



Remember when
the sky was the limit?

Translate Multi-Core Power into Application Performance

**Intel® Software
Development
Products Overview**



Agenda

Introduction

Multi-core processors change the rules

Intel® Software Development Products overview

Conclusion and next steps



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Intel® Software Development Products Overview



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The Intel Behind Intel Software

Intel Software and Solutions Group (SSG)

1 group • 6 divisions • 14 time zones • 24 major sites • 2,500 employees

170,000 registered developers, 20+ Operating Systems, Thousands of Applications



Enabling Highly Compatible and Robust Software Solutions



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Intel® Software Development Products Overview

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The Intel Behind Intel Software

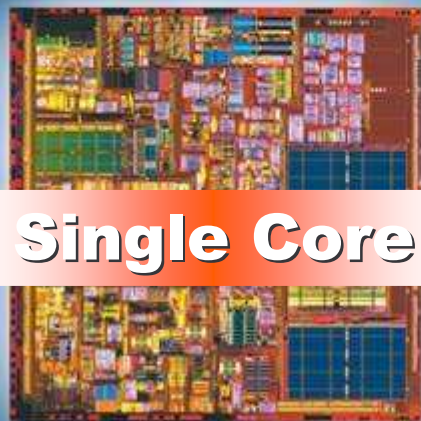
Intel Software and Solutions Group (SSG)

- Intel® Software Development Products help you use the power of your software to unleash the full potential of the hardware
- Multi-core is a paradigm shift for the Software development industry
 - To fully exploit the opportunity to execute multiple code streams in parallel, Intel® provides a set of software tools and technical information
 - Intel® Software Development Products, Training, and Support Speed Optimization of Multi-Core Designs
- Intel® Software Ecosystem provides resources and investments in software optimization and enablement technologies and expertise



