

INTEL® VISUAL Adrenaline

ISSUE 11, 2012

*TrackMania² Canyon** Revs up the Gameplay



TECHNOLOGICAL
ADVANCES PROPEL THE
3D REVOLUTION

The Ultrabook™ Device
Reinvents Mobile Computing

intel®
Software

Looking Beyond Tomorrow's UIs
and into the Future of
Human-Computer Interaction



21 THE FUTURE OF VISUAL ENTERTAINMENT LOOKS THREE DIMENSIONAL

Step into the realm of 3D's progression and how its future will continue to astound moviegoers and gamers, and redefine the household TV.

- 1** THINGS YOUR DEV TEAM CAN LEARN FROM A ZOMBIE
Check out how developers at Zombie Studios used Intel® tools to optimize the experience of their most heart-poundingly authentic game yet.

- 5** OPTIMIZE FOR SILICON
When Intel® tools and technological advances coalesce, media-editing products from ArcSoft and Corel enable non-stop creativity for professionals and enthusiasts alike.

- 10** PLAYERS TAKE THE WHEEL IN *TRACKMANIA² CANYON**
Follow Nadeo's journey through the design and development process—with input from fans around the world—of their latest speed-freak racing game.

- 15** PROPHET MARGIN:
INTEL'S FUTURIST LOOKS AT THE MOBILE LANDSCAPE
Peer through the lens of a wise and witty innovator to catch a glimpse of what's next in human-computer technology.

- 17** THE ULTRABOOK™ DEVICE: A COMPELLING FOUNDATION FOR MODERN MOBILE COMPUTING
Explore the exciting features and future plans for the device that will revolutionize the concept of "mobility."

- 28** ENHANCED FOR 2ND GENERATION INTEL® CORE™ PROCESSOR
Discover how Avid and Intel boosted application performance on Avid Studio to take it from outstanding to exceptional.*

- 32** FIEA DEVELOPERS RATE INTEL® SOLID-STATE DRIVES AN A+
Take notes on how a team of graduate students built the Nexus game, put Intel® SSDs to a performance test, and came up with not-so-surprising results.

Intel: Helping You Invent the Future

WELCOME TO ISSUE 11 OF *INTEL® VISUAL ADRENALINE*. As we enter a new year, Intel developers are excited about our new Ultrabook™ device platform.

*Letter from
the Editor:*

Tonya Degance

it will gain incredible speed, power efficiency, and capabilities. We are looking forward to having you be a part of it.

But the excitement isn't just about a great hardware platform. We're also thrilled to share with you the strides being made in the realms of software development and graphics processing

analysis, as you'll learn after reading about Zombie Studios' next big project, the revolution of 3D entertainment, and other articles we've prepared for you in this issue.

We're happy to share with you how James Cameron is looking to redefine our understanding—which is currently limited to only sci-fi and horror films—of 3D. "The possibilities for 3D are endless," said Cameron. "When done correctly, it brings out more emotion, more character, and more athleticism than any other medium out there."

We couldn't agree more. So as you enjoy this year's CES issue, we hope those in the software community are as excited as we are about marrying your vision with Intel technologies, and the promise they hold for a great future together! ■

— Tonya Degance



THINGS YOUR DEV TEAM CAN LEARN FROM A ZOMBIE

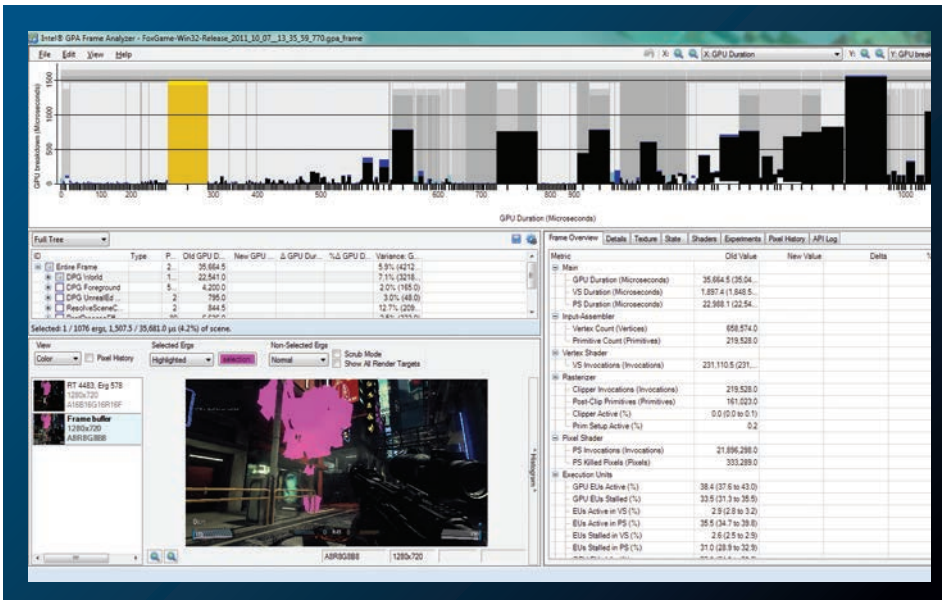
Zombie Studios Uses Intel® Graphics Performance Analyzers to Optimize Gameplay in Immersive Environments

COULD A ZOMBIE REALLY TEACH YOUR DEVELOPMENT TEAM HOW TO OPTIMIZE ITS GAME SOFTWARE? The answer is yes if the zombie is Zombie Studios, the Seattle-based creator of the popular *Blacklight®: Tango Down* multiplayer shooter game for the PC, Sony PlayStation® 3, and Microsoft Xbox® 360.

With a background that includes building simulation systems for the U.S. Department of Defense, Zombie founders Joanna Alexander and Mark Long are no strangers to virtual reality. Their young company is currently hard at work building *Blacklight: Retribution*, the sequel to *Tango*, that unlike its USD 15 predecessor will embrace a free-to-play model that relies on in-game microtransactions for revenue and will be available only for the PC.

Zombie's lead developer Chance Lyon is charged with squeezing every possible drop of performance from *Retribution* while supporting the largest spectrum of PC configurations possible. Considering the enormous variety of PC, processor, memory, and GPU combinations, he's got his work cut out for him.

To ease the job, for the past eight months Lyon has been using Intel® Graphics Performance Analyzers (Intel® GPA), a free optimization suite that comprises platform, frame, and system analysis tools for Microsoft Windows® applications. "We rely on Intel GPA to help us decide where to make platform-specific trade-offs," said Lyon.



profiling and [Microsoft's] PIX* when debugging GPU issues. "I have also used RAD Telemetry* and NVIDIA PerfHUD* on the PC, as well as a slew of console-specific profiling tools."

Building an Audience

Lyon and his team strive to create optimal play experiences for individual gamers, which they see as one of the best opportunities to grow the *Blacklight: Retribution* following. Lyon investigates optimization opportunities by digging into the data he gets from the Intel GPA tools.

The heads-up display, a major advance introduced with Intel GPA 4.0, superimposes performance stats atop a running game. This is particularly useful for delivering productivity when hunting for the cause of bottlenecks. "Having timely, accurate, easily accessible data is key when I'm trying to optimize play experience across the continuum of platforms we span," he said. "Ultimately, the results of optimizations using the Intel GPA tools make the game experience better and better for players. [And] the faster we can make the game, the more features we can include."

State-of-the-Art Tools; State-of-the-Art Games

Lyon relies on the productivity and performance advantages that leading-edge Intel® processors and solid-state drives afford his team. In addition to systems built around 2nd gen Intel Core i7 processors, Lyon's six-member engineering team recently added Intel® Solid-State Drives and has seen a marked performance improvement in their development workstations. "My team has some pretty lofty hardware requirements," said Lyon. "Every day, they are compiling, running, and debugging code, and working to evaluate the effects of various artwork approaches. Every little bit of added performance helps."

Of course, the programmers also take advantage of multi-threading. "We're using a lot of the SIMD (single instruction, multiple data) instruction sets for the animation systems in the game, particularly for skeletal animations," said Lyon. (For an in-depth look at using SIMD programming techniques to improve application performance, read "Optimizing Applications Using SIMD Applications" at software.intel.com/file/33940/). "It's very demanding work, so I do everything I can to keep them fully productive." The team's

"We've found [Intel® GPA] integrates easily with basically any engine, offers lots of flexibility, and most important, it's stable and being actively maintained, which makes me very happy."

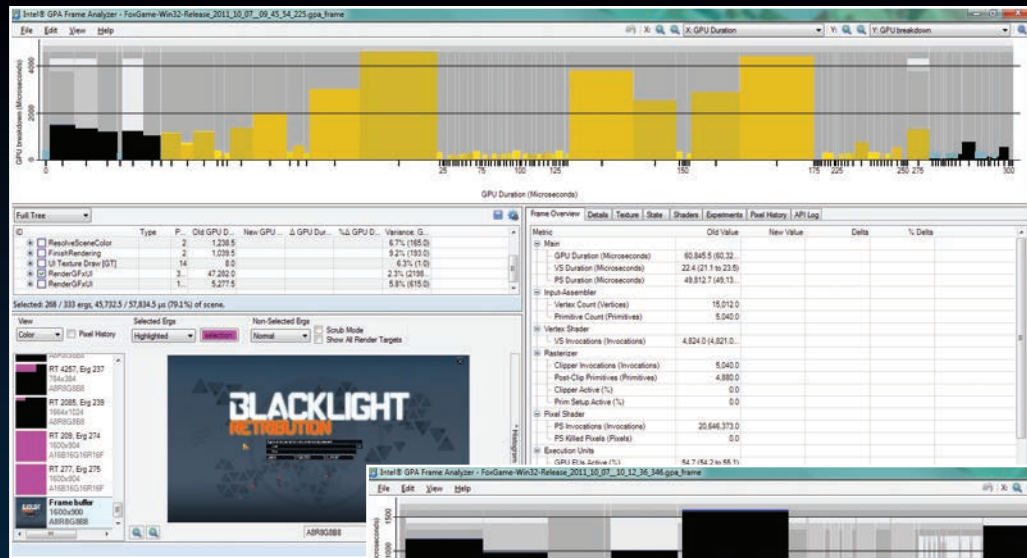
— CHANCE LYON, LEAD DEVELOPER, ZOMBIE STUDIOS

To hear Lyon tell it, Intel GPA can be set up and working in minutes on his team's development workstations, which happen to be equipped with the 2nd generation Intel® Core™ i7 processor, 8 GB of memory, discrete GPUs from either ATI or NVIDIA, and two or three monitors each. Once Intel GPA is configured to auto-detect launched applications, it picks up Zombie's games automatically "... and capturing frames is very easy from there," said Lyon.

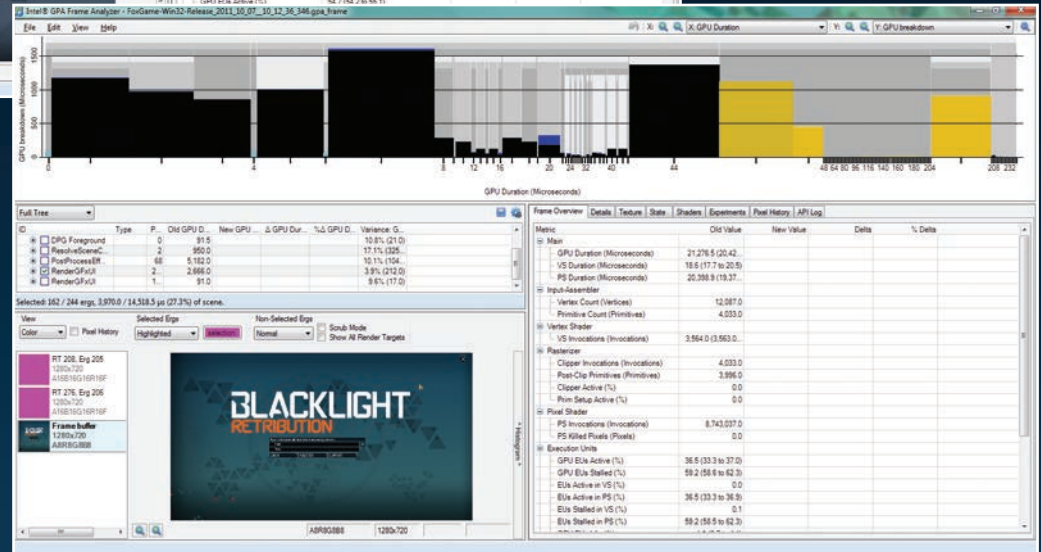
Lyon has come to rely on Intel GPA to identify potential performance problems early in the development process, where they can be remedied most quickly and with the least expense. When testers report a big drop in frame rates, for example, Intel GPA Frame Analyzer quickly identifies the components within the frame causing the bottleneck.

Plenty can also be done at runtime to optimize application performance. "With DirectX* 11, we can exploit quite a bit of scalability using dynamic tessellation, image reflection, and other features. Based on runtime detection of players' system characteristics, we can turn these on and off." At the very low end, for example, levels of shader complexity can be reduced, objects can be removed, or detail can be lessened. "We can certainly reduce data rates to the client if necessary."

The stability of Intel GPA tools also has proven to be a key benefit to Zombie. Prior to Intel GPA, Lyon and his team used "... a combination of Unreal Engine* 3 in-game metrics for CPU



Frame of in-game frame menu render (BEFORE).



Frame of in-game frame menu render (AFTER).

2nd gen Intel Core i7 processor systems have proven themselves more than capable of keeping Zombie developers productive through the company's aggressive development cycles.

The Science of Optimization

Lyon suffers no illusions about Zombie Studios, which he sees as a small fish in a big, crowded pond. "We have to go head-to-head against other game publishers that have hundred-million dollar marketing budgets and years of release cycles on us." So to get noticed, Lyon said Zombie's games "will have to be remarkable."

