



Pathscale™ Compiler Suite

High Performance Compiler Suite for 64-bit application development focused on maximum performance.

The Pathscale Compiler Suite represents the highest-performance 64-bit C, C++ and Fortran compilers for Linux-based environments. This advanced compiler suite takes advantage of the unique high-performance 64-bit features of both the Advanced Micro Devices AMD64 and the Intel® Xeon™ EM64T architectures.

The Pathscale Compiler Suite includes a world-class “Every Known Optimization” framework purpose built for inserting new optimization techniques to improve performance.

Benefits

- Produces optimal code for EM64T and AMD64 architectures, including new “Barcelona” Quad Core and Intel Core Microarchitecture
- Faster ports with less code modification
- Uses standard flags so Makefiles just work
- Mix and match GNU and compiled objects
- Outstanding floating-point optimization
- Works with popular commercial debuggers

Features

- C, C++, and Fortran Compilers
- 32-bit and 64-bit compilation
- Code Generation for AMD64 and EM64T
- OpenMP 2.5 C, C++ and Fortran
- Optimized AMD Core Math Library
- Interoperates with Intel Math Kernel Library



Derived From Proven Foundations. Noted for its mature FORTRAN and excellent Optimizer, the Pathscale Compiler Suite is derived from the SGI®/Cray® compiler. This compiler was modernized with OpenMP 2.5 and a GNU C/C++ front-end, and enhanced the code generator to support AMD64 and Intel EM64T processors. The result across all languages, is the world’s highest performance 64-bit Linux compiler with complete GNU tool chain compatibility.

In real-world application testing, HPC end-users have experienced up to 40% performance gain over alternative compiler products. This makes the Pathscale Compiler Suite the clear choice for 64-bit computing clusters focused on maximum performance.

Optimized for AMD Opteron and Intel EM64T Dual-core Systems. The Pathscale Compiler Suite maximizes the performance of application code when compiled for x86-64 compatible systems. With AMD64 and EM64T advantages like complex addressing modes, large register sets, more efficient parameter passing and SSE3 and SSE2 support, 64-bit code will simply perform better on this processor. For quad-core systems the compiler provides automatic, and explicit OpenMP parallization capabilities.

Flexible Purchasing Options. The Pathscale Compiler Suite is sold as a subscription service, which includes all major and minor product enhancements, bug fixes, performance improvements, and access to customer support. The subscription is sold on a per developer basis. Perpetual license options are also available

World Class Support. PathScale provides advanced technical support by some of the best compiler engineering talent in the industry. PathScale treats performance problems as bugs, and provides excellent assistance in application porting and tuning. PathScale also documents how to build many well known codes, such as Amber, CHARMM, FFTW, GROMACS, MPICH, NAMD, NWCHEM and more.

▶ Pathscale Compiler Suite Features

Functional Components

- GNU C/C++ front-end with OpenMP 2.5
- Fortran 95 with Cray/SGL extensions and OpenMP 2.5
- Optimizer and Fortran derived from SGI Open64 code base
- Pathdb command line debugger
- PathOpt2 compilation optimization tool
- Tuned libraries including ACML 4.0.1

▶ AMD64 and EM64T Capabilities

- Support for inline assembly code
- Long address support
- Supports AMD64 ABI (x86-64)
- Utilizes full 64-bit ISA including SSE3/SSE2 and register sets
- Instruction scheduling for the AMD out-of-order core
- All SSE3 instructions available
- Instruction scheduling for the Intel EM64T core

▶ Major Optimizations

Code Generation

- Control flow optimization
- If-conversion
- Instruction scheduling
- Global register allocation
- Loop unrolling
- Peephole optimization

▶ Quad Core Capabilities

- Auto Parallellization
- AMD march=barcelona scheduling
- Intel march=core support
- Explicit Parallellization by using OpenMP 2.5 in C and Fortran
- Fine-grained controls for CPU-thread affinity

▶ Loop Nest Optimizer

- Loop-caused dependency analysis
- Loop Interchange
- Cache Blocking
- Loop Fission
- Loop Fusion
- Outer loop unrolling
- Prefetching
- Scalar Expansion and Array Expansion
- Gather-scatter
- Pad arrays to reduce cache conflicts
- Vectorization (including SIMD)

▶ Binary and Source Code Compatibility

C/C++ Compatibility

- Source compatible with GNU 3.3.X and GNU 4.2.0 with OpenMP 2.5
- 100% binary interoperability, including name mangling
- Mix and match GNU and compiled objects
- -Finstrument support

Fortran Compatibility

- Source compatible Fortran 77/90/95 with Cray extensions including full pointer support
- OpenMP 2.5 support
- All common Fortran 77 extensions for compiling “dusty deck” code
- Links with g77 compiled libraries
- Custom libraries included, including libm and ACML2.5
- Support for ISO/IEC TR 15580,15581, 1539-2, and 1539-3*
- Big-endian/Little-endian Fortran I/O

Debugger Compatibility (pathdb)

- Well formatted printing of Fortran variables, arrays, expressions
- Properly prints standard C++ templates, maps, vectors, lists and dynamic types
- GDB compatible commands and works with GNU compiled code
- Compiler emits industry standard DWARF
- Works with commercial debuggers

▶ Global Scalar Optimization

Pre-optimizer

- Goto conversion and loop normalization
- Alias analysis (flow-free and flow-sensitive)
- Tail recursion elimination
- Dead store and dead code elimination
- Induction variable canonicalization
- Copy propagation

Main optimizer

- Partial redundancy elimination based on SSAPRE framework
 - Global common sub-expression
 - Loop invariant code motion
 - Strength reduction
 - Linear function test replacement
- Induction variable elimination
- Register promotion

▶ Inter-Procedural Analysis

- Operates across multiple compilation runs
- Function inlining
- Inter-procedural constant propagation of globals and parameters
- Dead function and dead variable elimination
- Automatic common block padding

▶ Tested Operating Systems

OpenSUSE™ 10.0, 10.1, and 10.2
 SuSE™ Linux Professional 9.3, 10, and 10.1
 SuSE Linux Enterprise Server 9 and 10
 SuSE Linux Enterprise 10
 Red Hat™ Enterprise Linux 4 and 5
 Red Hat Fedora Core 3, 4, 5, 6
 Red Hat Fedora 7

Now with SELinux Support

The Pathscale Compiler Suite contains on a common distribution medium both PathScale proprietary and open-source software components. All open source software is licensed in full compliance with the applicable open source license. Modifications to GPLed source are licensed under the GPL. End-users can receive source code for all of the open source components of the Pathscale Compiler Suite, along with their binary distribution, in compliance with section (3a) of the GPL. Open source license terms do not apply to the PathScale proprietary code, which includes code such as run-time performance enhancing libraries that are independent and separate works. End-users may not transfer, sublicense or distribute PathScale proprietary code to any third party. Except as permitted in the PathScale Subscription Agreement, endusers may not copy or modify PathScale proprietary code.

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