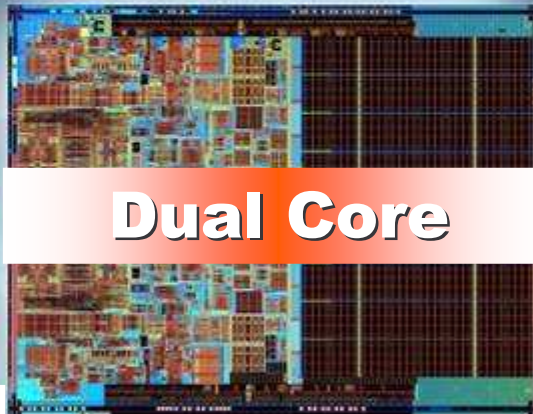
Processor Evolution

Intel® Xeon®
processor



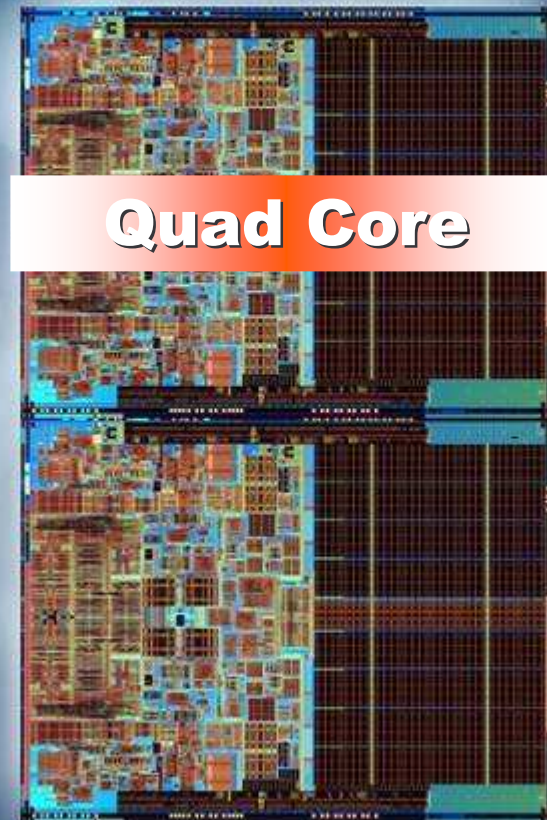
Single Core

Dual-Core Intel®
Xeon® processor
5100 series



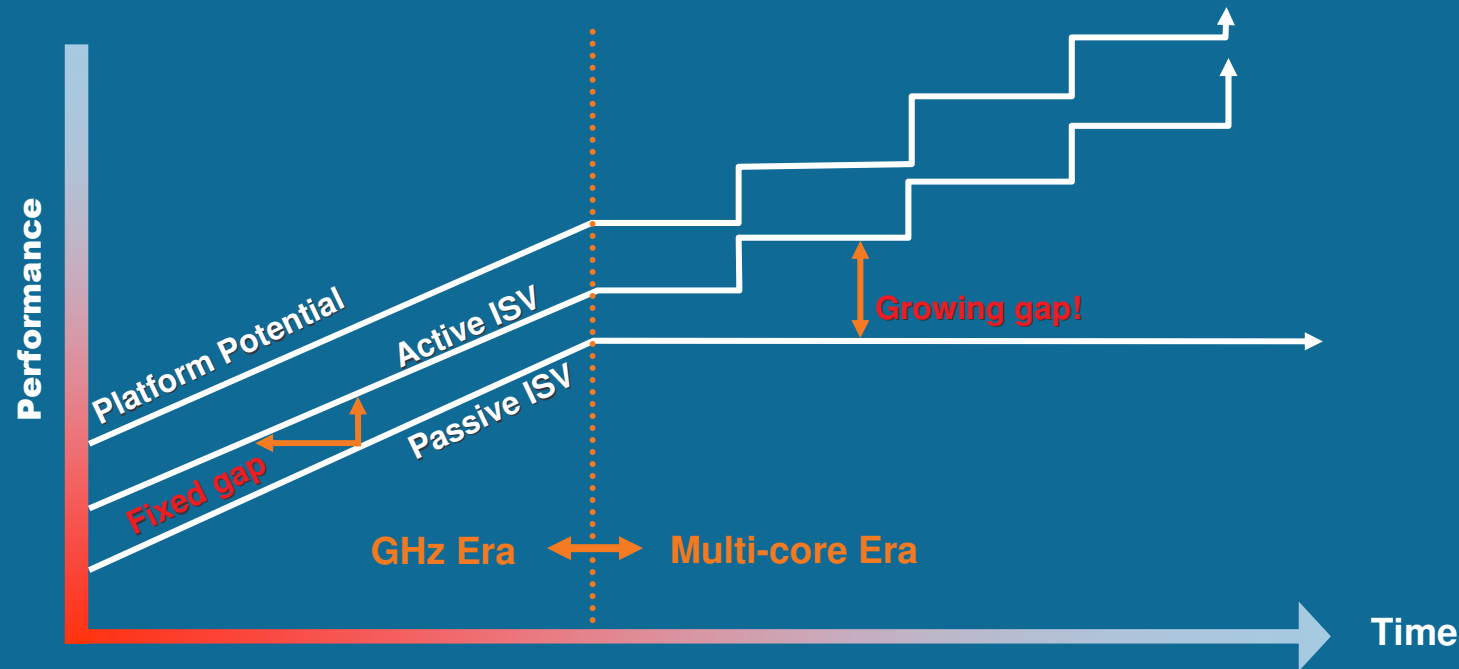
Dual Core

New Quad-Core
Intel® Xeon®
5300 for 2006



Quad Core

Multi-core Processors change the rules



Get your software ready for multi-core using Intel® Tools

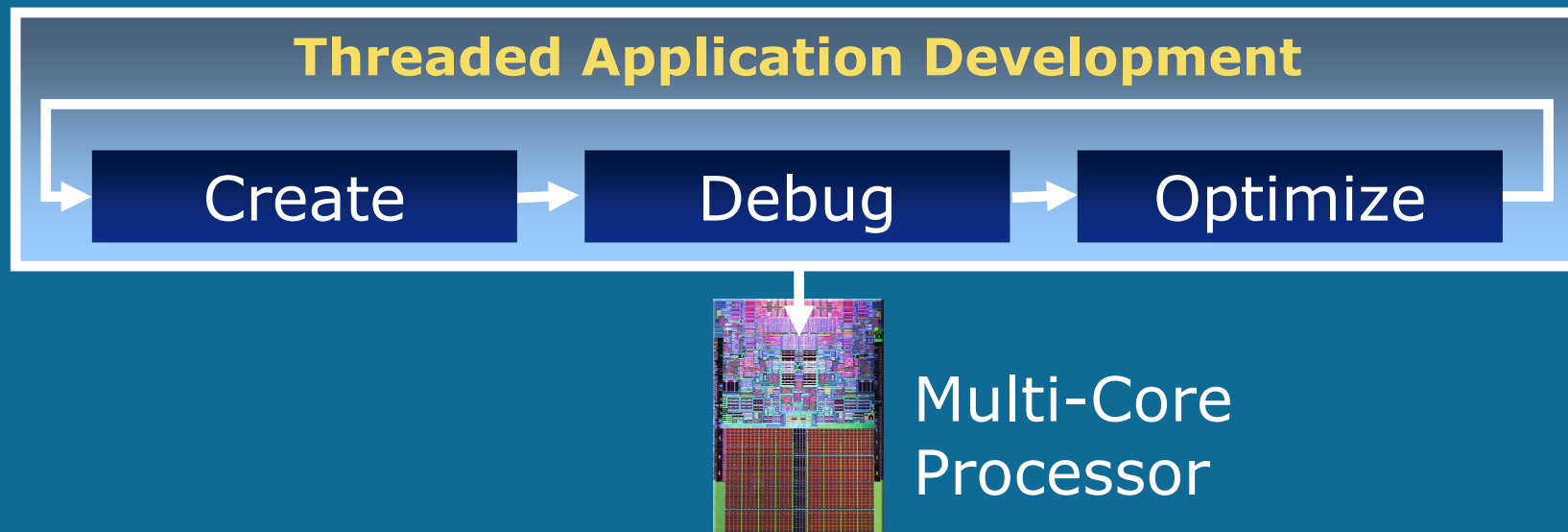


Maximize Multi-Core Performance By Threading Your Software

Software threading needed at the application level