To accomplish this, Lyon said Zombie's strategies have been to focus entirely on making games that are fun to play and to make optimization decisions based on hard performance data (not hunches). To provide the necessary insight, he has integrated Intel GPA Platform Analyzer within Zombie's in-game stat system, a process that he described as "relatively painless."

"This has allowed me to dig into the call stacks to do CPU profiling traces." Armed with this information, Lyon can easily pinpoint major performance problems that might otherwise have remained hidden. For example, he can now study patterns of line trace calls, which can account for as much as 30 percent of frame time on the server side of the game. "Reducing those or offloading them to other threads is a considerable challenge, but it can be accomplished given enough data to fully define impacts on gameplay," he said.

Intel GPA for Collaboration and Workflow

For a game on the scale of *Blacklight: Retribution*, optimization is never just about code. The structure, content, and interactions of artistic elements can matter as much or more than engineering approaches when it comes to performance. Resolving art-related performance bottlenecks often demands that two very different groups of people—artists and software

developers—work together, communicate effectively, and learn from mutual experience.

Lyon described how he uses Intel GPA Frame Analyzer to identify bottlenecks and help engineers and artists collaborate more effectively. During a recent test play, Lyon noticed extremely sluggish performance from the program's main menu. "[It] was rendering only about 10,000 polys . . . at 15 frames a second," said Lyon. Nobody could figure out why performance was slowing to a crawl when there was just a single character on the screen and an apparently simple background menu.

Lyon used Intel GPA Frame Analyzer to dig into exactly what was taking up all of the rendering time. "It turned out that the background menu was extremely complex and included several layers of full screen blur." Armed with this knowledge, he asked Zombie's UI team to refactor that entire background menu. "The frame rate went from 15 to a solid 60 immediately."

In another case, they discovered that the terrain in an entire level was being rendered in a single draw call, regardless of where the character was positioned. "With [DirectX] 11 tessellation, this meant we were drawing 300,000 triangles. We got the artist to divide the terrain and draw smaller increments less frequently."

Without the Intel GPA Frame Analyzer data, Lyon said it would have been difficult to explain to the UI developers what they need to do differently. "Sometimes we have to ask the artists to do things in ways that are counterintuitive to their aesthetic mindset. It really helps to have rendering statistics in hand, so I can explain without seeming arbitrary. We've had a lot of success finding problem assets using the Frame Analyzer."

Professional Advice on Professional Tools

With only six engineers, Lyon and his Zombie team have to wring every bit of productivity out of every day in their development schedule. For doing so, Intel GPA tools and hardware technologies have proven to be key assets. "We start with an accurate, detailed Intel GPA profiling of the engine," he said, adding that without such concrete knowledge about what's actually going on in the program, the team is running blind and guessing. "That wastes time and money and makes it harder to get to a stable game."

For Zombie, Intel GPA has been a key tool for optimizing GPU and CPU performance. "We've found it integrates easily with basically any engine, offers lots of flexibility to use it the way we want, and most important, it's stable and being actively maintained, which makes me very happy."

Unearthing Zombie Studios

Finding two people more qualified than Zombie Studios founders Joanna Alexander and Mark Long to run a game development company would be a challenge indeed.

Co-CEO and COO Alexander has a BS in Mathematics from Yale and a Masters in Engineering from Princeton. She has led virtual-reality research in the Simulated Systems group at the Sarnoff Research Center where she received the lab's Technical Achievement Award, has conducted research at the Max Planck Institute for Nuclear Physics in Germany, and served as Deputy Chair of a U.S. Department of Defense committee formed to advise government and military officials on issues relating to technology transfer and virtual reality.

Co-CEO, and designer and producer Long has an equally impressive background. He has produced more than 28 titles, and as a former member of the Silicon Graphics, Inc. advisory board advised SGI on requirements for their next-generation virtual-reality systems. His research experience spans the Sarnoff Research Center, University of Texas Institute for Advanced Technology, and General Dynamics' Combined Arms Systems Engineering Laboratory. He has collaborated with the National Science Foundation, the University of Washington Human Interface Laboratory, and the University of Illinois to produce a summary report for the Congressional Task Force on Virtual Reality. He also co-chaired, with NASA and the Stanford Research Institute, a conference on next-generation virtual-reality research.



Tapping the intense military symmetry, *Blacklight: Retribution* could be the company's most heart-poundingly authentic game yet. Alexander and Long formed Zombie Studios in 1994 with an eye to developing virtual-reality technologies for commercial and military uses. Today, while Zombie Studios mostly focuses on the consumer-gaming niche, the company's Serious Games Division is still active in creating live-fire military simulations where real shooters train using real weapons and real bullets in virtual environments.

With *Blacklight: Retribution*, Zombie enters a new area of the gaming business: The free-to-play model, under which revenue is generated when players purchase game-related items such as ammunition, supplies, or clothing. "Future game-revenue streams will shift from up-front purchase to in-game microtransactions," said Lyon. To succeed in this new business environment, a game must be feature-rich, immersive, and above all, engaging. It also has to perform well across a variety of platforms. In the free-to-play model, first impressions are critical because games must both attract players and retain their interest. "To win customers, we'll have to compete for their time and attention before we get to compete for their money," said Lyon. "Free-to-play is the future of multiplayer online gaming."

With Zombie's involvement in live-fire military simulations, let's just hope they don't invent a way to make those virtual realities cross over into the physical world. ■

Optimize for Silicon

Tapping into the Full Power of the 2nd Generation Intel® Core™ Processor Family with Intel® Software Development Tools

BY DOMINIC MILANO

CREATIVE ENTHUSIASTS WORKING WITH ENTERTAINMENT MEDIA SUCH AS HD VIDEO NEED HIGHLY RESPONSIVE TOOLS THAT SUSTAIN THE CREATIVE FLOW. After

all, waiting for an effect to render or suffering through herky-jerky video playback are sure ways to squelch inspiration. Therefore, tapping into the full performance potential of today's desktop, laptop, tablet PC, and mobile computing architectures—and eliminating latency-inducing bottlenecks—is essential for media application developers. These are typically daunting, time- and resource-intensive tasks. Developers need to stay abreast of the latest innovations for a multitude of platforms and maintain separate code paths that are fine-tuned and optimized for each of them.

A number of powerful Intel® developer tools help to streamline the process of analyzing and optimizing media and other graphics-intensive applications. For example, Intel® Graphics Performance Analyzers (Intel® GPA), Intel® VTune™ Amplifier XE, and Intel® Media Software Developer Kit (Intel® Media SDK)—used separately or together—allow developers to increase the parallelization of their code, readily identify and eliminate hotspots and bottlenecks, and accelerate media encoding, decoding, preprocessing, and transcoding operations across a variety of Intel® platforms, including legacy and the current 2nd generation Intel® Core™ processor family, as well as Intel® Atom™ processors.



Optimal Performance for Maximum Impact

Optimization is a critical part of the product development workflow, especially for media application developers. ArcSoft, a leading developer of video-editing, conversion, and sharing applications, for example, devotes 50 percent of its development cycle to the optimization process. Why is optimization so important? It all boils down to performance. "Today's users don't want to wait for effects to render or videos to load," said Yanlong Sun, ArcSoft deputy general manager of Video and Home Entertainment. "Tapping into the excellent performance of Intel® processor architecture through fine-tuning and optimization means that users don't need to wait."



For Corel, one of the world's top software companies, optimization is also important. As Jan Piros, senior strategic product manager at Corel, explained: "Platform optimization is fundamental to our development. A significant amount of our effort goes into this because the gains made can be felt throughout many of our features. It's an effort whose impact is multiplied throughout the software and of great benefit to the user."

“Speed has a dramatic impact on our user’s experience with our product. It’s clear that, with its technology, support, and dedicated people, Intel understands this—and that makes a big difference for us at Corel. Intel provides the tools that we can use to optimize our software and build a superior user experience. The Intel® Media SDK puts all the tools we need in our hands and helps us deliver maximum performance in our products.”

— JAN PIROS, SENIOR STRATEGIC PRODUCT MANAGER, COREL CORP.

With each new generation of processor, more cores are added to a single piece of silicon. For example, the 2nd gen Intel® Core™ i7 processor has six cores on a single 32nm chip. Intel® Hyper-Threading Technology enables each core to handle two separate instructions simultaneously. To make use of all that processing power, software developers tune and optimize their code for multi-core, multi-threaded operations. This allows the software to utilize all available cores and threads on a system, helping to boost performance in the process.

In addition, 2nd gen Intel Core processors feature Intel® Quick Sync Video and Intel® Clear Video HD Technology, powerful integrated acceleration technology for encoding, decoding, and preprocessing HD video formats and codecs. To access the incredible performance boost that Intel Quick Sync Video and Intel Clear Video HD Technology offer, developers must use the Intel Media SDK.

Gathering Accurate Performance Intelligence

Zeroing in on the exact cause of any particular latency, when hundreds of modules and millions of lines of code are involved, is like trying to find the proverbial needle in a haystack. Discovering bottlenecks and analyzing CPU and graphics workloads at the system, task, and intra-frame levels can help save developers a significant amount of time during optimization and development of their application.

Intel GPA provides developers with a suite of analysis tools for visualizing and optimizing applications efficiently from the system level all the way down to individual elements such as draw calls within a single video frame. In addition, Intel GPA lets developers experiment and actually see performance opportunities from optimizations without making source code changes, with the intuitive, standalone GPA Frame Analyzer tool.

Intel GPA includes the following tools and features:

- Intel GPA System Analyzer heads-up display provides a system-level view of CPU, GPU, and DirectX* metrics, and measures processor, memory, and graphics performance in real time, revealing potential bottlenecks.
- Intel GPA Frame Analyzer allows elements in individual frames to be analyzed and allows developers to see the visual and performance impact of changes without actually changing the code.
- Intel GPA Performance Analyzer allows developers to see how the interaction of multiple tasks and subtasks running on CPUs and GPUs affect performance. Support for Intel® HD Graphics 2000/3000 (GPU) hardware enables developers to analyze how efficiently their application takes advantage of hardware acceleration in 2nd gen Intel Core processors. Intel GPA now contains customizable task coloring, support for task sub-states, and more.
- The Intel® Instrumentation and Tracing Technology (Intel® ITT) API for the Intel® GPA Platform Analyzer enables the developer’s application to generate and control the collection of trace data during its execution.
- Instrumentation allows developers to recognize, analyze, and visualize trace data in the graphics driver and the Intel Media SDK library, and data from the DirectX library. Developers can monitor relationships that occur in the time between task submission and execution, identifying bottlenecks within the context of the entire computing platform.
- OpenCL* support through the Intel® OpenCL SDK allows developers to analyze and optimize performance of OpenCL 1.1 standard code run on Intel multi-threaded processors. This makes it easier to adopt OpenCL technology and to optimize OpenCL content.

Taking the Guesswork Out of Multi-Core Scalability

Intel VTune Amplifier XE is another powerful Intel developer tool for threading and performance optimization. By providing an accurate performance profile that is displayed on a time-line complete with data filtering and frame analysis capabilities, developers can tune their applications based on hard, actionable data rather than educated guesses. Data filtering selectively screens information, such as start-up statistics, that masks accurate results. Performance data is color coded to speed up the process of finding common causes of slow performance in parallel programs such as wait locks; that is, waiting too long for a lock while cores go underutilized.



"Intel® VTune™ Amplifier XE and Intel® GPA are integral to our development process. We use Intel VTune Amplifier XE for CPU usage profiling, which helps us pinpoint execution hotspots and analyze potential performance issues in multi-threading. We're currently developing an HD codec using both Intel VTune Amplifier XE and the Intel GPA tool for optimization across the CPU and GPU and for fine-tuning multi-thread scheduling."

– YANLONG SUN, DEPUTY GENERAL MANAGER OF VIDEO AND HOME ENTERTAINMENT GROUP, ARCSOFT

Every Intel® processor includes an on-chip Performance Monitor Unit (PMU) to facilitate optimization. Intel VTune Amplifier XE uses the PMU to keep track of various events, and with presets for Intel processor microarchitecture, developers don't have to keep track of complex event names. In fact, the tool automatically highlights routines that it recognizes as potential candidates for optimization and even offers suggestions as to what might be causing trouble, such as the number of cycles per instruction being too high.

Intel® VTune™ Amplifier XE Performance Profiler helps developers tune single-node threading by visualizing thread behavior, evaluating thread load balancing, and finding thread synchronization bottlenecks.

Intel VTune Amplifier XE is available as a standalone application or as a component of Intel® Parallel Studio XE. Intel Parallel Studio XE is another suite of developer tools that consists of Intel® C/C++ and Fortran compilers as well as optimized performance and parallel libraries.

Accelerating Encode, Decode, and Transcode Performance on Intel® Platforms

Intel Media SDK offers developers quick, easy access to hardware-accelerated video encoding, decoding, and pixel preprocessing capabilities with Intel-optimized software fallback. The cross-

platform API allows developers to take advantage of powerful Intel Quick Sync Video and Intel Clear Video HD Technology hardware acceleration that offloads processor-intensive tasks to the graphics component of 2nd gen Intel Core processors. Even when run on a platform that lacks hardware acceleration, applications created with Intel Media SDK still gain the benefit of tuned, optimized, and multi-threaded software-based video encoding and decoding that's tailored to the capabilities of the Intel platform on which they are running.

Intel Media SDK is extremely useful for creating video-editing and -processing, media conversion, streaming, and playback, as well as videoconferencing applications. It supports encoding and decoding of H.264, VC-1, and MPEG-2 format content, as well as stereoscopic

3D (S3D) content, through the Multi-View Video Coding (MVC) H.264 extension, all of which are used in applications such as ArcSoft ShowBiz* 5 and MediaConverter* 7, and Corel VideoStudio* Pro X4, among other popular video-editing, conversion, and sharing applications developed using Intel Media SDK.

