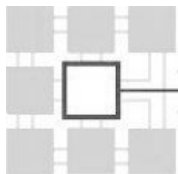



CHECS

Center for High-End
Computing Systems

www.checs.eng.vt.edu

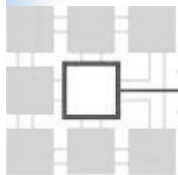


CENTER FOR HIGH-END
COMPUTING SYSTEMS

 VirginiaTech

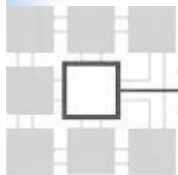
Mission/Vision/Goals

- “ ... world-class computer systems research in the service of high-end computing.”
- A consortium of CS research labs/groups.
- Core focus on computer science systems research.
- A “College center,” with seed funding from the College of Engineering.
- Committed to collaboration with HPC users.



Member Labs

- Computing Systems Research Lab (CSRL)
- Distributed Systems and Storage Lab (DSSL)
- Laboratory for Advanced Scientific Computing and Applications (LASCA)
- Parallel Emerging Architectures Research Lab (PEARL)
- Scalable Performance Laboratory (SCAPE)
- Systems, Networking and Renaissance Grokking Lab (SyNeRGY)



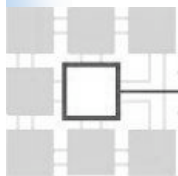
Objectives

1. Technical

- “... develop the next generation of powerful and usable high-end computing resources.”
- Prominence in a few key sub-areas.

2. Non-Technical

- Professional growth for faculty and students
- Build a culture/community, have fun.

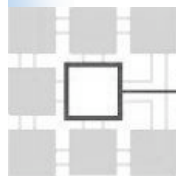


Historical Background

- People: Watson (78), Kafura (82), Ribbens (87), Varadarajan (99), Back (04), Cameron (05), Feng (06), Tilevich (06), Butt (06), Nikolopoulos (06)
- Machines: Sequent Symmetry, Intel iPSC/2 and Paragon, SGIs, clusters.
- Funding: NSF, DOE, DOD, NIH, DOA, ...
- Lots of collaborations across VT campus.
- System X (03).

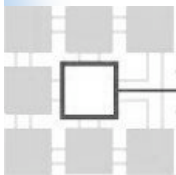
Current Projects (Back)

- **Top:** A framework for flexible, high-level instrumentation of binaries
- **Cadus:** Co-Scheduling of real-time threads and garbage collection
- **Practical Fair-Sharing scheduling:** finding automatically adopting policies for stock kernels
- **DyniX:** A framework for combined static/dynamic analysis of Java code



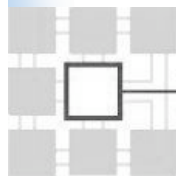
Current Projects (Butt)

- **FlexiCache:** Improving OS file system performance by developing an interface to support a repertoire of (pluggable) cache replacement policies in the kernel.
- **PeerStripe:** P2P-based distributed storage for large data files



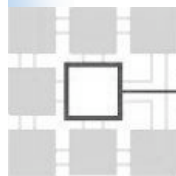
Current Projects (Cameron)

- **High-performance, power-aware computing:** frameworks for power, energy, and thermal measurement, analysis, and optimization
- **Performance evaluation and prediction:** creating scalable statistical, empirical, and analytical performance models, techniques, and tools for design, analysis and optimization of high-performance systems.
- **High-performance applications:** creating scalable high-performance algorithms and applications for emergent computational domains such as biology.



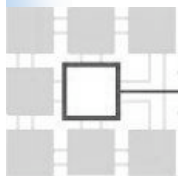
Current Projects (Feng)

- **High-performance networking:** architecture, protocols, performance (modeling, evaluation, auto-tuning) in system-area & wide-area networks
- **'MAGNETizing' SystemTap:** Enabling dynamic, on-the-fly probing and export of kernel information.
- **Supercomputing in small spaces:** low-power & power-aware supercomputing
- **mpiBLAST:** high-performance bioinformatics



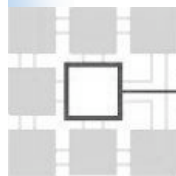
Current Projects (Nikolopoulos)

- **Programming Layered Multiprocessors:** a unified programming approach for layered shared-memory multiprocessors, with multithreaded or multicore execution components.
- **MELISSES:** Continuous hardware monitors for power-performance adaptation schemes on layered parallel architectures.



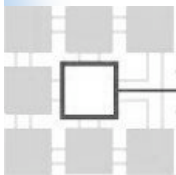
Current Projects (Ribbens)

- **Operation stacking framework:** algorithms and tools for improving the performance of large-scale ensemble computations.
- **ReSHAPE:** improving utilization and throughput on clusters via dynamically re-sizable parallel computations.



Current Projects (Tilevich)

- **MPI On-Ramp:** Removing the difficulties of mapping communication design abstractions to MPI code through visual tools and code generation.
- **Remote Multi Method Invocation:** An extension to Java RMI that enables the execution of multiple remote methods in one batch.
- **Code Generation on Steroids:** enhancing the functionality of automatically generated code through Generative Aspect Oriented Programming.
- **Mapping Deductive Databases to Java:** a middleware facility that enables seamless interoperation between Java & deductive databases.

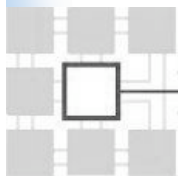


Current Projects (Watson)

- **Surrogate approximation:** mathematical construction of functional approximations using sparse data in high dimensions, with ultimate application to multidisciplinary design optimization (MDO).
- **WBCSim:** a problem solving environment for wood based composites manufacturing processes.
- **Mathematical software for terascale machines:** scalable algorithms for polynomial systems of equations, global optimization, MDO, and interpolatory approximation.

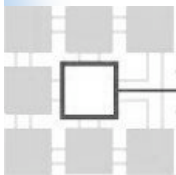
Current Projects (Watson)

- **Robust design optimization:** solving optimization problems with stochastic variables and constraints.
- **Remote sensing:** parallel algorithms for remote sensing applications.
- **Stochastic modeling:** parameter estimation for stochastic cell cycle models.
- **pDIRECT:** massively parallel direct search algorithms for global optimization.



What's Next?

- Take classes, do research, write papers, graduate
- Collaborate
- Attend mixers ~ 2/month
- Try out new equipment
- Meet with visitors
- Contribute to proposals



Why Should You Care?

- Rising tide floats all boats
- Enhance your current work
- Enhance your current quality of life
- Enhance your future opportunities & impact