- Breaks problem into pieces that can be solved in parallel
- Performance can scale with number of processors

Need tools to create, debug and optimize multi-threaded applications



Intel® Software Development Products

Intel® Compilers

- The best way to get application performance on Intel® processors

Intel® VTune™ Performance Analyzers

- Identify bottlenecks in source code and optimize multi-core performance

Intel® Performance Libraries

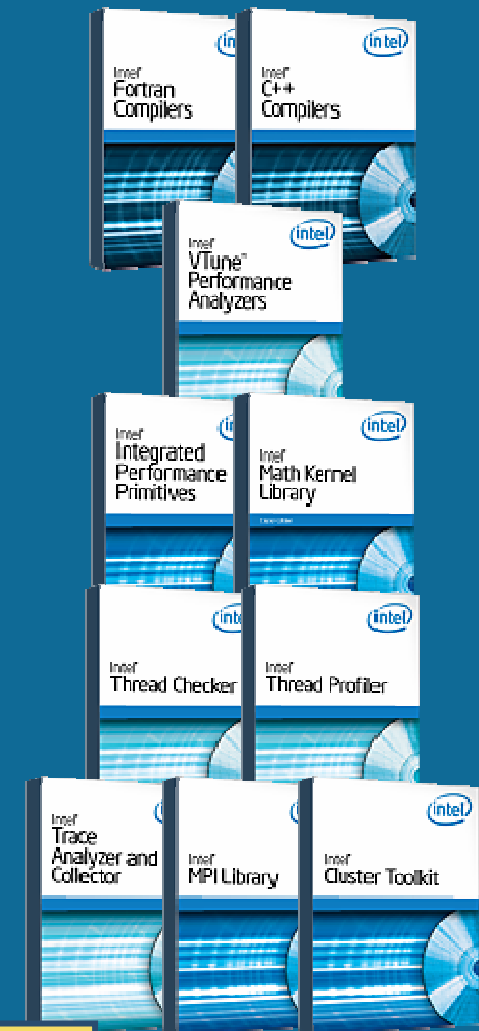
- Highly optimized, thread-safe, multimedia and HPC math functions

