



PERFORMANCE AND THREAD PROFILER



# Intel® VTune™ Amplifier XE 2013

Product Brief

## Top Features

- Profile C, C++, C#, Fortran, Assembly and Java
- Collect a rich set of data to tune CPU & GPU performance, multi-core scalability, bandwidth and more
- Powerful analysis lets you sort, filter and visualize results on the timeline and on your source
- Command line automates regression tests and makes remote collection easy

“The new VTune™ Amplifier XE brings even more capability to an already indispensable tool. The sampling based call stack hotspots is excellent and alone is worthy of the upgrade. We have also been impressed by how the concurrency and Locks and Waits analysis can even provide useful data on complex applications such as Premiere Pro.”

Rich Gerber - Engineering Manager, MediaCore, Adobe Systems Inc.

## Also available in:

- Intel® Parallel Studio XE
- Intel® C++ Studio XE
- Intel® Fortran Studio XE
- Intel® Cluster Studio XE

## Interoperable Products

- Intel® Graphics Performance Analyzer

## OS Support:

- Windows\*
- Linux\*

## Optimize Serial and Parallel Performance

Intel® VTune™ Amplifier XE 2013 is the premier profiler for C, C++, C#, Fortran, Assembly and Java\*.

## Easy

Performance analysis can be difficult, but the tool you use shouldn't be.

- **No special builds** - Use a production build with symbols from your normal compiler.
- **Preset performance profiles** - Preset profiles provide an easy “point and shoot” set-up.
- **Low overhead** - Accurate results you can count on.
- **Command line** - Automate regression analysis. Simple remote collection.

## Versatile - Rich Set of Performance Profiles

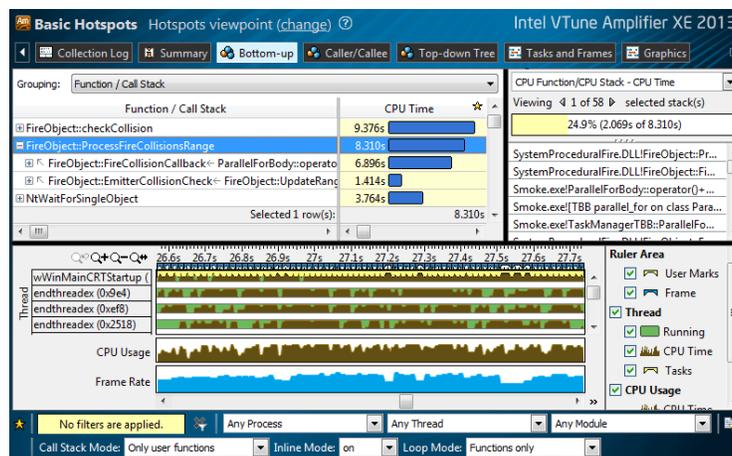
Whether you are tuning for the first time or doing advanced optimization, VTune Amplifier XE provides the data needed to meet a wide variety of tuning needs.

- **Hotspot Analysis** - Quickly locate code that is taking a lot of time. See the calling sequences.
- **Advanced Hotspot Analysis** - Low overhead, high resolution using on-chip hardware.
- **Locks & Waits** - Tune threading. Find synchronization objects impeding performance scaling.
- **System Wide Analysis** - Tune drivers, kernel modules and multi-process apps.
- **Call Count Analysis** - Find code that will benefit from inlining.
- **Bandwidth, Memory, Branch analysis, more** - Advanced analysis to dig deep.
- **MPI applications** - Analyze hybrid applications using MPI and OpenMP. Install on a cluster.
- **GPU compute** - Tune OpenCL. Collect and view GPU metrics. (Newer processors, Windows\* only)

## Productive - Sort, Filter and Visualize

Good data is not enough. You need tools to mine the data and make it easy to understand.

- **Source view** - See profile data on your source and assembly. (C, C++, C#, Fortran and Java.)
- **Timeline** - Visualize thread interactions, balance workloads, filter data.
- **Filter Results** - Eliminate the noise from the data. Select what you want to see.
- **Task Annotations** - Annotate your source to add meaningful task labels to the timeline.
- **Frame Analysis** - Detect DirectX\* frames and filter results to show slow code in slow frames.
- **Intel® TBB, OpenMP\* 4.0** - Built-in understanding of parallel programming models.
- **Issue Highlighting** - Potential tuning opportunities are highlighted. Hover to get suggestions.



