



## PGI® C, C++ & Fortran Compilers & Tools For Multi-core x64+GPU Workstations and Clusters

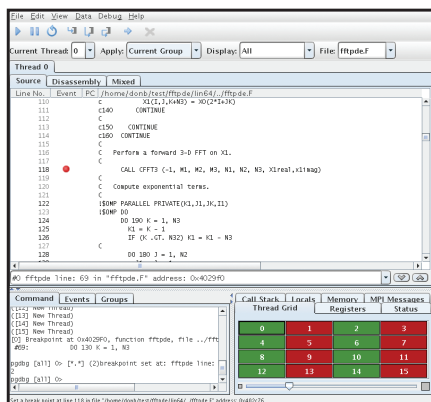
### The Compilers and Tools for Scientists and Engineers.

PGI parallel compilers and tools harness the full power of x64+GPU systems for science and engineering applications. PGI's industry leading performance, reliability, native multi-core and OpenMP support, GPGPU programming, and parallel-capable graphical debugging and profiling tools provide a complete state-of-the-art programming environment for scientists and engineers. PGI's support for legacy language and programming features ensures that existing applications will port easily and quickly to the latest-generation multi-core x64+GPU processor-based systems.

### PGCC® C99 and PGC++® C++ Compilers

Unlike low-end or freely available compilers, *PGCC* and *PGC++* provide vectorization, interprocedural analysis, auto-parallelization, native OpenMP 3.0 pragma-based parallel programming for multi-core systems and pragma-based GPU acceleration. *PGCC* is an ANSI C99 compiler designed to extract maximum performance from compute-intensive, floating-point array-based applications. *PGCC* includes VAX/VMS and all K&R extensions and supports the ANSI C99

standard. *PGC++* is a native ANSI C++ compiler and is fully compatible with the latest ISO/ANSI and GNU standards for C++. All C++ functions are compatible with Fortran and C functions, so you can compose programs from components written in all three languages. *PGC++* also supports compiling and optimizing CUDA C applications to run on 64-bit and 32-bit x86 targets.



### PGFORTRAN F95/03 Compiler

Fortran is still the cornerstone of technical computing. PGI's standard-compliant Fortran compilers provide the features, quality, and reliability required for developing and maintaining advanced scientific and technical applications. Common IBM, DEC, Sun and Cray extensions and *cpp* pre-processing help to get existing applications up and running quickly on the latest 64-bit systems. Vectorization, interprocedural analysis, profile feedback and target-specific

optimizations for both AMD and Intel processors deliver consistently high performance across all x64 systems. PGI Unified Binary™ technology streamlines cross-platform support by enabling a single executable to contain code optimized for both x64 processor families and GPU accelerators. Auto-parallelization and OpenMP user-directed parallel programming extensions deliver the full capabilities of today's multi-processor technical workstations, servers and clusters. PGI Accelerator™ directives and CUDA Fortran extensions simplify porting to x64+GPU platforms.

### PGDBG® Graphical Parallel Debugger

The *PGDBG* debugger is a graphical symbolic debugger for single thread, multi-thread, OpenMP and MPI applications. Use *PGDBG* to control execution and examine the state of a parallel Fortran 95/03, C or C++ program. Control and examine threads, OpenMP tasks or MPI processes individually, all at once, or in user-defined sub-groups. Debug MPI processes locally or remotely using a secure ssh connection from Linux, MacOS or Windows, and save the parameters of your debug session for later reuse. Debug 64-bit or 32-bit applications symbolically using source code or with interleaved assembly code and full access to the registers and hardware state of the processor. *PGDBG* is interoperable with the GNU *gcc/g77* and Microsoft Visual C++ compilers.