Intel® Threading Analysis Tools

- Find threading errors and optimize threaded applications for maximum performance

Intel® Cluster Tools

- Create, analyze, optimize and deploy cluster-based applications



**Intel has a broad toolset to help
develop fast, reliable threaded applications**



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Faster rendering on Multi-Core



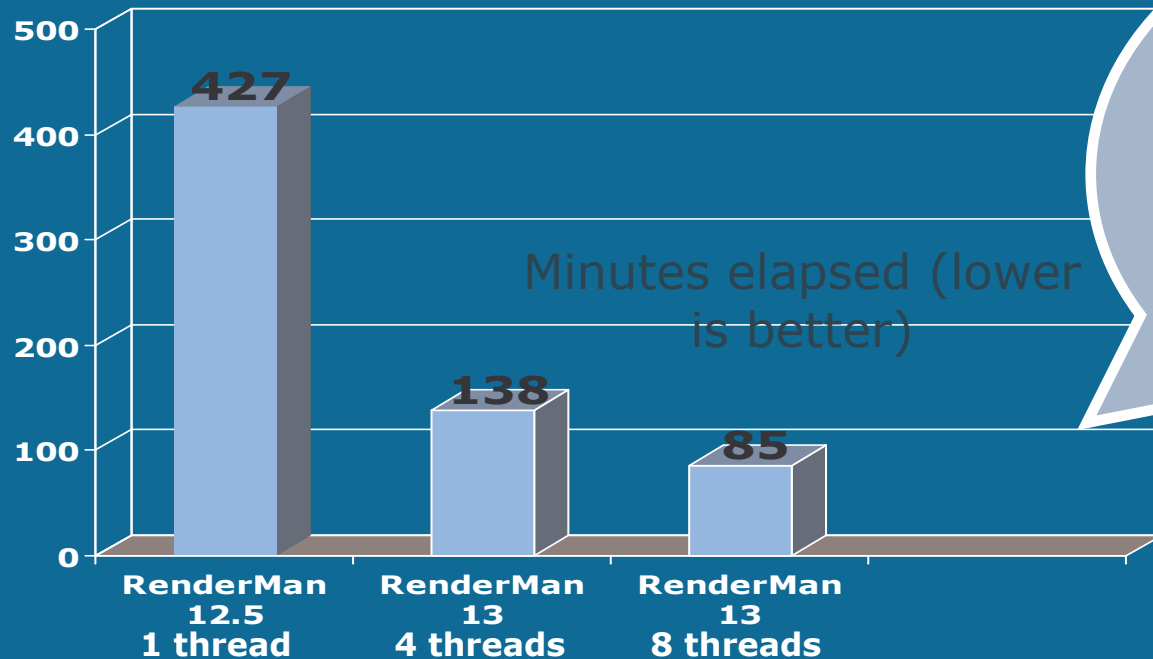
- New multi-core platforms
 - Dual-Core Intel® Xeon® Processor based systems
 - Intel® vPro™ technology
- New usage models
 - Each rendered frame can utilize multiple cores
 - Interactive rendering
 - Increasing scene complexity
- Product time to market important
 - Threading can cause incorrect results, crashes
 - Scaling may not meet performance expectations
 - Cross platform support



The result

New capabilities marketed by Pixar

- Ray Tracing >3x faster on 4 cores
- Dramatic reduction (60%) in memory requirements
- Faster "time-to-market" for movie creation



"Intel's Threading Tools have accelerated our development cycle dramatically. The Intel Threading Tools are now an integral part of our development process."

