

# Advanced Cluster Programming with MPI

Bill Gropp  
*Argonne National Laboratory*

## Abstract

The Message Passing Interface (MPI) provides a powerful, scalable programming model that is especially well-suited to clusters. The emergence of implementations of MPI-2, which provides many new features that extend the message-passing programming model, makes possible new applications and programming methods. This tutorial discusses both the new features in MPI-2, such as dynamic process creation, remote-memory access, and parallel I/O, along with techniques to achieve high performance with MPI-1 on clusters. Each of these is illustrated with a complete example program that discusses the use of MPI features in a cluster context.

*William Gropp received his B.S. in Mathematics from Case Western Reserve University in 1977, a MS in Physics from the University of Washington in 1978, and a Ph.D. in Computer Science from Stanford in 1982. He held the positions of assistant (1982-1988) and associate (1988-1990) professor in the Computer Science Department at Yale University. In 1990, he joined the Numerical Analysis group at Argonne, where he is Associate Division Director and Senior Computer Scientist. He also holds the position of Senior Scientist in the Computer Science Department at the University of Chicago, and Senior Fellow in the Computation Institute of Argonne National Laboratory and the University of Chicago. His research interests are in parallel computing, software for scientific computing, and numerical methods for partial differential equations. He is a co-author of the most widely used implementation of MPI, MPICH, and was involved in the MPI Forum as a chapter author for both MPI-1 and MPI-2. He is one of the designers of the PETSc parallel numerical library, and has developed efficient parallel algorithms for the solution of linear equations. He was a member of a team that was awarded a Gordon Bell Prize in 1999 for contributions in high performance computing.*