Functions using the most CPU time float to the top of the list.

Double click on a function to see the source with detailed profile data.

# Top Features

/Function /Call Stack	CPU Time
initialize_2D_buffer	11.768s
grid_intersect	5.916s
intersect_objects	5.431s
grid_intersect ← intersect_objects	0.485s
sphere_intersect	5.044s

## Quickly Locate Code Taking A Lot of CPU Time (or GPU time)

Hotspot analysis gives you a sorted list of the functions using a lot of CPU time. This is where tuning will give you the biggest benefit. Click [+] for the call stacks. Double click to see the source.

New! On newer processors, optionally collect GPU data for tuning OpenCL applications.

Line	Source	CPU Time
579	cur = g->cells[voxindex];	0.204s
580	while (cur != NULL) {	0.048s
581	if (ry->mbox[cur->obj->id] !=	1.611s
582	ry->mbox[cur->obj->id] = ry->	1.025s
583	cur->obj->methods->intersect(	1.098s

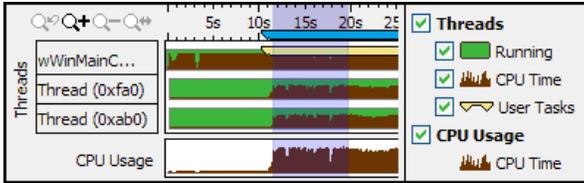
## See the Results on Your Source

A double click from the function list takes you to the hottest spot in the function.

/Sync Object /Function /Call Stack	Wait Time	Wait Count
Manual Reset Event 0xbe5a38e	36.070s	2
GdipCreateSolidFill	36.070s	1
video::~video	0.000s	1
Multiple Objects	20.966s	515

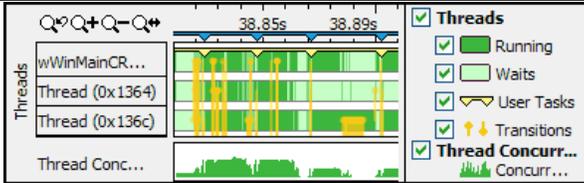
## Tune Threading with Locks and Waits Analysis

Quickly find a common cause of slow performance in parallel programs: waiting too long on a lock while the cores are underutilized during the wait. Profiles like hotspot and locks & waits use a software collector that works on both Intel and compatible processors. New! OpenMP 4.0 support and easier to understand OpenMP data.



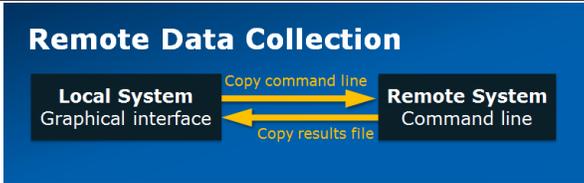
## Mine the Data with Timeline Filtering

Select a time range in the timeline to filter out data (e.g., application startup) that masks the information you need. When you select and filter in the timeline, the grid that lists functions using a lot of CPU time updates to show the list filtered for the selected time.



## Visualize Thread Behavior

See when threads are running and waiting, and when transitions occur. Balance workloads. Find lock contention.



## Remote Data Collection

## Profile Remote Systems - Profile a Running Application

**Profile remote systems.** Use your local GUI to configure the command line, run the collection remotely, and then analyze the results with the GUI or command line.

**Profile without restarting the app.** Profile a running process or profile the whole system with hardware event sampling and filter out what you need later.



Every Intel® processor has an on chip Performance Monitoring Unit (PMU)

## Low Overhead / High Resolution Hardware Profiling

In addition to hotspot analysis that works on both Intel and compatible processors, VTune Amplifier XE has advanced hotspot analysis that uses the Performance Monitoring Unit (PMU) on Intel processors to collect data with very low overhead. Increased resolution (1 ms vs. 10 ms) can find hot spots in small functions that run quickly. Now with optional stack collection to identify the calling sequence.

Analysis Type	Sandy Bridge / Ivy Bridge / Haswell Analysis
	General Exploration
	Bandwidth
	Access Contention
	Branch Analysis
	Client Analysis

## Predefined Hardware Event Profiles

Enjoy easy profiling setup for newer processors. No memorizing complex event names. Advanced profiles like memory bandwidth analysis, memory access and branch mispredictions find tuning opportunities. Now with optional stack collection to identify the calling sequence. Profiles vary by microarchitecture.

