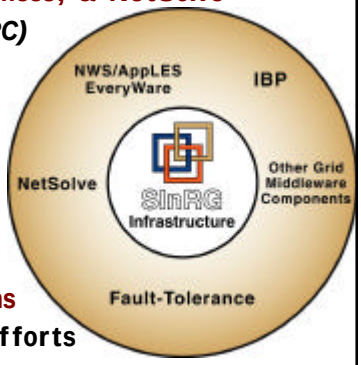
- Provide a solid, integrated, foundation to build applications
  - Hide as much as possible the underlying physical infrastructure
  - Deliver high-performance to the application
- Support access, location, fault transparency, state management, and scheduling
- Enable inter-operation of components



7

Grid Based Computing

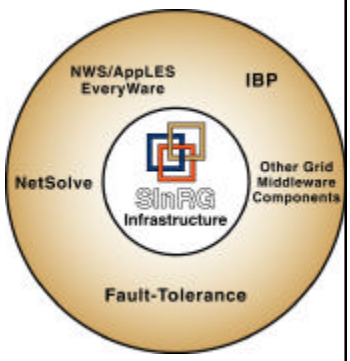
- Message and Network based computing
  - Experience with PVM, MPI, Harness, & NetSolve
- Tennessee-Oak Ridge Cluster *(TORC)*
  - Wide-area cluster computing
- Numerical Libraries
  - Grid aware
- Fault Tolerant library software
  - Built into software/library
- Graph Scheduling
  - Partitioning and Graph algorithms
- Collaborations with other related efforts
  - Globus, Legion, Condor, …



8

Infrastructure

- NetSolve
  - programming abstractions
  - intelligent scheduling framework
  - hides complexity
- Internet Backplane Protocol *(IBP)*
  - distributed state management
  - application driven caching
- Application-Level Scheduling *(AppLeS)*
  - dynamic schedulers
- Network Weather Service
  - dynamic performance prediction
- EveryWare
  - toolkit for leveraging *multiple Grid infrastructures* and resources
- Fault-tolerance
  - process robustness and migration