Intel Media SDK 2012 also includes the following benefits:

- Dramatically streamlined workflow. Creating video encoding and decoding routines to support multiple hardware platforms can be tedious and time consuming, particularly when dealing with the intricacies of the Microsoft DirectX Video Acceleration (DxVA) interface.
- Simplified development. Intel Media SDK 2012 introduces Opaque Memory, a new memory type, which dynamically allocates memory to determine the best memory configuration for the type of client configuration the software is running on, helping to make development easier and applications perform better.
- New tools. Intel Media SDK includes the same tracer technology as the other Intel® software developer tools mentioned, which helps make it easier to capture and log calls as they are sent to the media libraries, providing developers with an excellent debugging resource.
- Support for new camera usage models. New enhancements make it easier to develop videoconferencing applications such as Skype*, video surveillance, and other applications that use video cameras.
- Integral support for future Intel® architecture advances. The Intel Media SDK provides a flexible and extensible architecture, enabling application support for leading Intel® hardware, beginning with the Intel® Graphics Media Accelerator (Intel® GMA) 4500 HD, Intel HD Graphics, and 2nd gen Intel Core processors. It also extends to future Intel architecture. This allows developers to create applications today using the Intel Media SDK and take advantage of hardware acceleration available now and in the future—without rewriting any program code.

Additionally, Intel Media SDK provides lower latency encode and decode operations, dynamic bit-rate control, forced key-frame insertion, and reference list selection, as well as long-term reference and temporal scalability.

Putting Intel® Software Developer Tools to Work

ArcSoft Fine-Tuning and Optimization

ArcSoft is a leading developer of multimedia imaging technologies and applications for desktop and embedded platforms. The company creates software for smartphones, feature phones, tablets, PCs, smart TVs, and cameras. Its retail video software such as TotalMedia* Theatre*, MediaConverter, and ShowBiz* enables consumers to author, edit, and play back various HD formats such as AVCHD and Blu-ray* on PCs and smart devices.

Optimization is a crucial portion of ArcSoft’s development cycle, and Intel software developer tools play a key role in the process. “Intel VTune Amplifier XE and Intel GPA are integral to our development process,” said Yanlong Sun, deputy general manager of the Video and Home Entertainment Group at ArcSoft. “We use Intel VTune Amplifier XE for CPU usage profiling, which helps us pinpoint execution hotspots and analyze potential performance issues in multi-threading. We’re currently developing an HD codec using both Intel VTune Amplifier XE and the Intel GPA tool for optimization across the CPU and GPU and for fine-tuning multi-thread scheduling.”

ArcSoft utilized Intel Media SDK to optimize their video playback and editing applications, helping it develop easy-to-use, highly scalable products that run on a range of processors, including 2nd gen Intel Core processors and the Intel Atom processor.

ArcSoft worked closely with Intel to optimize its TotalMedia Theatre decoder pipeline for Intel GMA technology in Intel Atom processors. “TotalMedia Theatre delivers smooth, high-quality Blu-ray playback on Intel Atom processors,” Sun said.

Intel VTune Amplifier XE, Intel GPA, and Intel Media SDK were instrumental in allowing ArcSoft to parallelize the core engine used in both ShowBiz and MediaConverter. “Parallel tasking gives our users the ability to simultaneously output finished content to, say, YouTube* and a handheld device format,” Sun said. “The Intel GPA tool gave us a frame-by-frame GPU analysis to help us improve our decode and encode pipelines. Intel’s multi-core, multi-threaded processor technology significantly reduces the conversion time. The user can now convert four or more files concurrently while leaving the processor free for other tasks.”

Looking to the future, ArcSoft has been using a prerelease version of the Intel Media SDK 2012 to develop real-time transcoding technology for videoconferencing. ArcSoft is also working closely with Intel engineers to optimize a number of OEM applications for the Android* OS that run on Intel architecture and Intel Atom processor platforms.



Intel® VTune™ Amplifier XE Performance Profiler helps developers tune single-node threading by visualizing thread behavior, evaluating thread load balancing, and finding thread synchronization bottlenecks.



Corel Optimized Performance and Multi-Core Scalability

Corel, one of the world's top software companies with over 100 million active users in more than 75 countries, develops innovative products that are easy to learn and use. Corel VideoStudio* Pro X4, its flagship video-editing software, offers video makers of all skill levels a comprehensive set of video-editing tools, along with plug-ins for rock-steady video stabilization and broadcast-quality titles, animations, and graphics.

In developing VideoStudio Pro X4, Corel engineers used Intel Media SDK and Intel Parallel Studio XE to achieve optimal load balancing between CPU and GPU media-processing pipelines in 2nd gen Intel Core processor architectures. "The decode/encode functions in the latest Intel Media SDK allowed us to achieve very fast transcoding speed, as well as fast read-back

between video and system memory," said Chung-Tao, director of development at Corel.

Intel VTune Amplifier XE helped Corel engineers identify bottlenecks and hotspots by analyzing modules related to a single feature or feature set instead of having to look at the entire VideoStudio Pro code base. Once identified, bottlenecks were eliminated, resulting in code optimized for performance and multi-core scalability.

"The design of 2nd gen Intel Core processors, with its Intel HD Graphics, Intel Quick Sync Video, Intel Clear Video HD Technology, increased parallelism, and greater throughput, can really stand up to the stresses of HD video," Piros said. "It lets us deliver a video editor with a smooth and responsive creative experience that really wasn't possible with previous-generation chips."

Corel's new MotionStudio 3D* is an easy-to-use 3D and motion-graphics application that makes titles and graphics for video. "MotionStudio is very graphics intensive," Chung-Tao said. "Looking ahead to future releases, we can absolutely see where Intel GPA will help optimize our very complex and computing-intensive graphics."

Speed Thrills

"Speed has a dramatic impact on our user's experience with our product," Piros concluded. "It's clear that with its technology, support, and dedicated people, Intel understands this—and that makes a big difference for us at Corel. Intel provides the tools that we can use to optimize our software and build a superior user experience. The Intel Media SDK puts all the tools we need in our hands and helps us deliver maximum performance in our products." ■

About the Author

Before signing on as one of the writing muses for Rose & Her Minions, Dominic Milano spent over 30 years in print, online, and event media production, working on DV magazine, Game Developer magazine and the Game Developer Conference, Keyboard magazine, Guitar Player magazine, and more.

PLAYERS TAKE THE WHEEL IN *TrackMania² Canyon**:

FRENCH GAME DEVELOPER NADEO PUTS THE
PLAYERS FIRMLY IN THE DRIVING SEAT

BY JOHN TYRRELL



THE 15TH ARRONDISSEMENT IS THE MOST DENSELY POPULATED PART OF THE BEAUTIFUL AND ANCIENT CITY OF PARIS, and home to impressive institutions, including the global headquarters of UNESCO. However, it's better known as the place where millions of visitors every year make a pilgrimage to gaze up at, and down from, the Eiffel Tower, one of the world's greatest architectural icons. It's in this decidedly international and incomparably romantic atmosphere that one company's unique vision is steering video games toward an exciting new future at gravity-defying velocities.

Nadeo Blazes Game-Development Trail

Founded in 1999, game-development studio Nadeo cut its teeth with the *Virtual Skipper** sailing simulator series, which for over 10 years and through five iterations has invited players to indulge in high-stakes nautical racing on the PC. However, a very different kind of racing brought the company to the attention of leading global video-game publisher Ubisoft, resulting in Nadeo being added to Ubisoft's stable of in-house studios in 2009. Since 2003, the *TrackMania** franchise of online PC racing games has blazed a new trail and earned the company a reputation as a major innovator.

User-generated content has evolved from being an industry buzzword to being the cornerstone of a growing number of successful video-game franchises. However, while many developers and publishers refer to it as a core gameplay element or as a way to extend the content for a game's more committed players, Nadeo rejects both of those definitions outright in favor of a more radical vision of the player's role in game creation.

"Generally speaking we try not to use the term *user-generated content*," said Edouard Beauchemin, international product manager at Nadeo. "In many games that term refers to additional content that players produce on the side. For us it's part of the core game mechanics."

This vision has more in common with nascent crowdsourcing techniques than with traditional game development and puts Nadeo at the vanguard of an exciting new approach to game development. With the *TrackMania* series, Nadeo places the community of players—and the content they create—firmly at the heart of the creative process and the gameplay experience.

“We create gaming tools and systems rather than designing games with a history and a background story,” said Beauchemin. “When we start to create a game, we think about delivering the best creative tools for our community, offering them the chance to create, share, and, of course, play. The gameplay is key because the game has to be good. Then we make sure the tools are very powerful and offer the maximum number of possibilities to players.”

This player-centric approach is central to Nadeo’s success. The first game in the *TrackMania* series was released in 2003, and nine iterations later the franchise has become something of a PC racing phenomenon, with well over 10 million registered drivers online to date. “I think the players thrive in this kind of environment,” said Beauchemin. “The community has been growing for years now, with more and more players online, so it seems to be a good recipe.”

The Squaring of *TrackMania*

The most recent full-fledged sequel in the series is *TrackMania² Canyon*, launched by Ubisoft in September 2011 to a rapturous reception from fans and critics. The superscript 2 in the game’s title is significant, representing the idea that—more than a simple sequel—the game is *TrackMania* squared, with every feature multiplied rather than simply added to. “After the success of the first *TrackMania* we decided to pursue two goals,” said Beauchemin. “First, to offer a better, more comfortable experience, but also to offer an experience with more of a sensation of speed and of driving, to put it simply.”

“That’s why we say *TrackMania² Canyon* is *TrackMania* squared. It’s a more powerful game. Everything is better. We improved the graphics, the gameplay, the tools for creation, and offered it all to players for an accessible price.”

Built entirely on Nadeo’s own in-house technology with the ManiaPlanet system at its working core, *TrackMania² Canyon* hands players

a vast sandbox of racetrack components and invites them to construct tracks—a scenario limited by only their imaginations. The *Canyon* portion of the game’s name refers to the majestic, rugged desert setting, which serves as the blank canvas for the tracks in *TrackMania² Canyon*. Often with games featuring user-generated content, only a minority of players take the time and effort to contribute, but with *TrackMania² Canyon* Nadeo has carefully crafted the tools and the gameplay itself to put creation at the core of the experience, ensuring that barriers to participation are low and the fun quotient is high.

“It’s a game you can drive with four cursor keys,” said Beauchemin. “My five-year-old nephew managed to handle a car in less than a minute, so it’s easy to handle; but it’s hard to master because the track defines the difficulty level.” Every tool at the disposal of the in-house development team, including the track editor and even the video-creation tools, is handed over to the players, creating a level playing

field where skill and creative vision are the only factors in play. “Everything we deliver—from tracks to videos—is made with the in-game tools,” said Beauchemin. “Offering tools to everyone allows people to recreate or do the same thing at home. *TrackMania* has over half a million created tracks and over 30,000 videos. Obviously people enjoy it a lot.”

Collaboration Breeds Innovation

The track editor makes it simple for anyone to dive in and create accomplished and great-looking tracks in very little time that can then be shared with the entire community of millions of online players. “It’s designed to be an open world where people come with their own style, their own ideas, and decide to race the way they want,” said Beauchemin. “Some people like to do stunts, some like really technical driving, and some do grand prix driving, running around for hours on a round circuit.”



"It becomes a really impressive experience when the graphics are smooth and sharp. We've been improving the lighting with radiosity, shadows, and lights in general. Reflections, bloom, the level of detail, anti-aliasing—those are the things that require the highest graphical power."

— EDOUARD BEAUCHEMIN, INTERNATIONAL PRODUCT MANAGER, NADEO



"Some even created a game mode called RPG where they do a sort of platformer with their car. They try to jump from place to place, and just finishing a track is already an achievement. When you get into *TrackMania² Canyon* you never know what you can encounter. You can choose from what you see and choose the way you want to race."

In addition to leading to a great deal of exceptional creativity from the community, sharing its powerful yet easy-to-use toolbox has led Nadeo to proving that it's serious about its vision of players at the core of the

development process. Not long ago, the designer who created the 65+ tracks that ship with *TrackMania² Canyon* was himself just a regular fan of the series.

Nadeo was so impressed with what this fan was doing with its editing tools that he was invited to become a full-time member of the team. Similarly, the stunning official trailers of the game (which can be seen online) were created by talented players that Nadeo brought onboard, letting them continue to produce their work on a professional basis.

"They're all people that made videos for their own fun," said Beauchemin. "They were just so talented and gifted in deciding what to film that we hired them to work with us on the video trailers using only the in-game video editor."

However, collaborating with the community isn't simply a matter of harvesting created content. It's a genuine, living process that continues throughout the life cycle of the game starting from its inception. "The *TrackMania* community is very much alive and very knowledgeable about many things," said Beauchemin. "Throughout the alpha and beta process they've been incredibly helpful with pointing out any kind of possible issue. We also have community discussions on forums and servers. It's very helpful to know what people enjoy, the way they want to play, and what for them is the next step forward. Then we think about what our next step forward is, and hopefully we're going in the same direction."

As a player, however, the sheer volume of content created and available online could easily become daunting, and Nadeo understands the importance of being able to unearth the real gems. The game server hub and numerous online fan sites make the process straightforward, showing rankings and letting players rate tracks and find the ones they want to race on. "When you connect online you'll see servers that are more popular than others, and you'll see quite quickly who's successful in creating tracks and attracting players," said Beauchemin. "There are several thousand servers to choose from, so honestly by just going around and seeing what's popular, normally you can find something that you're looking for."