/Function	PMU Event Count	CPI	Branch Mispredict
initialize_2D_buffer	CPU_CLK... 22,566,000,000 INST_RETIRE... 51,210,000,000	0.441	0.040
grid_intersect	11,304,000,000	1.049	0.205
sphere_intersect	11,030,000,000		
grid_bounds_intersect	1,580,000,000		

The CPI may be too high. This could be instruction starvation, branch mispredic the other hardware-related metrics to ir

## Opportunities Highlighted

The cell is highlighted in pink when there is a potential tuning opportunity. Hover to get suggestions.

# Details

## Tune Parallel (and Serial) Applications

Older style profilers only provide data for tuning serial applications. While this is important, it is not enough when you need to optimize today's parallel applications. Intel® VTune™ Amplifier XE's concurrency and locks & waits analyses combined with a threading timeline give you the tools you need to tune for scalability and parallel performance.

## Powerful Data Analysis

Unlike most competitive products, Intel® VTune™ Amplifier XE does more than just display the data - it lets you analyze it.

Select a time range using the timeline and filter the data to exclude everything outside of that time range. This updates the list of functions consuming a lot of CPU time to show what is consuming the CPU during the selected time. This lets you filter out noise like initialization, or home in on a performance glitch that occurs only at a certain time.

By default, data is grouped by function, then call stack so that you get a list of functions using the most CPU time. But data can be regrouped in many ways. For example, regroup by function then thread to see if your threaded routine is well-balanced.

Combining selection and grouping can be especially powerful. Tuning a graphics app? Regroup by frame to identify the slow frames. Select the slowest frames and filter. Then regroup by function. Now you have the list of functions taking the most time in the slow frames. This is exactly what you need to know when tuning to speed-up the slow frames.

## What's New?

Feature	Benefit
Tune Inlining with Call Counts	When a function is called frequently it may make sense to "inline" the code and eliminate the overhead of the function call. New statistical call count data to help you make better inlining decisions.
Hardware Stack Sampling	VTune Amplifier XE now supports stack sampling for both hardware and software collectors. Advanced hardware events like cache misses can now also have stacks making it easier to find tuning opportunities.
Better Memory Bandwidth Analysis	VTune Amplifier XE performs a more accurate memory bandwidth analysis for both reads & writes to cache and memory. It also adds bandwidth analysis for additional processor types.
Java Profiling	Analyze Java or mixed Java and native code. Results are displayed on the original Java source.
Profile a running Java App ★	Attach to a running process now works for Java apps too eliminating the need to quit and restart Java apps when profiling.
Analyze User Tasks	The task annotation API is used to annotate your source so VTune Amplifier XE can display which tasks are executing. For example if you label the stages of your pipeline, they will be marked in the timeline and hovering will reveal details. This makes profiling data much easier to understand.
Auto Detect Microsoft DirectX* Frames	Got a slow spot in your game play? You need to know where you are spending a lot of time and the frame rate is slow. VTune Amplifier XE now automatically detects Microsoft DirectX* frames and filter results to show you what is happening in slow frames. Not using DirectX*? Just define the critical region using the API and frame analysis becomes a powerful tool for analyzing latency. ★ Now supporting multiple regions.
Tune for Intel® Xeon Phi™ coprocessor	Hardware profiling is supported for Intel® Xeon Phi™ coprocessor. It can collect advanced hotspot and event data. Time markers correlate data across multiple cards. ★ Now for both Windows* and Linux*.
Analyze MPI Applications	Analyze hybrid applications using both MPI and OpenMP (or other threading). Easy install on a cluster. Results sorted by rank.
GPU profiling data ★	Collect and analyze GPU performance data to tune OpenCL*. Correlate GPU / CPU utilization. (Newer processors, Windows* only.)
OpenMP 4.0 ★	Easier to understand OpenMP data with affinity controls, tasking and scalability analysis.
Caller / Callee Window ★	Easier analysis of the parent and child functions for a particular focus function.
Better Grid View ★	Search capability, overhead and spin metrics, and display of loop hierarchy simplify data interpretation.
Loop Analysis ★	Find the hot loops taking the most time. These can see a big speed up if they can be vectorized.
Timeline Improvements ★	Timeline sorting, overhead and spin metrics, and a configurable time scale make data analysis easier.
Support for New Processors ★	VTune Amplifier XE is constantly adding support for the latest processors. Updates are released shortly after new processors are announced.