Dana Batali
Director of Pixar RenderMan Development



Intel® C++ and Fortran Compilers

"The Intel C++ Compiler for Linux provided to Fluent's Computational Fluid Dynamics (CFD) software an **impressive 9% to 37% performance improvement** over the GNU C compiler, when we ran our standard benchmarks. The Intel C++ Compiler for Linux integrated smoothly into our development environment, with no technical issues." — *Dr. Dipankar Choudhury, CTO, Fluent Inc.*

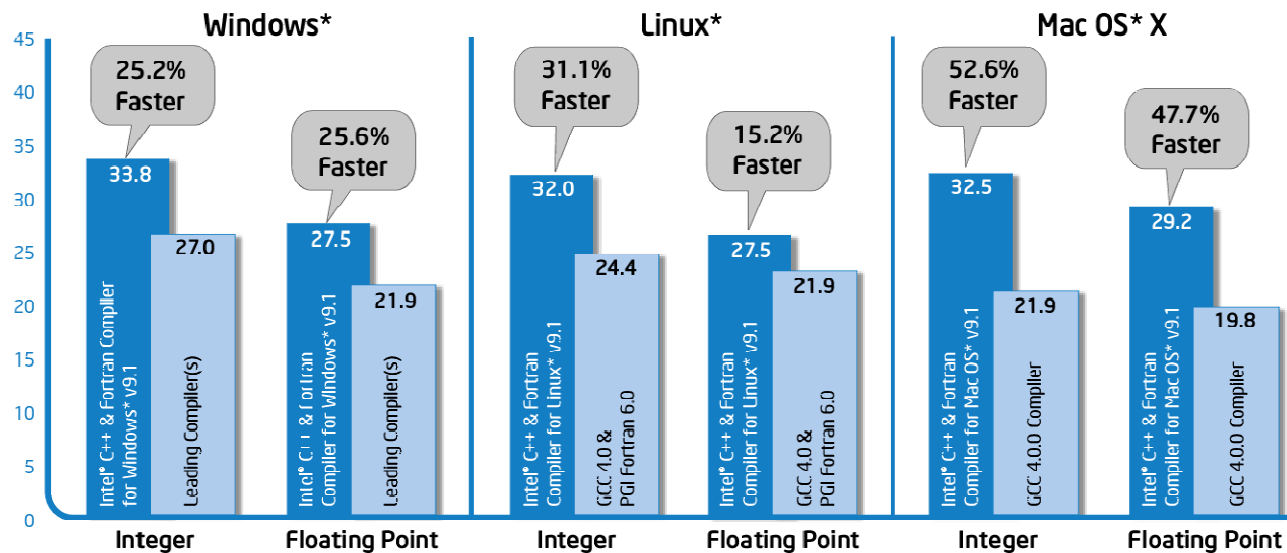
- Multi-threading support
 - Auto-parallelization and OpenMP* support
- Mac OS* X support
 - XCode* Integration - Command line, source, and binary compatibility with GCC 4.0/ G++
 - Universal Binaries supported
- Windows* support
 - Plug-in compatibility with Microsoft Visual Studio* (98 (C/C++ only), 2002/ 2003/ 2005)
 - Native source and object code compatibility with Microsoft Visual C++*
 - Source compatibility with Compaq Visual Fortran*
- Linux* support
 - Command line compatibility with GCC (C++ Linux)
 - Source and binary compatibility with GCC 3.2/ 3.3/ 3.4/ 4.0
 - Integration with Eclipse* 3.1.1/CDT 3.0 (IA-32 & IA-64)
- Intel® processor support
 - Support for Streaming SIMD Extensions (SSE2, SSE3, SSE4)
 - Latest IA-32, IA-64, Intel 64, and Multi-core processors.
 - Support for AMD* processors such as AMD Opteron* and Athlon*
- Intel® Code Coverage & Intel® Test Prioritization Tools



Est. SPEC* CPU2000 V1.2, Intel® Core™ Duo Processor on Windows*, Linux* and Mac OS* X

Performance Advantage of Intel® Compilers

using Spec2000 Benchmark on Intel® Core™ Duo Processor (Higher is Better)



This graph shows how Intel compilers can provide impressive performance improvements over leading compilers on Windows*, Linux* and Mac OS*X operating systems as measured using the Spec2000 benchmark.