"Then there are many exchange Web sites, such as Mania Exchange, where people rate tracks, give them awards, comment on them, give a difficulty level, and also give a racing style," continued Beauchemin. "Let's say you're into technical driving. You can find maps that are designed especially for drivers like you. And because it's rated by other players, you also have accurate feedback. It's not an automatic machine offering you content that may not be exactly what you're looking for—you're talking with humans about their creations and what they want to share."

With the online experience such a core part of the overall *TrackMania² Canyon* experience, Nadeo designed the gameplay to take into account the problems players of online racing games encounter, where all too frequently a minority are determined to spoil the experience for others. To neatly sidestep the problem, Nadeo implemented a system that makes it impossible to crash into another car. Instead, all the other cars on the track behave like ghosts, so your high-speed progress is unimpeded.

"On any public server I'd say you'd always have one, two, or three people that just enjoy giving a hard time to other people in general, so we decided to stay away from that," said Beauchemin. "This helps keep the community sane and the competitor spirit as high as possible because you don't have to worry about people blocking the road in front of you."



Future Gaming and the PC Platform

Just as bold as its approach to game creation is Nadeo's attitude toward the PC platform, which is the exclusive platform for *TrackMania² Canyon*. The PC has no shortage of fans at Nadeo.

"We want to develop cutting-edge, new technology for gaming, and we believe that the PC platform offers the best possibilities for that," said Beauchemin. "It's accessible, it offers the best graphics, and it's the most-used platform throughout the world, which is very important for us because we have players from many countries. We already have 96 countries represented in *TrackMania² Canyon*."

"I think the PC is the future for gaming," continued Beauchemin. "Its integration with the Internet is best and that's very important for us as we are a social network of players. The PC is where innovation has always happened, so that's why we also want to be there. It's also becoming more and more democratic, with people having very accessible laptops that are still very powerful machines. It's just the ideal platform for us."

Some of the most important advances in *TrackMania² Canyon*, and most expensive technologically, are graphical. With the solidity of the core gameplay experience well established, Nadeo chose to focus significant resources on the improvement of the game's visuals, both in terms of development resources and the system resources the game demands of the computer. "It becomes a really impressive experience when the graphics are smooth and sharp," said Beauchemin.

"We've been improving the lighting with radiosity, shadows, and lights in general. Reflections, bloom, the level of detail, anti-aliasing—those are the things that require the highest graphical power."

Key to bringing Nadeo's vision to life is putting the full game experience and its beautiful graphics in the hands of as many players as possible with no compromise on quality. It's here that PC hardware innovation counts.

One of the hardware innovations that is playing an important role in the democratization of powerful PC technology and the platform's potentially bright future for games is Intel® HD Graphics. Thanks to the technological advances, more power is finding its way into a greater number of hands at lower cost, letting players enjoy increasingly sophisticated experiences, such as *TrackMania² Canyon*, on a wider range of PC hardware, all of which is great news for Nadeo.

"What's exciting for us is that now pretty much anyone can have a good laptop or a good desktop



for gaming and be able to run our game and do it smoothly. Computing power has increased so much that, for example, now we can run in full HD on low-end machines, which was not possible before.”

Paris-based Intel engineer Guy Grenier collaborated with the team at Nadeo during the final months of development and testing, providing them with a system equipped with 2nd generation Intel® Core™ processor family and Intel HD Graphics, and helping them optimize the platform. By Guy’s own admission, the skilled team at Nadeo, armed with their own powerful proprietary tools, were more than capable of achieving an extremely high level of optimization themselves, but he was able to help ensure that they reached their common goal as efficiently as possible. The results were showcased on the Intel stand at the 2011 GamesCom show in Cologne, Germany.

“*TrackMania² Canyon* was being played on six HD graphics machines and honestly it was just looking like a great game running smoothly in full HD,” recalled Beauchemin. “German PC gamers often have a very critical eye for these matters, and they said that it looked like an awesome game. That’s great for us.”

“Just knowing that the 2nd gen Intel Core processor is such a great technology for consumers in general helps us work with peace of mind, knowing that if our game runs so smoothly on this processor we don’t have to worry too much about accessibility for our games in the future,” continued Beauchemin.

During the development of *TrackMania² Canyon* Nadeo also took into account the increased prevalence of multi-core and multi-threading processors. “We made sure that the game ran smoothly on multi-threading simply because it helps players to be comfortable while running the game,” said Beauchemin. “If they can run it full window and do other tasks in the background at the same time it means comfort for them. We’re aiming at making sure they have the best experience possible, and we think those processors help very much.”

When asked whether the continued advances in PC technology are going to benefit PC gaming in the long term, Beauchemin is unequivocal. “I’m actually convinced so. With the 3rd generation Intel® Core™ processor family coming soon—and the Ultrabook™ device that also looks extremely promising—people are looking for ways to improve their way of gaming. And, I think those technologies are definitely the way forward and the future for gaming.”

What’s Next?

As far as Nadeo’s future is concerned, *TrackMania² Canyon* is just the beginning. Based on the same ManiaPlanet system, Nadeo is planning to bring the same player-driven experience to the first-person shooter (FPS) and role-playing game (RPG) with *ShootMania** and *QuestMania** respectively, and plans for the next *TrackMania* title are already well underway. Helped by the increased proliferation of powerful and affordable hardware, Nadeo’s atypical approach to development puts it at the forefront of a major evolution in collaborative, crowdsourced game creation, the fruits of which are just beginning to emerge.

As Beauchemin said, “It’s much like a social network of gamers in a 3D high-quality gaming environment. The difference with games that tend to be more like platformers or mini-games is that we try to do games that core gamers like—racing, FPS, and RPG—and really put the player at the center. That’s why we say ManiaPlanet is powered by players, because without the players there’s no power in the games.” ■

About the Author

John Tyrrell’s career in the games industry began with the launch of Nintendo’s Pokemon on an unsuspecting British public in 1999. After a decade of creating international PR campaigns, supplemented with work as a freelance writer, he left the position of Worldwide PR Director at Atari in 2009 to establish Hot Socket, a communications consultancy based in Lyon, France.*



Download the *TrackMania² Canyon** game for USD 24.99 at: www.trackmania.com

Prophet Margin:

Intel's Futurist Looks at the Mobile Landscape

We are computing in the past. Every chipset and microprocessor we use today is the product of five to 10 years of development and design. For a technology company to be successful, it must be able to not only deliver cutting-edge products, but also tailor those products for a marketplace and consumer demand that doesn't yet necessarily exist. It's enough to make you want to break out the crystal ball.



That's where Brian David Johnson comes in.

As Intel's first and only futurist, Johnson's job is to look 10 to 15 years into the future and develop an actionable plan to create the technology the people of tomorrow will want. Developing such a vision is a complicated mix of sociology and research into how people interact with computation today to anticipate how that will likely evolve over time.

Johnson took time out from working on the 2019–2020 processor to talk to *Intel® Visual Adrenaline* about forecasting future technology trends, the human component of technology design, and the Ultrabook™ device—a lightweight, powerful new form factor that is set to revolutionize mobile productivity and innovation.

VISUAL ADRENALINE (VA): CAN YOU TELL US A BIT ABOUT YOUR HISTORY IN THE INDUSTRY?

BRIAN DAVID JOHNSON (BDJ): My first job was at the computer lab at the local university in Virginia. That was back when every printer room had one printer, and that printer was in a soundproof box. And there was an entire room of Wang word processing machines and a room full of mainframe terminals. I was there when they carted in the first personal computer. The joke was that it was called a personal computer because you could lift it by yourself.

VA: SO WE HAVE COME A LONG WAY, THEN.

BDJ: Oh, yeah! I always laugh about the computers that I learned to program on; today, we carry around more computational power in our pockets.

VA: HOW HAS YOUR WORK AS A FUTURIST INFORMED YOUR VIEW OF THE INDUSTRY AS A WHOLE?

BDJ: Well, it has made me very boring, to be quite honest. I am a very pragmatic futurist. The work I do is for the specifications of processors, so I have to make sure that whatever visions I come up with are really grounded and that we can build them. If I tell Intel that we're all going to have rocket cars and jet packs and come 2020 we don't have rocket cars and jet packs, then this futurist won't have a job.

I think more on the human side. Our lab at Intel is actually run by a cultural anthropologist, Dr. Genevieve Bell. Everything we do is based in social science

first and foremost. We are designing processors, platforms, and multiple products, and even the software and the algorithms that go into those products from a human standpoint. The futures we are looking at . . . need to be very accomplishable.

VA: HOW DO YOU GO ABOUT PROJECTING 10 TO 15 YEARS IN THE FUTURE?

BDJ: We start with social science. We have, in our lab, ethnographers and anthropologists who go all over the world to study people and give us insights into human behavior—how humans communicate with each other, how humans live, how people interact with their governments, how they buy things, and what their cars are like. Whatever you can think of, they are looking at it.

That gives us a basis—we have to remember that we are building products for us, for people. From there, I look at the computer science side of things: the people who are doing the innovative hardware and software development that goes on at Intel.

Next we ask, "What is possible with technology?" We look back at those human insights and ask, "Okay, how do we make people's lives better?"

Then I like to look at trends, what I call the math of the future. Most people start with population growth and the projections of where we are going. Although those are important to me, they aren't as important as the first

two steps—social science and computer science—because, again, we have to understand the people we are building for, and then we have to understand the technology that we are building.

VA: WHAT KIND OF EFFECT DO YOU SEE SMALLER SCREENS AND PORTABLE FORM FACTORS HAVING ON THE INDUSTRY GOING FORWARD?

BDJ: Computation power has spread and found its way into our living rooms and pockets, and is finding its way into our cars, walls, and hospitals. For the longest time people asked, “Will the PC kill the TV?” Now you hear them ask, “Will the smartphone kill the laptop?” or “Will the tablet kill the laptop?”

One device isn’t going to rule them all; it is about whatever device people have handy. People really like choice. People will watch *Inception*, a big blockbuster movie, on their big-screen TV at home, but if they happen to be stuck in an airport or on a bus, they will watch it on their smartphone. With that type of power on those small screens, computation fits more elegantly into people’s lives.

VA: SO MORE SPECIFICALLY, WHERE DO YOU SEE THE ULTRABOOK DEVICE FITTING IN?

BDJ: You need to touch an Ultrabook device. It is a rush of innovation when you touch the form factor.

Consumers love them, and they are beginning to see them as another really viable screen that lives in the device ecosystem or in this constellation of devices that consumers have in their lives. You have a smartphone, a tablet, an Ultrabook device, a television—all these things begin to fit quite nicely together, becoming more about the consumer and the consumer’s choice about the kind of screen they would like to interact with.

If you want to look at the math of the future, the Ultrabook device becomes another significant, innovative step in Intel bringing computation in smart ways to people all over the world. From a consumer standpoint, the Ultrabook device allows them to have that screen and keyboard anywhere they want it. Because it is so thin, the battery life is so long, and it works so well with other devices, the Ultrabook device fits into people’s lives in a meaningful way. I think you will see a lot more of them because people can just throw it in a purse or backpack and take it anywhere.

VA: HOW DO YOU SEE PEOPLE OUTSIDE OF THE TECH AND GAMING INDUSTRIES USING ULTRABOOKS IN THEIR DAILY LIVES?

BDJ: People say that small business is the engine of our economy. The Ultrabook device as a tool for work and a tool for small- and medium-size businesses begins to make a lot of sense. People need to be mobile—they work at home, at cafés, and in their office. In that way, I think the form factor fits into how people live their lives rather than requiring the people to change their lives to fit the computer.

The other side is the maker in us. I think you can look at a smartphone or tablet as a way of connecting, finding your way, and being entertained. But I also think there is something very specific around the Ultrabook device where people are using it to create. Not only is there an incredible amount of processing power and that really cool technology inside, but people are also gaining freedom to make things wherever they want to.

VA: AS THESE HIGH-POWERED MOBILE SCREENS BECOME MORE AND MORE UBIQUITOUS HOW DO YOU SEE THEM AFFECTING DAILY LIFE?

BDJ: They allow us to have access. With a lot of the research that I was doing in the more near-term, looking out to 2015, you have all these different screens and the computational power, input and output, battery life, computation, and electricity, which allow those screens to become windows that give you access to the people and the entertainment you love. That is what drives most people.

All of these mobile form factors and screens really give us a myriad of ways to make that connection in different places, in different areas, and in different spaces; and I think that will only continue.

VA: ARE THE DIFFERENCES BETWEEN PLATFORMS BECOMING LESS IMPORTANT TO THE PUBLIC AT LARGE?

BDJ: It’s not just about processor speed or the type of processor. We have multi-core, many-core, and single-chip cluster computers (SCC). There are different ways of bringing computational power and coming up with solutions to different problems—whether you want a tablet or a smartphone that lasts all day or you need a high-performance computer that needs to calculate particle physics for the large hadron collider. These are very different types of computation.

Inside Intel, it isn’t just about making it smaller, faster, and less expensive, although this is important and it’s what we will continue to do—we live in the house of Moore’s Law. That is necessary but not sufficient. We have a significant shift where the way that people understand computational power has less to do with the guts and more to do with the experience.

I think you can see Intel being able to make that shift. The Ultrabook device is a perfect example of that. It is amazing and sexy, and full of really great technology, but our discussions will center around the experience—what you can do with it and what it will mean to your life.

VA: IN TERMS OF COMPUTING WHAT DO YOU SEE THE FUTURE LOOKING LIKE IN 20 YEARS?

BDJ: I think the future is awesome. And you can quote me.

I am an incredible optimist for a number of reasons. Everything I do is based upon social science research. Usually when you talk to people about computers, devices, and gadgets, they’re generally very optimistic. They think it is cool.

