



Applications
Toolset

SPECIFICS

iPSC®/860 APPLICATIONS
TOOLSET DELIVERS
ADDITIONAL PERFORMANCE

Numeric computation is the cornerstone of most supercomputing applications. Intel's applications toolset for the iPSC/860 provides both broad functionality and high performance for numerically intensive applications. The toolset includes:

- The ProSolver family of linear equation solvers, a comprehensive set of parallel matrix solvers designed for ease of use and optimal performance on the iPSC/860.
- The Basic Linear Algebra Subprograms (BLAS) 1, 2 and 3, standard routines for low-level numeric computation, optimized for Intel's parallel supercomputer architecture.
- The Numerical Algorithms Group (NAG) library of single-processor algorithms, an extensive set of routines for solving numerical and statistical problems.

PROSOLVER™ LINEAR
EQUATION SOLVERS

Solving large matrix equations is a critical part of many numeric applications. Intel's ProSolver family of parallel linear equation solvers addresses the need for efficient solutions to large matrix equations and includes three products:

- The Skyline Equation Solver (ProSolver-SES)
- The Iterative Equation Solver (ProSolver-IES)
- The Dense Equation Solver (ProSolver-DES)

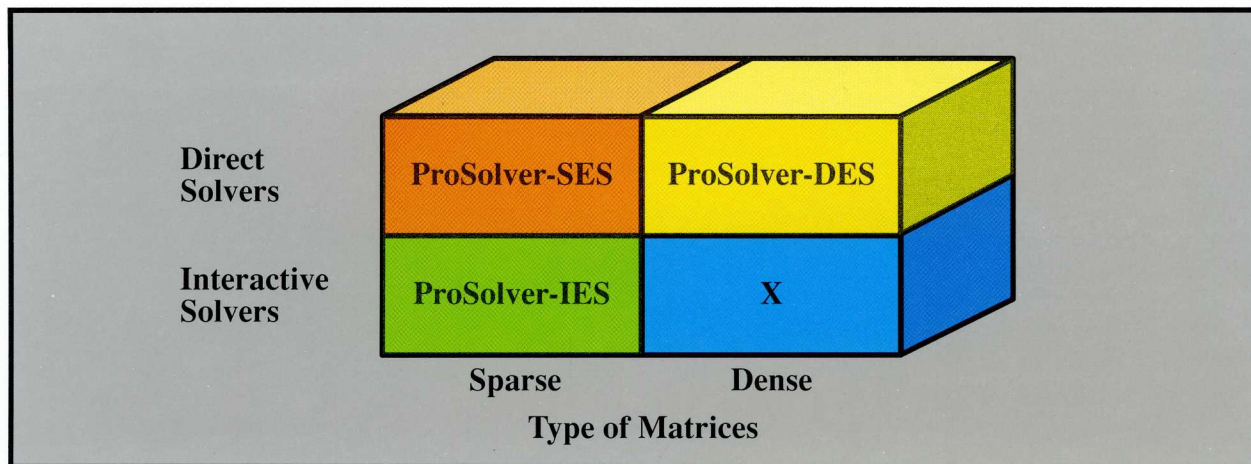
Solvers that operate on matrices are divided according to two dimensions: whether the matrix to be solved is sparse or dense and whether the solver uses a direct or an iterative method. As Figure 1 shows, the three products of the ProSolver family cover a broad range of application requirements, including those with sparse matrices and those with dense matrices that are solved by direct rather than iterative methods.



ProSolver-SES is a direct in-core or out-of-core solver based on an inner-product formulation optimized for the iPSC/860 and its Concurrent File System. ProSolver-SES uses optimal storage and factoring methods to achieve performance of up to 20 MFLOPS per processor. The solver also includes a data capture module that relieves programmers of the burden of storing and decomposing the coefficient matrix and right-hand side. ProSolver-SES will be useful for programmers doing implicit solutions to partial differential equations, such as for structural mechanics, circuit simulation and hydro codes.

ProSolver-IES, a parallel iterative solver package, is a fully sparse solver that stores and processes only the non-zero elements of the matrix. It provides both 32-bit and 64-bit precision and shares a common interface to ProSolver-SES data capture routines, so that programmers can switch between direct and iterative sparse solvers. ProSolver-IES is used for applications such as fluid mechanics, which often run more efficiently with an iterative solver rather than a direct one.

Intel's Application Toolset provides broad functionality and high-performance for application development.



ProSolver-DES is useful when dense matrices are generated, such as in integral equation methods. ProSolver-DES can process matrices well beyond the memory capacity of any known computing system. The solver is optimized for both parallel computing and I/O management to achieve sustained performance of as much as 1.6 GFLOPS on 64 processors. For very long-running applications, ProSolver-DES supports periodic checkpointing and restarting.

BLAS LIBRARIES

Intel's Basic Linear Algebra Subroutine (BLAS) libraries offer hand-coded performance for single-processor computational kernels. The libraries provide a portable set of building blocks that support 32-bit and 64-bit precision as well as complex data types.

Intel provides three BLAS libraries:

- BLAS 1—Vector-vector operations (e.g., inner product)
- BLAS 2—Matrix-vector operations (e.g., matrix-vector product)
- BLAS 3—Matrix-matrix operations (e.g., matrix-matrix product)

iPSC/860 BLAS library routines are tuned for maximum performance by exploiting the caching and the multiple functional units of the i860 microprocessor. The libraries conform to the subroutine names and calling sequences developed by Argonne National Laboratories.

THE NAG LIBRARY

The NAG library, developed and distributed by the Numerical Algorithms Group, Ltd. on behalf of Intel, is a set of nearly 1,000 routines. Callable from FORTRAN and C programs, the NAG routines are used to solve numerical and statistical problems. The iPSC/860 release of the NAG library provides the complete set of routines, and the routines are callable from individual iPSC/860 processors.

The NAG library is distinguished by its breadth of coverage in numerical and statistical computing. Library routines run the gamut from special functions, random number generation and operations on complex numbers, to matrix operations such as factoring and inverting.

Because the NAG routines can invoke BLAS routines, the Intel BLAS libraries enhance the computing speeds obtained by the NAG library.

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Figure 1: The ProSolver family is a comprehensive set of parallel solvers for large matrix equations.

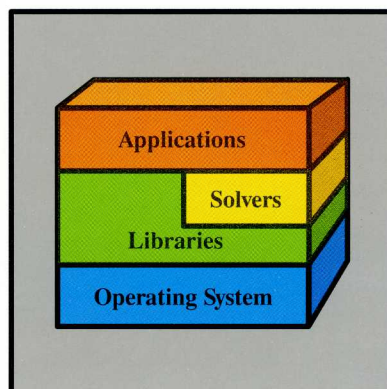


Figure 2: Optimized for Intel's parallel supercomputer architecture, the Application Toolset includes high-performance parallel solvers and libraries of standard routines for numerical and statistical problems.



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