- Results from SPEC int2000 and SPEC fp2000 base measurements. For more information about the SPEC benchmark, visit www.spec.org/cpu2000/
- Test configurations:

Windows: Compilers: Intel® C++ Compiler 9.1 for Windows*, Intel® Visual Fortran Compiler 9.1, Standard Edition, for Windows, Microsoft® Visual C, C++ 7.1, Compaq Visual Fortran* 6.6C. Hardware: Intel® Core™ Duo Processor, 2.0 GHz., 1 GB, 2 MB L2. Operating System: Microsoft Windows Server 2003 Enterprise Edition* SP1 v.1260, Build 3790.

Linux: Compilers: Intel® C++ Compiler 9.1 for Linux*, Intel® Fortran Compiler 9.1 for Linux*, GCC 4.0 & PGI Fortran 6.0. Hardware: Intel® Core™ Duo Processor, 2.0 GHz., 1 GB, 2 MB L2. Operating System: Linux*, kernel 2.4.21-20.EL #1, glibc 2.3.2-95.30.

Mac OS X: Compilers: Intel® C++ Compiler 9.1 for Mac OS*, GCC 4.0.0. Hardware: Intel® Core™ Duo Processor, 2.0 GHz., 1 GB, 2 MB L2. Operating System: Mac OS X, kernel 8.4.1, glibc 0.

Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Buyers should consult other sources of information to evaluate the performance of systems or components they are considering purchasing. For more information on performance tests and on the performance of Intel products, refer to http://www.intel.com/performance/resources/benchmark_limitations.htm.



Intel® VTune™ Performance Analyzer

Quickly find application bottlenecks

- Multi-threading support
 - Tune multi-core sharing of the bus & cache
 - Balance loads & reduce idle time
- Multiple techniques to gather tuning data
 - Sampling – locates bottleneck with < 5% overhead
 - Call Graph – identifies calling sequence, loop counts
- Support for Java* and .NET*

Windows* NT, Vista, Visual Studio* 2005

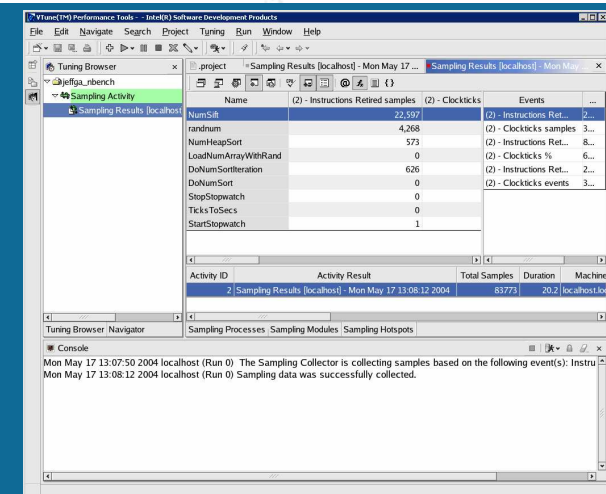
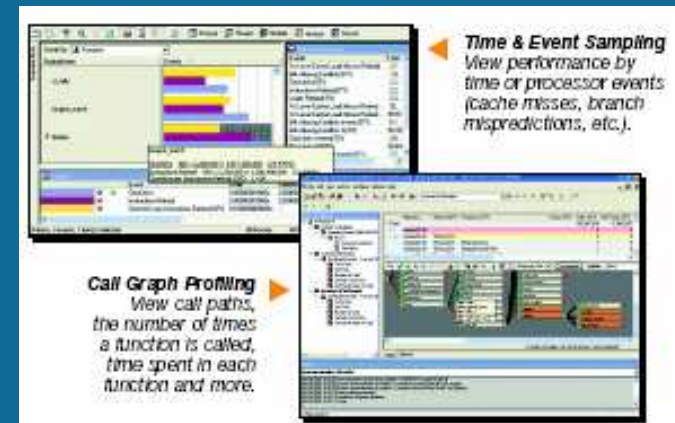
- Full 32 and 64-bit profiling support
- Powerful graphical analysis
- Remote agents for profiling Linux* and Intel® XScale® processor platforms