That is one of the things we can’t forget—for most people, the future is going to be pretty awesome. We can’t let ourselves forget that we will be surprised, and we can’t discount that when we pick up an Ultrabook device for the first time, we’ll say, “Wow, that feels really cool.” I think when we talk about the future of economies and the future of Intel, we can’t forget that in the future that wow is still going to happen—and that is pretty cool.

VA: IT IS. CAN I JUST ASK YOU ONE LAST QUICK QUESTION?

BDJ: [laughs] I don’t know what Intel’s stock price is going to be next year. Thank you and good night. ■

About the Author

Stu Horvath is a writer, editor, and online media consultant. He introduced serious videogame coverage to the New York Daily News and has since worked with Wired, Paste, Complex, Kill Screen, and Wizard magazines, and Crispy Gamer and Joystiq video-game-focused web sites to bring smart and thoughtful media coverage to tech and gaming audiences. In addition to being the mastermind behind Unwinnable, he is the managing editor of Digital Innovation Gazette and is a founding member of the NYC Videogame Critics Circle.



THE ULTRABOOK™ DEVICE: A COMPELLING FOUNDATION FOR MODERN MOBILE COMPUTING

BY EDWARD J. CORREIA

WHAT COMING ADVANCES IN COMPUTING TECHNOLOGY WILL SHAPE THE WAY APPLICATIONS ARE DEVELOPED IN THE FUTURE? LANs of the 1980s forced applications to become network-aware. In the 1990s, that awareness spread to the Internet. And in the first decade of this century, increasingly powerful smartphones spawned a new generation of apps for the small screen. Before long, smartphone apps began taking advantage of the always-on device, the always-connected network, the phone's location awareness, and other characteristics unique to the cell-phone platform.

By the middle of the decade, web sites such as Facebook*, YouTube*, and the iTunes* Store were appealing to a different kind of new generation—those born after the invention of the Internet and the World Wide Web. This crop of highly tech-savvy users has grown up accustomed to always-on, always-connected devices and real-time communication with their peers. Their communication devices have, in essence, become extensions of their personalities.

Meanwhile, in the arena of game consoles, Microsoft and Nintendo were pushing the limits of the human-machine interface. With the use of accelerometers and optical sensors, these companies got gamers off the couch, and Microsoft's Kinect* even took away their hand controllers.



“The Ultrabook™ combines performance of high-end laptops with the technologies and sensors typically available on mobile platforms like tablets and smartphones.”

– TOM DECKOWSKI, DEVELOPER MARKETING MANAGER, INTEL

Today at Intel, engineers are working on what the company believes is the next big thing in mobile computing. Building on the networking and sensory inputs that have come before, the company and its partners are elevating devices to a new level of self-awareness, enabling users to be at their most powerful, most productive, and most creative.

A New Way to Experience the Visual World

They call it “perceptual computing,” and to hear it described might conjure images of *Minority Report*, the 2002 sci-fi thriller in which cops from 2054 use ultra-high-tech computers to fight crime. “Imagine your hand in the shape of a gun and your finger is actually pulling the trigger,” said David Flanagan, managing director of the Mobility Group at Intel Capital, in an interview with *Intel® Visual Adrenaline* magazine. He was describing what might be the controlling action of a first-person shooter. “Touch [sensitivity] is wonderful, and it has expanded the computing environment,” he continued, “but people will want to do a host of things, and touching with your finger isn’t the optimal way to engage your device and get full utility out of it.” In essence, Intel envisions devices that will liberate people to be their “UltraYou.”

With perceptual computing, Intel envisions a realm of computing that is natural, intuitive, and compelling. “We’re looking at technology that will enable that,” said Flanagan, adding that beyond gaming, perceptual computing will have numerous applications in the fields of social interaction, online shopping, content creation, education, healthcare, and much more.

For those who remember HTML 1.0, instant access to high-speed Internet also has become a necessity, though perhaps for slightly different reasons. User productivity today is tied to the Web—to cloud-based apps for e-mail, word processing, number crunching, and collaboration. Users and developers have discovered that “mobile markup languages” such as WML cannot deliver much of a user experience to the diverse set of mobile devices.

The unstoppable force that is today’s mobile workforce is always on and ready to go, and demands device-specific apps that dissolve boundaries, expand horizons, and allow life without compromise. In just a few short years, web-based news sites and social networks have given rise to real-time communications capabilities never before seen. And people have gotten used to—perhaps even take for granted—the instantaneous delivery of information, goods, and services that the Internet facilitates.

What Users Want

What type of device is tomorrow’s thought worker likely to purchase? Intel was determined to find out. In 2009, the company embarked on a research project intended to reveal the characteristics people most wanted from a

new computer, were they to buy one. But instead of focusing on transistors-per-square-inch and gigahertz-per-nanometer, Intel Director of Insights and Market Research, David Ginsberg, decided to conduct “an emotional inquiry” using techniques from neuroscience, and cognitive and behavioral psychology.

“People want technology to fade away into the background so they can focus on the task at hand,” Ginsberg told *Forbes* magazine in an October 2011 online story. “That still implies speed but it’s about how people experience speed,” he said. His research had revealed that people think of a positive computing experience in much the same way as any other positive experience: Everything just works.

Part of what Intel found was that when today’s mobile achievers are “in the groove,” a smooth user experience is paramount, and their computing platform must be as connected and capable as their smartphone. It can never be out of sync with the social scene and must never keep them waiting. For anything. Ever.

And when it comes to security, just make it automatic, keep the system free from viruses, and keep files and identities safe.

In the end, researchers found that success in the brave new world of mobile computing required devices that delivered high availability and connectivity, application responsiveness, seamless workflow, an intuitive user interface, improved security, and stylish good looks.

Armed with the priorities of next-generation road warriors, Intel engineers developed a blueprint for systems that would operate more like smartphones—wake up in a flash, combine responsiveness with performance, offer seamless and compelling experience and be sleek and less than an inch thick.

With this new specification in mind, Intel unleashed the USD 300 million Intel Capital Ultrabook Fund (see the sidebar Intel Capital Ultrabook Fund: Developers Wanted in this article) to spread the word of its plan, generate user interest, and attract hardware partners. Just six short months later, Intel announced that a handful of companies were ready to launch Ultrabook devices and that many more had signed on. The Ultrabook device, Intel’s vision of a device that provides the best of everything users want, was a reality.

Ultrabook™ Device Benefits

Built around the 2nd generation Intel® Core™ i3, Core™ i5, and Core™ i7 processors, the platform’s key design elements has inspired a generation of Ultrabook devices that are sleek and lightweight, yet instantly responsive to the user’s every need at a price that’s within reach of many people.

"What Ultrabook offers to the user audience is to make life easier," said Tom Deckowski, Intel's developer marketing manager, during an interview with *Intel Visual Adrenaline* magazine. "It differentiates. It's unique and different in the marketplace, compared to anything else Intel has done."

That's certainly not an exaggeration. Dell and many other companies have designs in the works. And Ultrabook devices are available today in the form of the half-inch-thin Acer Aspire* S, the 11-inch Zenbook* UX21 and 13-inch Zenbook UX31 from Asus, Toshiba's 2.5-pound Portege* Z830, the HP Folio

13, and the solid aluminum IdeaPad* U300S from Lenovo. From personal experience with the Acer Aspire S, its paper-thin physique and handsome brushed metal exterior only add to its strong application benchmarks, instant-on responsiveness, and extremely long battery life. And it lists for a fraction of comparable systems outside the spec.

The Ultrabook device specification describes three major responsiveness technologies, one of which is mandated. With Intel® Rapid Start technology, "you open the system and within seven seconds it's fully functional," said

Intel Capital Ultrabook Fund: Developers Wanted

Intel Capital is looking for developers to help it spend USD 300 million. When the next generation of Ultrabook™ devices begins hitting store shelves later this year, Intel said we'll be seeing mobile computers with capabilities beyond the traditional clamshell, and notebook and tablet convertibles.

"We want to drive breakthrough experiences around the user interface in terms of gesture control, voice control, and HD audio and video into the platform," said David Flanagan, managing director of the Mobility Group at Intel Capital. "Many of these [capabilities] are software enabled, and developers will have a new set of inputs to work with to boost their ability to build immersive experiences," he said.

"The new ingredient technologies you don't see in mobile platforms today like touch sensors, gyros, accelerometers, and altimeters, enhance the experience and allow users to extract maximum utility from a device," he said. "These things need to be put into devices that consumers are demanding."

In short, Flanagan says that Intel is seeking developers to "deliver the next set of 'wow factor' applications to showcase what consumers don't have today." There will be lots of new form factors. "Clamshell devices, sure, but a myriad of hybrids, sliders, and [other] convertibles that operate as a notebook or tablet," he said. They'll also feature instant-on, always-on capabilities borrowed from smartphones. "Enabling these new, non-resident technologies will be an area of focus for the fund as well."

Intel finds and engages developers in three primary ways, said Flanagan, the first of which is through its 100,000 employees worldwide. "This allows us to cast a wide net to identify these opportunities," he said. "Most of our people understand our longer-term strategies and help us find these small emerging companies while they're in the development stage."

We're looking for the next set of app developers who are forward-moving and forward-thinking.

The company also uses its venture capital (VC) network, Intel Capital, which according to Flanagan is the industry's longest surviving corporate venture group. "Since 1991, we've built a well-established set of traditional VC relationships."

Then there's indirect engagement, under which developers and solution providers are invited to submit proposals through the Intel Capital Web site (www.intelcapital.com). Flanagan described the general categories into which Intel Capital places such proposals.

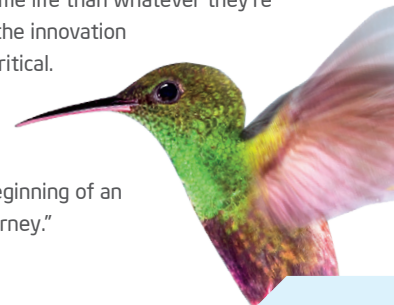
The first is gap filling, which identifies a piece of hardware or software critical to the platform and engages a third party to develop or build it. The second Flanagan described as "eyes and ears" investments, which today includes its vision of perceptual computing, and generally includes any long-term capability or technology that's too far out to attract traditional VC funding.

"It's about identifying the next gen of software capabilities that will deliver experiences we have yet to think of today but know will materialize in the future," he said, adding, "We bet ahead of the VC community in belief of new technologies." He used Intel's push into perceptual computing as an example, describing it as a natural progression in the history of human-machine interaction.

"[We've] gone from mouse and keyboard to touch," he said. "Touch has expanded the environment tremendously, [but] we believe the next evolution is a touchless way of interacting with the device. There's a bunch of software and hardware that you need to integrate, and we're relying on third-party companies to help us develop a lot of this."

"There are a host of other things people will want to do with the devices in the near future," said Flanagan. The developer opportunities are many. "We're looking for the next set of app developers who are forward-moving and forward-thinking. I'd like to spend more money in next-gen technologies, and research and development . . . to deliver strong capabilities and usage on the Ultrabook."

He said it's important that people want to migrate to the Ultrabook device because it provides more value and is more useful in business and home life than whatever they're using now. "It's the innovation element that's critical. Sleek is great, but this platform itself, in time, is the beginning of an evolutionary journey."



Deckowski. "Start-up time also is extremely short. A certain portion of the hard drive is reserved for caching information about the operating system and application state, giving users an "uninterrupted, easy, quick, responsive device that's highly mobile and makes sense." Acer's Ultrabook device dedicates a 20-gigabyte (GB) solid-state drive (SSD) to responsiveness, in addition to its 320-GB spinning drive.

The second performance feature is Intel® Smart Response technology, which is not limited to Ultrabook devices. This feature helps to boost performance by using an SSD or SSD-hybrid as a cache between a system's hard drive and its memory without the use of an additional drive letter. This is intended mainly to speed up application launch times.

Then there's Intel® Smart Connect technology, which among its many uses will provide game developers a way to enable players to never really leave the arena.

"When someone finishes playing a game, they don't necessarily shut it off, they just close the laptop and it goes into hibernate mode," said Deckowski. At this point, Intel Smart Connect can take over, allowing the application to continue receiving updates in hibernate or sleep mode. "When they re-open that clamshell and [the system] wakes up, all the info in a cloud-based game is available to them right away; they don't have to wait for it to update." Deckowski continued, "Users looking for connectivity while sleeping will have to wait until Windows* 8 comes out."

Future Apps

Deckowski revealed some mouth-watering features that will be available later in the year. "The Ultrabook [spec] combines performance of high-end laptops with the technologies and sensors typically available on mobile platforms like tablets and smartphones," he said. These sensors include an accelerometer, gyroscope, and compass.

"Developers that were strictly building PC apps will now have a platform that's more mobile than a typical laptop and have technologies and sensors they previously could not access," said Deckowski. "The end user can use these and other sensors as inputs into the app right within the game," he added.

"On the flip side, mobile application developers who were focused on creating apps for small-footprint devices that didn't take a lot of CPU will now have access to the CPU and graphics performance they never had before, without losing access to the sensors," said Deckowski. So there's something new in the Ultrabook device for both x86 and mobile developers alike.

"We believe that driving a new level of accelerated innovation and user features will drive a new level of consumer and enterprise demand for this new computing platform," Flanagan said. "We're looking at the next set of apps that will give us that 'wow factor,'" he said. "If all we do is deliver the equivalent experience you see on a tablet, or thin and light form factors like [Apple's] MacBook* Air, then I think to some extent we have failed."

Ultrabook devices will be equipped with those sensors after the release of the 3rd generation Intel® Core™ processor family sometime later in the year. "The 3rd gen Intel Core processor is the platform with the sensors.