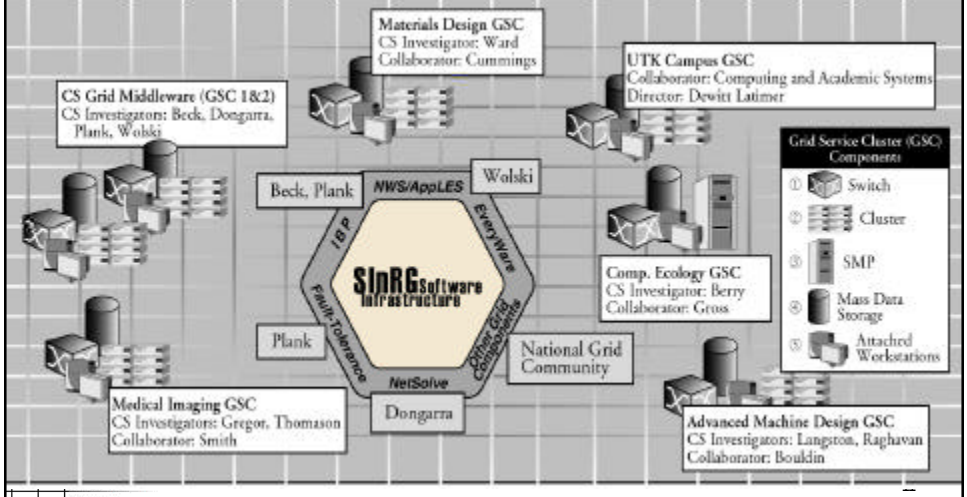
9

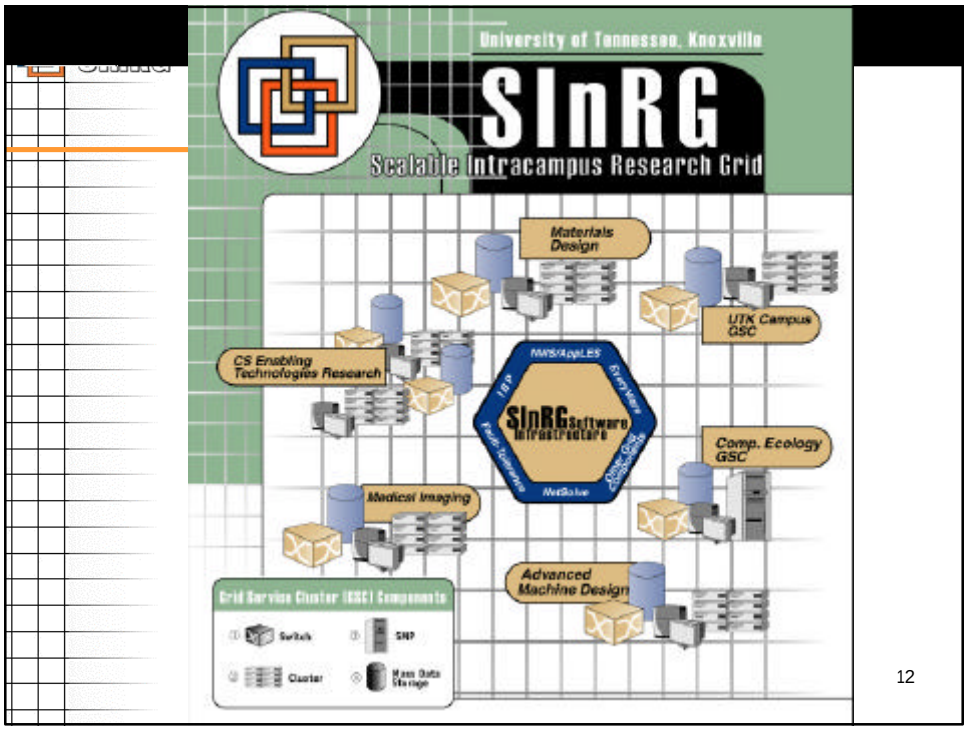
SInRG Today

- GSC #1 - Dell PowerEdge service cluster, Linux
  - 18 Dell PowerEdge 1300 dual 500MHz Pentium III
  - 2 Dell PowerEdge 2400 dual 600MHz Pentium III
- GSC #2 - Sun Enterprise service cluster, Solaris
  - 17 Sun Enterprise 220R dual 450MHz UltraSPARC-II
- GSC #3 – Donation from Microsoft, Windows NT
  - 4 Dell PowerEdge 6350 quad 550MHz Pentium III Xeon
- GSC #4 – TORC, Linux
  - 10 Dual Processor 550 MHz Pentium II
- Gigabit network
  - Foundry Networks FastIron II (4 slot) with 26 fiber ports
  - Cisco Catalyst 6000 with 26 fiber ports
  - SysKonnect SK-NET GE-SX (SK-9843) 1000Base-SX with SC fiber connectors

10

SInRG


Materials Design GSC
CS Investigator: Ward
Collaborator: Cummings
UTK Campus GSC
Collaborator: Computing and Academic Systems
Director: Dewitt Latimer
CS Grid Middleware (GSC 1&2)
CS Investigators: Beck, Dongarra, Plank, Wolski
Grid Service Cluster (GSC) Components
Switch
Cluster
SMP
Mass Data Storage
Attached Workstations
Beck, Plank
NWS/AppLES
Wolski
IBP
EveryWare
SInRG Software Infrastructure
Fault-Tolerance
Other Grid Components
NetSolve
Plank
National Grid Community
Comp. Ecology GSC
CS Investigator: Berry
Collaborator: Gross
Dongarra
Medical Imaging GSC
CS Investigators: Gregor, Thomason
Collaborator: Smith
Advanced Machine Design GSC
CS Investigators: Langston, Raghavan
Collaborator: Bouldin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