Native Linux* for many popular distributions

- Eclipse based GUI
- Flexible command line interface

“The improved Eclipse GUI in VTune analyzer has made it much easier and much quicker to identify problem areas in the application codes.”

– Donny Cooper, Senior Systems Analyst, NEC Solutions (America) Inc.



Intel® Threading Building Blocks 1.0

Scalable Threads Faster

Intel's new C++ template-based runtime library that simplifies writing multithreaded applications for performance and scalability

Key Benefits

- Ready to use parallel algorithms that easily plug into applications and deliver scalable performance
- Highly concurrent containers for robust threaded applications
- Task based parallelism to abstract platform details and focus on application
- Library based solution that seamlessly integrates into development environments
- Cross platform support speeds deployment of applications on various multi-core platforms
- Supports 32-bit and 64-bit platforms using Intel®, Microsoft* and GNU* compilers
- Support for Windows*, Linux* and Mac OS* X

"The Autodesk Maya team has worked closely with Intel on the challenges of threading a large 3d application and we're excited about the potential of Intel® Threading Building Blocks to bring scalable performance automatically, without requiring us to update our code to support the latest multi-core processor."

*-Gerry Hawkins, Maya Team Leader
Autodesk*



Intel® Thread Checker 3.0 for Windows* & Linux*

Create Threads Faster

- Detects challenging data races and deadlocks
- Pinpoints errors to the source code line
- Works on standard debug builds without recompiling
- Supports 32-bit and 64-bit applications
- Batch scripts integration for regression test runs
- Recommends modules to instrument by usage
 - Minimize instrumentation overhead
- Linux*
 - Introduction of native Linux* support through command line views
- Windows
 - Supports Microsoft Visual Studio 2005*

Intel's Thread Checker helped identify potential threading issues very quickly, in days compared to weeks if done otherwise.

*Dana Batali, Dir. of RenderMan Development
Pixar*



Intel® Thread Profiler 3.0 for Windows*

Optimize Threads Faster

"Intel ThreadProfiler was very useful for analyzing bottlenecks in our threaded code."

*Martin Watt, Software Architect,
Alias*

- Shows how much of your application is not optimally parallel and where
- Identifies where thread specific overhead impacts performance
- Highlights thread workload imbalances and thread activity
- Shows the number of cores utilized
- Pinpoints issues to the source code line
- Maximizes application time spent in parallel regions
- Supports 32 and 64-bit applications
- Supports Microsoft Visual Studio 2005

New



Intel® Performance Libraries

Intel® Integrated Performance Primitives [Details](#)

- Library of highly optimized functions for imaging, audio, video, speech, vision, data compression, cryptography and signal processing
 - Ideal for real-time applications

Intel® Math Kernel Library

- Highly optimized math functions for scientific, engineering and financial applications
 - BLAS & LAPACK
 - Sparse Solvers
 - Fast Fourier Transforms
 - Vector Math
 - Random Number Generators

Intel® Math Kernel Library Cluster Edition

- All the functions in the Intel® Math Kernel Library plus ScaLAPACK and distributed memory FFTs

"People want to have the ability to view good quality, high-resolution video from their own desk or on the move. For ImageCom, providing targeted applications that are specifically optimized with Intel® IPP and C++ compiler is crucial to enabling this."

– Thomas Dove – CEO, Imagecom, Inc.