### PGPROF® Graphical Parallel Profiler

The *PGPROF* profiler is an interactive OpenMP thread-parallel, MPI parallel and GPU parallel performance analysis tool. Use *PGPROF* to quickly determine where execution time is spent and to identify which functions were called and how often. *PGPROF* supports function, line and assembly level profiling using a uniform time-based sampling mechanism across all supported x64 and x64+GPU platforms. Hardware performance counter technology is supported on Linux. The *PGPROF* GUI displays information in intuitive easy-to-use formats and enables browsing of compiler optimization feedback (CCFF) correlated with loop and function source code. Additional capabilities include the ability to quickly analyze MPI Sends, MPI Receives and other MPI communication. Execution time in multi-threaded regions is also readily accessible.

## Multi-core x64+GPU Compilers & Tools

### C99, C++ and F95/03 Compilers

#### Language Features

Full 64-bit support on AMD64 and Intel 64  
 NVIDIA GPGPU support  
 PGI Unified Binary™ technology for AMD64, Intel 64 and NVIDIA GPUs  
 Auto-parallelization  
 OpenMP 3.0 parallelization  
 Vectorization/Optimization directives and pragmas  
 PGI Accelerator™ directives and pragmas

CUDA Fortran Extensions  
 Full Fortran 2003 support  
 IEEE arithmetic options  
 Inter-language calling  
 Integrated *cpp* pre-processor  
 Fast compile times  
 Common Compiler Feedback  
 Format (CCFF) compile time optimization listings  
 Byte-swapping I/O  
 GNU and Visual C++ interoperability

#### Compiler Optimizations

AMD64 and Intel 64 cross-target optimization  
 InterProcedural Analysis (IPA)  
 AVX/SSE/SIMD Vectorization  
 Function inlining  
 Profile feedback optimization  
 Invariant code and conditional hoisting

Loop fusion  
 Common sub-expression elimination (CSE)  
 Global constant propagation  
 Global dependence analysis  
 Global flow analysis  
 Memory hierarchy and memory allocation optimizations

#### Compiler Vector/Parallel Transformations

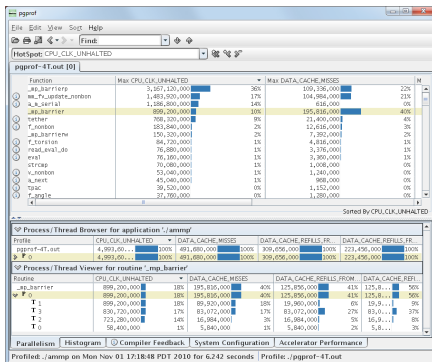
State-of-the-art dependence analysis  
 Nested loop autoparallelization  
 Nested loop vectorization  
 Loop interchange  
 Loop splitting, unroll & jam  
 Iteration peeling  
 Aligned access optimizations

Scalar promotion  
 Temporary vector creation  
 Stripmining, Cache Tiling  
 Concurrent call support  
 Inline concurrent code segments  
 Single and double precision  
 Streaming SIMD Extensions  
 Software prefetching

### PGDBG Parallel Debugger

64-bit and 32-bit targets  
 Debug Fortran, C and C++  
 Debug parallel OpenMP, MPI and multi-threaded programs  
 Debug locally or across a network  
 Interleaved source and assembly language  
 DBX compatible commands  
 One-touch breakpoint setting  
 Step into, over, out of functions

Hardware watchpoints  
 Attach to running processes  
 Traceback, Log files, Help  
 Examine core files  
 One-touch symbolic display  
 Multiple display formats  
 Track register states  
 Graphical User Interface (GUI)  
 Interoperable with *gcc*, *g77* and Microsoft Visual C++



### PGPROF Parallel Profiler

64-bit and 32 bit x86, and GPU targets  
 Profile Fortran, C and C++  
 Profile parallel OpenMP, MPI and multi-threaded programs  
 MPI communication profiling  
 Display collective MPI Sends and Receives  
 Hardware counters support

Parallel scalability analysis  
 Function, line and assembly level displays  
 Multiple data display formats  
 Sort by line number, value, time  
 PGI-style or gmon.out trace files  
 GUI or command line profiling  
 CCFF browsing



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