Some sensors are not supported in Windows 7 but will be [supported] once Windows 8 launches," said Deckowski.

On the plus side, Deckowski said developers will be able to create and test apps using the Windows 8 beta on 3rd gen Intel Core processor hardware and be confident of a Q4 platform launch. "So if their apps are going to be released in Q4, they can take advantage of the sensor [support] in Windows 8 and be ready to ship by the end of the year."

Application distribution and installation also will be a bit different from the present. Since most Ultrabook devices will lack an optical drive, installations will consist almost entirely of downloads over WiFi* after purchase from a site such as the Intel AppUpSM center.

Ultrabook Device Security

While no system is totally impervious, Ultrabook devices allow users to lock down a lost laptop or other device to protect user identity and digital content with Intel® technology baked right into the hardware. This goes far beyond simple name and password security.

With Intel® Identity Protection Technology (Intel® IPT), embedded security hardware can detect potential theft or loss and automatically disable the Ultrabook. Once returned, the technology can easily reactivate the system without harming content. And select Intel-inspired Ultrabook devices also offer an additional trusted link between devices and online accounts and destinations.

Great Expectations

Ultrabook systems will provide users with all the speed, power, and efficiency of the 2nd gen Intel Core i3, Core i5, and Core i7 processors and the 3D graphics of Intel® HD Graphics. And that's just the first iteration. Combine the planned capabilities borrowed from smartphones and tablets such as touch navigation, motion sensing, and always-on synchronization, with the power and efficiency of the 3rd gen Intel Core processor, and the only thing more amazing than Intel's technology will be what people will do with it. ■

About the Author

Edward J. Correia has been a part of the computer industry since 1980, when he began selling (and occasionally hacking) computers from Atari and Commodore. In addition to writing for Rose & Her Minions, Correia currently serves as technical editor at the CRN Test Center, a computer and networking test lab that he helped establish in 1995. During a 10-year hiatus from CRN's parent company, United Business Media, Correia was editor of Software Test & Performance magazine and executive editor of SD Times.



THE FUTURE OF VISUAL ENTERTAINMENT LOOKS THREE DIMENSIONAL

BY JOHN GAUDIOSI

DESPITE SOME OF THE NEGATIVE STORIES THAT SURFACED IN 2011 AROUND 3D MOVIES,

James Cameron, the man who propelled 3D entertainment into the mainstream, is happy with their current path. In fact, 3D movies are on the exact trajectory that he expected; more 3D movie screens and more 3D movies are being released than ever before. One need only look at the global box office to see that 3D isn't a fad like it was in the 1950s and 1970s. The next-generation technology propelling 3D films, television, and video games is changing the landscape of entertainment.

Case in point: Only 10 movies have ever crossed the USD 1 billion mark at the worldwide box office; six of them are 3D films and a seventh is getting a 3D makeover. The newest member of the club is Michael Bay's *Transformers: Dark of the Moon*, which became the top-grossing movie in the history of Paramount Pictures. That movie was filmed using CAMERON | PACE Group's latest 3D camera setup and rigs, which have evolved by leaps and bounds since *Avatar*. Speaking of Cameron, he holds the number one and two slots on that all-time list with *Avatar* (USD 2.8 billion) and *Titanic* (USD 1.8 billion). And *Titanic's* 3D release on April 6, 2012 is sure to add to the record gross. *Harry Potter and the Deathly Hallows: Part II* (USD 1.3 billion) was the first 3D Potter film and also the biggest in the franchise. Pixar's *Toy Story 3* (USD 1.06 billion) rode 3D all the way to an all-time record for the Disney-owned studio. And rounding out the list are two 3D Disney live-action movies starring Johnny Depp: *Pirates of the Caribbean: On Stranger Tides* (USD 1.04 billion) and *Alice in Wonderland* (USD 1.02 billion).

"If you look at the numbers, 3D movies have seen a 40 percent revenue growth year-over-year for the last four years," said Cameron. "You're not going to put the toothpaste back in the tube at this point; it's just a matter of people realizing this. The numbers don't track to some of the negative stories the media has written. 3D is being punished by its own success. There are more 3D films in the market in parallel with each other, and theaters are having trouble keeping up. They need to double-down on 3D screens to prevent cannibalizing of multiple 3D movies playing at the same time. It's a question of being a growing pain and not a contraction of the market."

Cameron Continues to Shape 3D Future

Cameron is working on two *Avatar* sequels, which will hit theaters in December 2014 and December 2015. He's also been busy working with long-timer partner Vince Pace, helping other filmmakers push 3D technology with their films. Cameron partnered with Pace in 2011 to form the CAMERON | PACE Group (CPG), the industry leader in 3D technologies and production services—from SLATE²SCREEN and SHOOT²BROADCAST. The company leases the latest 3D equipment to filmmakers and broadcasters to bring 3D entertainment to the big screen and to the home.

"The understanding of what constitutes 3D entertainment as opposed to 3D dimension is the difference filmmakers really need to understand to take advantage of the latest technology and tools that are out there," said Pace. "They have to be used properly, and I think there's been a progression of understanding about what you need to do to create good 3D entertainment. It's a percentage increase in your overall effort. A lot of people are making it the whole effort, and it's not."

Pace said 3D entertainment has been progressing at an exponential rate thanks to technological advances. Before *Avatar* came out, people didn't think an audience would watch 3D for an extended period of time.

"3D is literally enabling the ability to tell your story spatially, not only for action but also for interaction with characters. Feeling like a character is spatially close to you as the viewer is a very emotionally intense experience."

— PHIL MCNALLY, STEREOSCOPIC SUPERVISOR,
DREAMWORKS ANIMATION



"One thing I'd change if I could go back and do it over is push the depth of *Avatar* more," said Cameron. "We knew the movie was going to run long, and I took a conservative path. My advice is to push it more, and we're doing that with *Titanic*. If you look at films that played it safe with 3D and look at films where filmmakers have embraced it, it works best if you let the film open up and breathe a little deeper in an organic way."

Pace believes the best way to see *Avatar's Pandora* is in the 3D environment, although consumers have made the 2D Blu-ray* version the best-selling disc of all time.

"3D became a picture window into the world, and I think that both games and sports have to make that transition," said Pace. "It becomes this viewing window for the public where these things—whether it's a movie, television show, sporting event, or video game—are happening right there in front of you. Too many people came out of the gate with the theme-park mentality of 3D, where it's just going to jump all over me and beat me up. In the end that is just bad 3D. We're seeing 3D evolve over time so that the concentration isn't on 3D but on entertainment. Good 3D is also good 2D and that's where we see the market right now."

Captain 3D Sees PC Processing Power as Key to Success of 3D

Phil McNally, who goes by the name Captain 3D, has been working with 3D from the early days of computer animation with Walt Disney Pictures' *Chicken Little*. He moved over to

DreamWorks Animation as stereoscopic supervisor on 3D spectacles such as *Monsters vs. Aliens*, *How to Train Your Dragon*, *Kung Fu Panda 2*, and *Puss in Boots*.

"3D is significant now because of computer advancements," said McNally. "For a long time, we've been increasing our ability to render more complex particle effects such as fire, smoke, and water. It's not necessarily just from a hardware point of view, which allows a new sophistication in the lighting in films. We're also seeing sophistication in the camera work in combination with stereo."

McNally said the advancements in the latest computer technology, including those running on Intel® processors, have opened up the creative possibilities for 3D animation directors. He explained that the faster a computer can render, the more ideas animators can try.

"It's more about the iteration," said McNally. "If you can iterate a shot ten times instead of two times, you gain the ability to continue to advance the shot to a higher level of sophistication. Pushing the speed is something we can really do now with the amount of sheer horsepower that we have."

McNally said that what's interesting now is that directors who are taking on 3D projects for the first time don't think about 3D movie making. And that's a good thing because when directors start thinking about 3D, they tend to think about 3D gimmicks.

"Thinking about spatial movie making puts you in a mindset that really starts to mean something," said McNally. "Spatial movie making is about telling your story now that you have facial information to help you. The 3D is really enabling what was already there in the directors' ideas for what they would do for 2D filmmaking. 3D is literally enabling the ability to tell your story spatially, not only for action but also for interaction with characters. Feeling like a character is spatially close to you as the viewer is a very emotionally intense experience. The height that the dragon is flying is scarier because you're literally seeing the height in stereoscopic space, as well."

3D Invades Homes

While much of the focus around 3D has been on the silver screen, both Cameron and Pace believe the future of 3D is in the home. According to Research and Markets, the global 3D TV market size is expected to exceed USD 100 billion by the end of 2014. In the United States, 3D TVs are expected to generate over USD 25 billion in sales by 2015. A key driver of these sales is content, including video games for Sony PlayStation* 3 and Microsoft Xbox* 360 consoles such as *Batman*: Arkham City*, *Gears of War* 3*, *Uncharted* 3: Drake's Fortune*, and *Resistance* 3*. Hollywood is also offering more Blu-ray 3D movies such as Paramount Home Entertainment's *Transformers: Dark of the Moon*, *Thor*, and *Captain America: The First Avenger*,
(continues on page 24)



(LEFT) Screenshot from FIFA* 11. © 2010 Electronic Arts. All rights reserved.

(BELOW) Screenshot from Left 4 Dead* 2. © 2009 Valve Corporation. All rights reserved.



Dynamic Digital Depth Brings More Than 100 3D Games to Intel® Processor-based PCs

Even Hollywood bigwigs such as James Cameron and Jon Landau believe the future of stereoscopic 3D entertainment rests with 3D games in the home. Anticipating this trend, Intel is collaborating with Dynamic Digital Depth (DDD) to bring a catalog of over 100 of the biggest PC games into the third dimension, including Activision's *Call of Duty*: Modern Warfare 2*, Capcom's *Devil May Cry* 4*, Valve's *Left for Dead* 2*, Blizzard's *World of Warcraft**, and the popular Chinese series *QQ**.

"TriDef®3D is DDD's automatic 2D- to 3D-conversion solution for videos, photos, and games," said Chris Yewdall, president and CEO of DDD. "For games, the TriDef 3D game player is middleware that enables nearly any 2D PC game that uses DirectX* 9, 10, or 11 to be played in 3D. In stereo mode, it extracts the game's depth information from the DirectX stream and renders the left and right views to provide a 3D output. It also offers a high-performance mode, where DDD's patented 2D-plus-depth rendering is used to lower processing overhead while maintaining high-quality 3D gaming."

TriDef 3D officially supports 590 games, with more than 100 of those certified for use with the 2nd generation Intel® Core™ processor family with Intel® HD Graphics. DDD maintains a dedicated 3D game testing center in its offices in Perth, Australia, and is continually optimizing 3D play across various platforms for the latest PC games. At CES 2012, DDD is expected to unveil the latest DirectX 10 and 11 game titles that will be playable in 3D.

That library will continue to grow thanks to the distribution of the TriDef 3D SDK that game-engine developers can use to integrate the technology while the 3D game is being designed. This allows TriDef 3D to be embedded into the 3D game, giving the gamer the best performance and highest-quality 3D experience possible.

"TriDef 3D is the only software that enables 2D- to 3D-game conversion on a CPU platform," explained Yewdall. "It's great that excellent 3D game performance can be achieved on lower-cost CPU systems that don't come with discrete GPUs. For example, the new Fujitsu 3D Lifebook* is an all new 3D notebook with the 2nd gen Intel Core processor, using only processor graphics, that allows for great 3D gaming. Future PCs with Intel® processors will offer even better performance."

Yewdall added that DDD and Intel have bi-weekly technical conference calls to review the issues tracking list and repair any bugs on either the hardware or software side, helping to ensure optimum game performance on all 3D titles.

"The engineers at Intel are very cooperative with DDD's software developers, helping them to optimize TriDef 3D for the 2nd gen Intel Core processor architecture," said Yewdall. "This has allowed DDD to fully utilize Intel's improved processor graphics, opening the world of 3D gaming to a wide range of new 3D consumer products. TriDef 3D is the only technology that works with the Intel® platform to enable 3D gaming on devices that don't include a discrete GPU."

Independent game review sites such as mtbs3D.com—Meant to be Seen—provide certification for 3D games, both native and converted, based on separation and convergence. Most reviews show that TriDef 3D performance exceeds that of competitors.

The technology also works with converting videos and photos. Yewdall said the TriDef 3D algorithms analyze the motion and color composition of the incoming 2D video image, creating a depth map that is then used to manipulate the 2D image efficiently into a stereo 3D image. The 2D video is converted instantaneously, within one frame of video, and allows viewer control over the 3D focal point and strength of the depth effect.



and Walt Disney Home Entertainment's *Cars 2*, *Pirates of the Caribbean: On Stranger Tides*, *Toy Story 3*, and *TRON: Legacy*. But 3D programming, including sports such as soccer, and college football and basketball, is going to be crucial for the growth of 3D entertainment.

"There's been a tremendous migration into what would be considered the home-viewing environment, including sports, concerts, and even ballet," said Cameron. "What excites me is we're taking the bookends of what we understand 3D to be contained to—a sci-fi film or a horror film—and removing them. The possibilities for 3D are endless. When done correctly it brings out more emotion, more character, and more athleticism than any other medium out there."

CPG is focusing its efforts in the broadcast realm, having won an Emmy for technical achievement and the George Wensel Technical Achievement Award—a category that recognizes technical innovation that is extraordinary and enhances the broadcast for the viewer—for its 3D broadcast of the 2010 U.S. Open Tennis Championships with CBS Sports. CPG has also delivered FUSION 3D systems and production support services for over 150 sports productions, including The Masters Golf Tournaments and the NBA All-Star Games and Finals in 3D. Cameron believes that on the film side, CPG can and will always make improvements to the movie technology and camera systems, as well as to post-production processes. But where he sees a massive rapid growth is in 3D broadcasts.