"The performance increase from simply using the Intel Math Kernel Library (Intel MKL), with its threading capabilities, was amazing. We are more than delighted with the results."

– Gavin Lavelle – President, Panorama

Write once, realize performance over many processor generations



Intel® Cluster Tools

Boost cluster application's development and performance

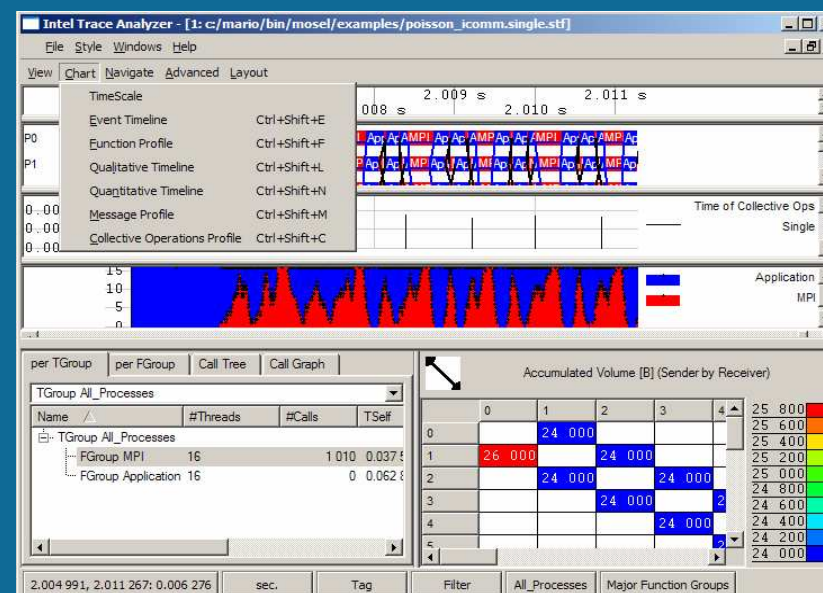
- Create, analyze, optimize and deploy parallel applications
- Network-independent MPI library
- Ready for multi-core cluster

Intel® Cluster Toolkit
A complete MPI tools environment

- [Details](#) – Intel® MPI Library
- [Details](#) – Intel® Trace Analyzer and Collector
 - Intel® MKL Cluster Edition
 - Intel® MPI Benchmarks

Intel's MPI and Cluster Tools provide us the best cluster development environment. Using Intel Trace Analyzer and Collector, we were able to shorten MPI communication time by half by finding and removing bottlenecks with non-blocking and blocking communication patterns."

Dr. Takahiro Koichi, Computational Astro Physics Laboratory, RIKEN, Japan



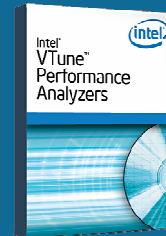
**New GUI with
Trace Analyzer and Collector 6.0**



Comprehensive, industry leading solutions for parallelized software development

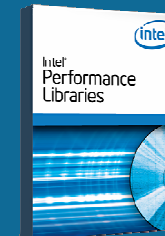
Visualization of applications and the system

Architectural Analysis



Highly optimizing compilers delivering scalable solutions

Introducing Parallelism



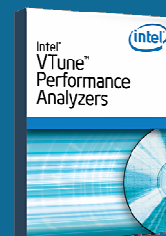
Detect latent programming to address unique challenges

Debugging



Tune for performance and scalability

Performance Tuning



Intel has a broad toolset to help develop fast, reliable threaded applications



Conclusion and Next Steps

**Intel® Software Development Products
are
the products you need
to develop parallel applications**

- Architect, introduce, debug and tune parallel programming including multi-threading & MPI clusters
 - Supports existing build process
 - Cross hardware and OS platform support
- Tools deliver excellent value to the developer's community today
- Intel has a solid understanding of the Software industry to address new market needs
- Intel's role in Software industry is growing – addressing shift to multi-core

Next Steps: Try the products ...

Learn more and download evals at: www.intel.com/software/products





Remember when
the sky was the limit?

Questions?

