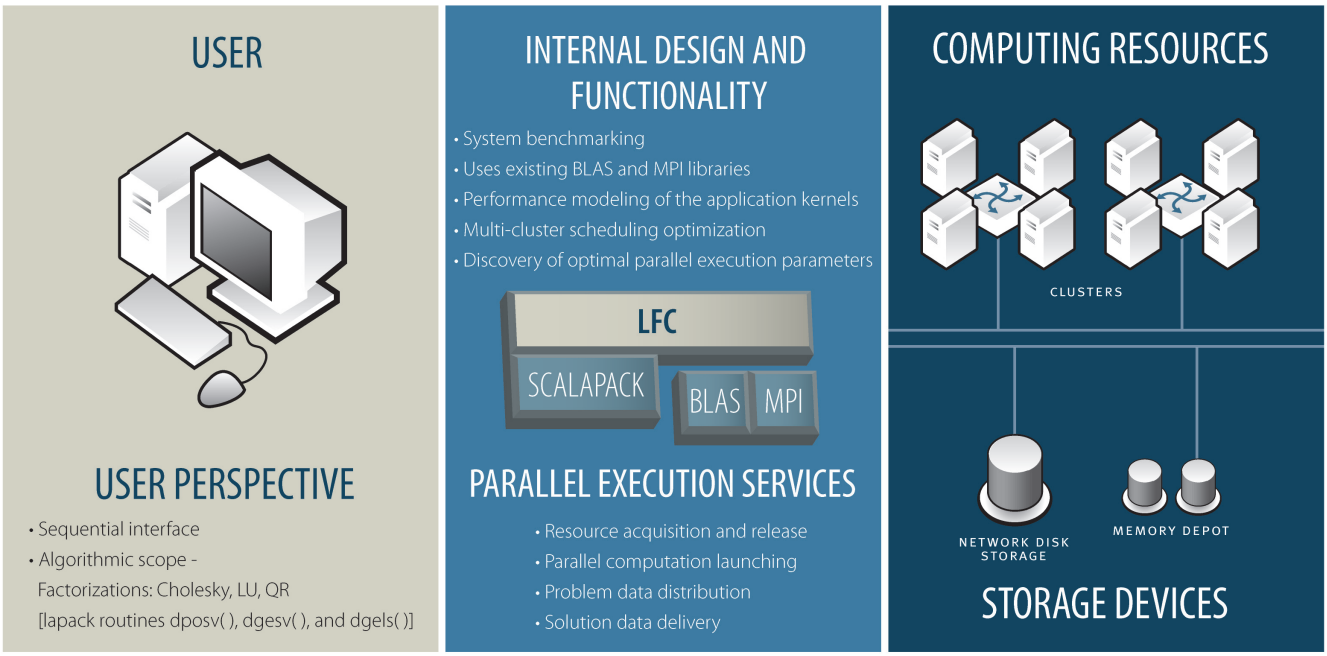
LFC

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

LAPACK FOR CLUSTERS

LAPACK for Clusters (LFC) aims to bring the performance of ScaLAPACK and the expertise of advanced performance tuning to an average user familiar with the LAPACK interface. The approach to problem solving taken by LFC hides the complexity of parallel application development, deployment, and use in a fashion similar to that of the computational grid. Encapsulation of expert knowledge in high performance parallel numerical linear algebra enables optimized use of existing hardware resources and software technologies. LFC automates solution selection and adaptation to the problem type, the available computing power, and the data storage space. On June 6, 2003, LFC officially became part of NPACI's NPACKage, which is a supported bundle of tools and other applications developed by NPACI and its research partners.



FUTURE DIRECTIONS

- Support for symmetric and unsymmetric eigenvalue problems
- Out-of-core computations
- Checkpointing capabilities
- Fault tolerance
- Dynamic load balancing

RELATED PROJECTS

ATLAS	http://icl.cs.utk.edu/atlas/
GrADS	http://icl.cs.utk.edu/grads/
JLAPACK	http://icl.cs.utk.edu/f2j/
NetSolve	http://icl.cs.utk.edu/netsolve/
PAPI	http://icl.cs.utk.edu/papi/

ICL UT Innovative Computing Laboratory
The University of Tennessee Computer Science Department
CITR Center for Information Technology Research
SPONSORED BY
LACSI
NPACI

LFC

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

LAPACK for Clusters (LFC) is numerical software for solving linear algebra problems on tightly coupled cluster computing systems in a self-adapting manner (ref. SANS, self-adapting numerical software). Amongst other things, SANS systems:

- Simplify the user of the burden of configuring, tuning, and the installing numerical software.
- Optimize the performance of software for a given platform.
- Tune at the installation or execution time for a generic or specific data set.
- Decide which resources to use based on the user's problem and the current state of the system.

The current release is lfc-0.1.1 and includes routines for solving under-determined, over-determined, exactly determined, and symmetric positive-definite systems of linear equations and some utility routines for the cluster. LFC merges the ease of use of LAPACK with parallel processing capabilities of ScaLAPACK, without the latter one's software dependences other than BLAS and MPI implementations. It is a self-contained package with built-in knowledge of how to run linear algebra software on a cluster.

The LFC software supports a C API through a serial, single processor user interface, but delivers the computing power achievable by an expert user working on the same problem who optimally utilizes the resources of a cluster. The basic premise is to design numerical library software that addresses both computational time and space complexity issues on the user's behalf and in a manner as transparent to the user as possible. The software assists the user in resolving linker dependencies when linking against an archived library of executable routines. The user is assumed to call one of the LFC routines from a serial environment while working on a single processor of the cluster. The software executes the application. If it is possible to finish executing the problem faster by mapping the problem into a parallel environment, then this is the thread of execution taken. Otherwise, the application is executed locally with the best choice of a serial algorithm.

The following details for parallelizing the user's problem are all handled by the software:

- resource discovery,
- selection and allocation,
- mapping the data onto (and off of) the working cluster of processors,
- executing the user's application in parallel,
- freeing the allocated resources,
- returning control of the user's process in the serial environment from which the procedure began

In June 2003, LFC officially became part of NPACI's NPACKage, which is a supported bundle of tools and other applications developed by NPACI and its research partners. The supported platforms are running IBM's AIX, Linux, or Sun's Solaris. The NPACKage serves as a substantial portion of the software stack being used in the emerging global grid infrastructure, including the TeraGrid.