★ - New since the original gold release. New features are continuously released in product updates, free with a current support subscription.

# Purchase Options: Language Specific Suites

Several suites are available combining the tools to build, verify and tune your application. The products covered in this product brief are highlighted in blue. Single or multi-user licenses along with volume, academic, and student discounts are available.

Purchase includes a one year subscription to product updates.

Suites >>		Intel® Cluster Studio XE	Intel® Parallel Studio XE	Intel® C++ Studio XE	Intel® Fortran Studio XE	Intel® Composer XE	Intel® C++ Composer XE	Intel® Fortran Composer XE
Components	Intel® C / C++ Compiler	●	●	●		●	●	
	Intel® Fortran Compiler	●	●		●	●		●
	Intel® Integrated Performance Primitives <sup>3</sup>	●	●	●		●	●	
	Intel® Math Kernel Library <sup>3</sup>	●	●	●	●	●	●	●
	Intel® Cilk™ Plus	●	●	●		●	●	
	Intel® Threading Building Blocks	●	●	●		●	●	
	Intel® Inspector XE	●	●	●	●			
	Intel® VTune™ Amplifier XE	●	●	●	●			
	Intel® Advisor XE	●	●	●	●			
	Static Analysis	●	●	●	●			
	Intel® MPI Library	●						
	Intel® Trace Analyzer & Collector	●						
	Rogue Wave IMSL* Library <sup>2</sup>							●
	Operating System <sup>1</sup>	W, L	W, L	W, L	W, L	W, L	W, L, O	W, L, O

Note: <sup>1</sup> Operating System: W=Windows, L= Linux, M= OS X\*. <sup>2</sup> Available in Intel® Visual Fortran Composer XE for Windows with IMSL\*

<sup>3</sup> Not available individually on OS X, it is included in Intel® C++ & Fortran Composer XE suites for OS X

## Technical Specifications

Specs at a Glance	
Processor Support	Intel® processors and compatible processors when analyzing applications containing Intel® instructions. Many profiling features work on both Intel® processors and compatible processors. Features using the on-chip performance monitoring unit require a genuine Intel® processor for data collection, but results can analyzed on a compatible processor.
Operating Systems	Windows* and Linux*
Development Tools and Environments	Compatible with compilers from vendors that follow platform standards (e.g., Microsoft*, GCC, Intel). Can be integrated with Microsoft Visual Studio* 2008, 2010 and 2012. See <a href="http://www.intel.com/software/products/systemrequirements">http://www.intel.com/software/products/systemrequirements</a> for the latest details.
Programming Languages	C, C++, C#, Fortran, assembly.
System Requirements	See <a href="http://www.intel.com/software/products/systemrequirements">http://www.intel.com/software/products/systemrequirements</a> for details
Support	All product updates, Intel® Premier Support services and Intel® Support Forums are included for one year. Intel Premier Support gives you secure, web-based, engineer-to-engineer support.
Community	Join the Intel® Support Forums community to learn, contribute, or just browse! <a href="http://software.intel.com/en-us/forums">http://software.intel.com/en-us/forums</a>



Learn more about Intel VTune Amplifier XE

- Click or enter the link below: <http://intel.ly/vtune-amplifier-xe>
- Or scan the QR code on the left



Download a free 30-day evaluation

- Click or enter the link below: <http://intel.ly/sw-tools-eval>
- Click on 'Performance Profilers' link

### Optimization Notice

Notice revision #20110804

Intel's compilers may or may not optimize to the same degree for non-Intel microprocessors for optimizations that are not unique to Intel microprocessors. These optimizations include SSE2, SSE3, and SSSE3 instruction sets and other optimizations. Intel does not guarantee the availability, functionality, or effectiveness of any optimization on microprocessors not manufactured by Intel. Microprocessor-dependent optimizations in this product are intended for use with Intel microprocessors. Certain optimizations not specific to Intel microarchitecture are reserved for Intel microprocessors. Please refer to the applicable product User and Reference Guides for more information regarding the specific instruction sets covered by this notice.