"There are not enough television sales right now, so the delta for them and the cost of 3D is therefore more significant because it's not compared to a huge revenue intake. But we're setting our sights on a medium that could be

huge in the marketplace," said Cameron. "The penetration of 3D TVs in the home with good 3D content will be enormous. It's just that we need to reach that point. We've been the cart before the horse before (as with *Avatar*), and we see television as being the next big 3D push."

While *Avatar* was shot with mostly two or three 3D cameras, CPG worked with ESPN on the *X-Games* with 40 3D cameras to capture the extreme sports action live. Cameron and Pace have split time between filming and working on motion pictures, and filming live sporting events and concerts.

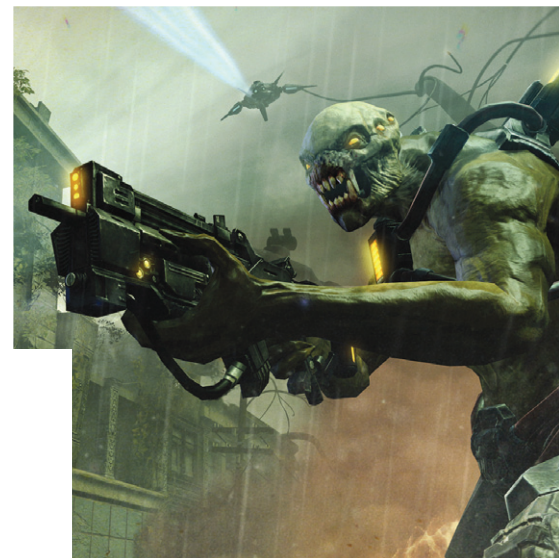
"Historically there was film shooting movies, and there was video shooting sports and live entertainment television. Because we've been in 3D for 12 years we were always doing both," said Cameron. "We were using a highly modular camera platform that we could reconfigure for movies or sports, but it was the same system, and our technology actually spans both camps. It's all converging into one technology right now, which is pretty interesting because there really isn't any other place you can point to that was like that."

Another key area of 3D growth is the PC. A growing number of laptops and desktops support 3D movie playback and video gaming. And tablets are expected to enter the market that feature auto-stereoscopic (glasses-free) 3D entertainment, as well as smartphones and portable gaming systems such as Nintendo 3DS*.

"We're talking about a complete revolution of the way we interact with screens," said Cameron. "That's all we do all day long. You're looking at a screen right now. On your desktops, you look at screens. We view our mobile devices. And then for

"What excites me is we're taking the bookends of what we understand 3D to be contained to—a sci-fi film or a horror film—and removing them. The possibilities for 3D are endless. When done correctly, it brings out more emotion, more character, and more athleticism than any other medium out there."

— JAMES CAMERON, DIRECTOR,
FILM PRODUCER, SCREENWRITER





entertainment we go and look at large screens. If we change that very basic contract between human beings and their screens—and that’s what 3D is—you’re talking about billions of dollars. We believe this is where 3D is going and so we’re making an aggressive play.”

Intel Forges into the Third Dimension

Intel has been at the forefront of bringing 3D entertainment home. At CES 2011, the technology of the 2nd generation Intel® Core™ processor family introduced 3D TV support using HDMI 1.4 for full HD viewing of Blu-ray 3D, 3D broadcasts, or streaming 3D video. Intel has expanded its

offerings to support the active-shutter 3D panels and displays that are expanding in the marketplace.

“Going forward, we’re supporting some of the new hybrid 3D technologies like LG Display’s film-pattern retarder technology, which addresses some of the limitations around the passive polarized solution with resolution on the 3D panel,” said Andy Weidner, solutions marketing manager for Stereo3D at Intel. “These displays support passive polarized glasses but offer a higher resolution for a better viewing experience. Once other panels come out that don’t require glasses at all, which we’ve already seen in the mobile industry with smartphones and laptops, consumers will be able to watch 3D content on their PCs as easily as they watch 2D content today. We also expect user-generated content to steadily grow as more 3D devices are introduced in the market.”

Weidner said Intel is working on the glasses-free front to deliver more mainstream alternatives to premium-priced notebooks on the marketplace today using discrete graphics, which offers auto-
(continues on page 26)

Fernando Apodaca Brings 3D Art to Life at Adobe MAX 2011

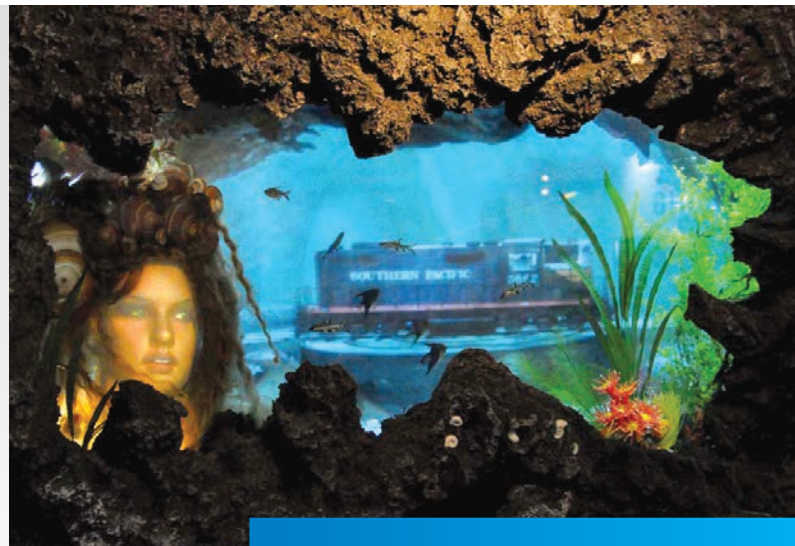
Fernando Apodaca is a new breed of artist. In addition to directing film, composing music, and creating art, Apodaca has been fusing all three of his passions together in 3D. The internationally acclaimed director used the new Panasonic A1 3D video camera to bring an underwater world—train and railroad tracks included—to life at a live exhibit during Adobe MAX 2011 in Los Angeles. The 3D art exhibit, which measured 20 feet long, 10 feet high, and 10 feet wide, came to life on 42-inch Alioscopy (see www.alioscopyusa.com) 3D auto-stereoscopic multi-view displays (glasses-free) using Adobe software and Intel® hardware. No 3D glasses were required for attendees to immerse themselves in this exhibit. Apodaca, who partnered with Jason Mueller and Type 3 Films on the project, tells how he brought this surreal 3D underwater and railway realm to life in this exclusive interview.

WHERE DID YOU GET THE IDEA FOR THIS 3D PROJECT, WHICH MIXES VIDEO WITH ART?

When I first spoke with Alioscopy about this opportunity, I wanted to work with all the different tools that were available, the limitations of the devices, and the equipment used to optimize 3D viewing. Once I had the pallet, I just let my imagination run free to see what was possible.

WHERE DID YOUR IMAGINATION RUN TO WHEN IT CAME TO THE STORY IN THIS 3D EXHIBIT?

The story was improvised. There are hostesses—enchanted creatures or nymphs—who engage the viewer from underwater as they walk



through the exhibit. I wanted to fuse organic things that would give people that “Wow” moment. It’s more of a platform to show off the technology of the 3D glasses-free displays combined with animated sculptures, live animals, and illusions. Up until now, the only way people could access and appreciate 3D displays was through glasses or a viewing device. By merging these elements together we wanted to create something seemingly impossible.

To learn more about the difference between stereo and multi-view technologies, see <http://www.alioscopyusa.com/content/our-technology>.



stereoscopic 3D for price points at USD 1,700 and higher. Instead, Intel's own processor will deliver glasses-free 3D and enable mainstream pricing for this category of laptops, with an initial target as low as USD 1,000. These PCs are expected to deliver Blu-ray 3D, YouTube* 3D, and mainstream 3D gaming content. Weidner explained that the intent is to support the variety of 3D solutions for the customers, based on processor graphics, allowing them to select the 3D technology that best suits their needs. The latest Intel processors will be able to deliver 3D content on nearly any platform a customer chooses.

Intel is also working with Dynamic Digital Depth (DDD) to give PC gamers plenty of choices when it comes to 3D gaming. As of winter 2011, over 590 games are playable in 3D on systems with a discrete GPU, with over 100 supported on 2nd gen Intel Core processor-based systems. Supported games include some of the most popular games available today such as *League of Legends** and *World of Warcraft*: Cataclysm*. Weidner said Intel is targeting the mainstream and casual gaming market with 3D games (see the sidebar Dynamic Digital Depth Brings More Than 100 3D Games to Intel® Processor-based PCs in this article).

"Stereoscopic 3D has proven very successful at the cinema, with its popularity driving the supply of 3D to consumers at home through their TVs, PCs, and mobile phones," said Chris Yewdall, president and CEO at DDD. "In gaming, 3D gives players the

opportunity to become even more immersed in the game environment. DDD's TriDef* 3D offers the ultimate 3D gaming experience with unique features like Power 3D and autofocus. Power 3D is the best way to play games in 3D on lower-powered systems because it delivers higher frame rates compared to traditional stereo 3D rendering, which translates to smoother, faster game play for the player. Autofocus gives a better 3D gaming experience because the 3D effects look more natural because major elements of the game (player and shooter, vehicles, and so forth) are all placed in the right context."

Whether we're talking about an intense 3D interactive entertainment experience, watching an epic 3D Hollywood movie designed for the big screen, or receiving a 3D college football game delivered straight to your home, the future of entertainment includes the third dimension. Moving forward, Intel is planning to continue offering more 3D options for consumers. In 2012, Intel is looking to launch a wireless display connection for 3D content where consumers will be able to stream 3D content from their PC or

laptop to their 3D TV using Intel® Wireless Display. Weidner said media is the primary focus for this experience. Future usages also would include streaming content through YouTube 3D and other social networking sites, and ultimately premium 3D movies through Blu-ray 3D or Intel® Insider will be delivered wirelessly from computer to 3D TV. While we are seeing glasses-free come to the PC and devices, the mainstream 3D TV experience is likely to stay with glasses—for the time being. ■

About the Author

John Gaudiosi has been covering video games for the past 19 years for media outlets such as The Washington Post, CNET, Wired magazine, and CBS.com. He has focused on the convergence of entertainment and video games for various publications, including The Hollywood Reporter, Reuters, and Yahoo! Games. He currently serves as editor-in-chief of Gamerlive.tv and is a freelance game writer for Rose & Her Minions; GamePro, Rosebud, and Geek magazines; Forbes.com, IGN.com, and Gamespot.com.

Hollywood Director Paul Anderson is Hooked on 3D Filmmaking

Director Paul Anderson is now filming his third 3D movie using the latest camera equipment and rigs from the CAMERON | PACE Group, which is the next generation of 3D setups from what James Cameron used on *Avatar*. Anderson, who brought the *Three Musketeers* to life in 3D for Summit Entertainment, is currently filming his second 3D *Resident Evil** video game adaptation, *Resident Evil: Retribution*. The director talks about the rapid advances he has experienced with 3D filmmaking over the past three years in this exclusive interview.

WHAT ARE YOUR THOUGHTS ON THE CURRENT 3D MOVIE LANDSCAPE?

Obviously there's a backlash against 3D, and I would say it's being brought on almost entirely by bad post-converted movies, an issue that those of us who shoot our movies in 3D properly have been banging on about forever it seems. There was a relentless money grab by some studios, where they just tried to make these movies into 3D to make more cash and they did it badly. They did post conversions in a few months and they made people angry. I've passionately believed right from the outset that if you're asking people to pay a premium price to come and see something, you better deliver a premium product. That's why I shoot my movies in 3D. They originate in 3D. We spend all the extra time, money, and effort to actually make a good 3D product.

CAN YOU COMMENT ON JAMES CAMERON'S CONVERSION OF *TITANIC* INTO A 3D FILM FOR AN APRIL 2012 RELEASE?

I'm not saying post conversion can't work. I'm sure the 3D *Titanic* will be amazing, but the fact is Cameron's been working on that for years and has spent I'm sure a gazillion dollars on it, which is a lot different than a studio trying to post-convert a movie in eight weeks. I've seen some of these things; they make your eyes hurt. No wonder people don't like it. It gives you a headache, plus you pay an extra five bucks to have a headache. Why?

WHAT DO YOU LIKE ABOUT THE EXPERIENCE FILMING IN 3D BRINGS TO THE THEATER?

Not every movie is good for 3D, and as more of these movies come out, I hope people can make a more sensible decision as to what's the right fit for 3D and this immersive experience. I believe a movie like *Three Musketeers* is absolutely perfect for 3D because it immerses you in a world that you've never seen before. Whether it's the planet of Pandora or seventeenth-century Paris, I think an audience should know when they go see a movie that they will get a quality 3D experience. As more and more of these movies actually get shot in 3D, that's what's going to happen. I hope that post-conversion 3D will fade away, unless it's something that has been done over a huge amount of time.

WHAT DOES 3D, WHEN DONE CORRECTLY, ADD TO THE AUDIENCE EXPERIENCE?

There were scenes in the last *Resident Evil* when there were axe battles where the audience actually ducked. Or there were scenes in *Three Musketeers* where Christian, Logan, and Milla are walking down these incredibly huge chambers that are lined with chandeliers and mirrors and it looks incredible. In 3D, you really feel like you've been sucked into the location and traveled back in time. That's worth paying an extra five bucks for, in my opinion.



WERE THERE THINGS THAT YOU LEARNED HAVING DONE *RESIDENT EVIL* AS YOUR FIRST 3D FILM THAT YOU WERE ABLE TO LEAPFROG INTO?

I think it emboldened me, definitely. When I first saw the 3D rigs and how big they were and the fact that they were hard-cabled to computer towers and things, it was a little intimidating. I made *Resident Evil* an all-studio shoot rather than location shoots for that very reason. But then the filmmaking process was so slick and fast on *Resident Evil* that I got very emboldened by it. I decided with *Musketeers* that we were going to go out and shoot the whole movie on Lake Constance and with lots of exteriors, and that's exactly what we did.

ARE YOU AT A POINT NOW WITH 3D THAT YOU CAN FILM ANYTHING THAT YOU'D NORMALLY BE ABLE TO FILM IN 2D?

That's how I approach it. I don't let anybody tell me I can't do that in 3D. Even though it might be difficult to do in 3D, I think our job as filmmakers is to figure out how to do it. I never take "no" for an answer. I don't want to hear the rigs are too big to get them up there. I want to know how we can get them up there. We've done pretty much everything. We've shot underwater with them. We shot in the pouring rain with them. We've shot on top of cathedral roofs with them. We've done a lot of stuff people don't even dare to do in 2D. So we're all about pushing the envelope when it comes to 3D.

HOW QUICKLY HAVE YOU SEEN 3D TECHNOLOGY EVOLVE SINCE *RESIDENT EVIL: AFTERLIFE*?

It's really every time—and I'm shooting a movie a year—so only 12 months goes by, but it feels like it's completely different each time around and with definitely huge improvements.

HOW DO YOU SEE THINGS MOVING FORWARD WHEN IT COMES TO 3D?

As the technology gets cheaper, I think we'll see more people exploring 3D. When color photography first came in, people felt it worked for only big road-show movies, and the smaller movies would still be done in black and white. But then as the cost of color film and cameras came down, more and more movies were done in color. I'd like to see the same happen with 3D. For example, there's a scene in *Three Musketeers* where it's just the Musketeers and D'Artagnan sitting around talking in the apartment. It's a very small set, and it's amazing the effect that 3D has with four people sitting around a table and talking. You really appreciate the space and the distance between people. It's actually a very beautiful scene, and 3D enhances it. So it doesn't always have to be about a vast spectacle. And it was a big learning experience for me because afterward I thought, "Wow, now I can see you could make a really interesting drama in 3D just sitting in a house." ■

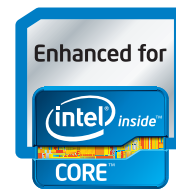
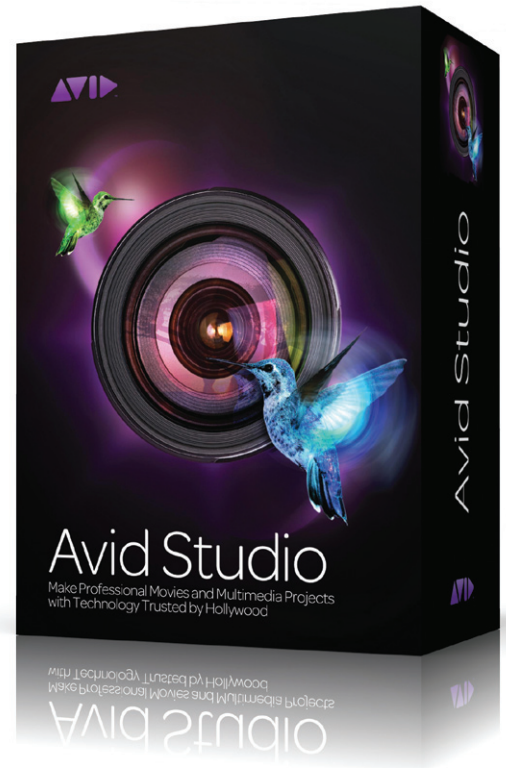
Enhanced for 2nd Generation Intel® Core™ Processor:

INTEL® SOFTWARE DEVELOPER
TOOLS AND AVID DELIVER HIGH-
PERFORMANCE VIDEO EDITING TO
PROS AND ENTHUSIASTS

BY DOMINIC MILANO

AVID HAS BEEN SERVING THE NEEDS OF CREATIVE PROFESSIONALS FOR OVER TWO DECADES. Its flagship product, Avid Media Composer*, is used by a majority of film, television, and news editors. Offering a powerful editing tool set, 64-bit optimized operation, and the ability to work with everything from old-school analog videotape to footage shot with the latest digital camera technologies, Avid Studio* gives home enthusiasts access to the same time-tested video-editing and -sharing technologies that video professionals use. A streamlined interface and professionally designed templates, effects, and transitions—as well as in-depth training materials—help enthusiasts create compelling home videos, web content, and wedding and event videos.

Avid engineers turn to Intel® software developer tools, such as Intel® Media Software Development Kit (Intel® Media SDK), Intel® VTune™ Amplifier XE, and Intel® Integrated Performance Primitives (Intel® IPP) to overcome decoding inefficiencies, identify performance bottlenecks, and greatly boost application performance on the 2nd generation Intel® Core™ processor family.

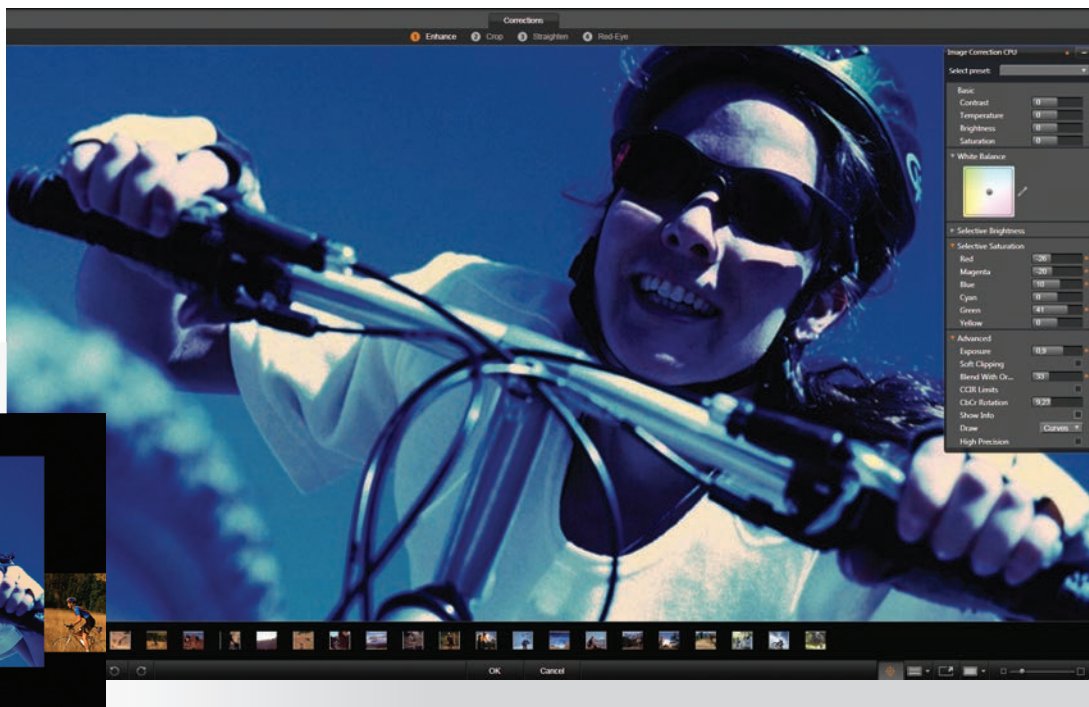


Avid Studio*: Doubling Performance with Intel® Media SDK

Avid Studio is the latest addition to Avid's line of user-friendly consumer video-editing software. Avid Studio builds on the success of Avid's Pinnacle Studio* version 15 and features a completely revamped user interface and a new project engine that run on top of the existing runtime.

"The first goal of this rewrite was to develop a user-interface architecture that was more flexible than the old UI," explained Dieter Huber, engineering manager of Avid's Creative Enthusiasts Division. "In addition, we added a complete management and browse facility for all of the media on your system. The library helps you efficiently organize your media and allows you to tag and rate files, as well as assemble collections of video, audio, and still pictures."

"We also now support unlimited compositing," Huber added. "Where the old Studio was limited to handling two-track-style editing, Avid Studio lets users work with an unlimited number of tracks." The ability to work with numerous tracks of video makes it possible to create complex picture-in-picture and multi-layered effects.



Avid Studio supports playback and editing of H.264-format HD video. H.264, also known as MPEG-4 Layer 10 or AVC, requires a lot of computing muscle to edit and play back smoothly. To accommodate handling many tracks of demanding HD footage based on the H.264 codec, Huber's team used the Intel Media SDK.

"We had problems with our old decoder," Huber said. "When run on multi-core CPUs, it did not scale as well as we wanted it to. And there was no hardware support, especially on notebooks. We've been working with the Intel Media SDK since version 1.1. We used version 2.0 to create the current version of Avid Studio, and we're now working on our next release using 3.0 [Intel Media SDK 2012]," Huber said. "We've had a very good experience with Intel Media SDK. It has given us a real boost in the number of H.264 streams we could play in parallel. On a 2nd gen Intel® Core™ i7 processor, we're seeing 2x faster performance, doubling the number of H.264 streams we can play."

Avid was able to tap into the hardware-accelerated decoding of Intel® Clear Video HD Technology, a feature that's built into the 2nd gen Intel Core processors, by developing its code with the Intel Media SDK. "The nice thing about writing code with the Intel Media SDK is that your applications work right out of the box," Huber said. "You don't need to write a separate solution for each platform. If

"We've been working with the Intel® Media SDK since version 1.1, so it's impossible to quantify how much time we've saved. I can say, however, that coming up with a similar solution without Intel Media SDK would have required at least two or three more developers."

– DIETER HUBER, ENGINEERING MANAGER, CREATIVE ENTHUSIASTS DIVISION, AVID

your application is run on a platform that doesn't have hardware acceleration, it automatically uses an Intel-optimized software decoder. If a hardware decoder is seen, it's automatically used. Without the Intel Media SDK, you'd need to write a separate code path to support third-party GPUs. Another nice thing about using the [Intel] Media SDK is that it was easy to port our code to 64-bit"

Huber's team worked closely with Intel engineers and used Intel VTune Amplifier XE to identify hotspots in their video-processor pipeline. Intel staff also suggested ways to optimize specific areas of Avid's code. "We typically try to optimize wait state and load times," Huber explained.

How much time did Avid engineers save by using Intel software development tools? "We've been working with the Intel Media SDK since version 1.1, so it's impossible to quantify how much time we've saved," Huber said. "I can say, however, that coming up with a similar solution

without Intel Media SDK would have required at least two or three more developers."

Avid Media Composer*: Pinpointing and Eliminating Bottlenecks with Objective Data

Avid Media Composer is a cross-platform media-creation tool that professionals use to create television shows, movies, and news. "Media Composer users want their software to be responsive," Rob Gonsalves, who works in the office of Avid CTO Tim Claman, explained.

"When they add video effects and then press the Play button, they expect to see immediate results. They don't like to wait for things to render. The performance of the product is critical."

Like their counterparts in the Avid Creative Enthusiasts division, the Avid Media Composer team worked closely with Intel to ensure that Avid Media Composer was fully optimized to get the best performance possible on Intel® processors.

Identifying hotspots and bottlenecks in a code base that consists of hundreds of modules and millions of lines of code, however, is no easy task. “Many things can make a program run slow,” Gonsalves said. “Most developers have a notion of what might be slow. When you ask them to try to improve performance, if they don’t have hard data to go by, they’ll work on improving routines that they think are slow. A lot of times, that work has no impact on performance.”



Intel VTune Amplifier XE has been invaluable in identifying performance bottlenecks, allowing Avid to optimize their code based on objective data as opposed to hunches. “[Intel] VTune [Amplifier XE] gives us data on the timing of different instructions within the program. With that data we can pinpoint the actual hotspot,” Gonsalves said.

Gonsalves has worked at Avid for 22 years and spent many of them optimizing Media Composer. He has seen how the evolution of microprocessor architecture has affected the way that applications are optimized. “In the past you could make the assumption that your applications were going to be running on a single CPU,” he said. “To optimize them, you would have to figure out either how to avoid slow calls or how to reduce the complexity of the algorithm. With the proliferation of multi-core systems, we have to think about optimization in a different way: How can we break up a task to spread the workload across multiple cores? That is actually a difficult thing: (1) to design, and (2) to prove that it is working effectively. That is where the Intel® Threading Building Blocks have come in. With Intel TBB you can actually use some libraries like Intel® Cilk™ Plus to distribute the workload across multiple cores, but you can also use the Intel® Thread Profiler, an analysis tool, to see the utilization of the cores as your program is actually running.”

As computing power advances, so too do applications that stress even the most powerful new multi-core, multi-threaded microprocessors. Prime examples of this in professional video-editing workflows are new cameras, such as the RED ONE* and RED* Epic digital-cinema cameras that record RAW-format video at 2K, 4K, and even higher resolutions. RAW-format video footage borrows from digital-still camera imaging techniques and captures all of the image data—gamut, color detail, exposure, and so on—directly from the image sensor, producing high-quality video footage. Files of that size and depth, however, are incredibly tough on a system’s processors, making performance optimization all the more important.

An OpenCL* Future

Intel® OpenCL SDK 1.5 is the Intel implementation of the OpenCL* (Open Computing Language) standard optimized for Intel® processors and running on CPUs. OpenCL provides a uniform programming environment for software developers to write efficient, portable code for client computer systems, high-performance computing servers, and handheld devices using a diverse mix of multi-core CPUs and other parallel processors.

The Intel OpenCL SDK 1.5 makes it easy for developers to design, build, debug, and profile OpenCL applications. The Intel OpenCL SDK is optimized for 2nd generation Intel® Core™ processor family and Intel® Xeon® processors and includes:

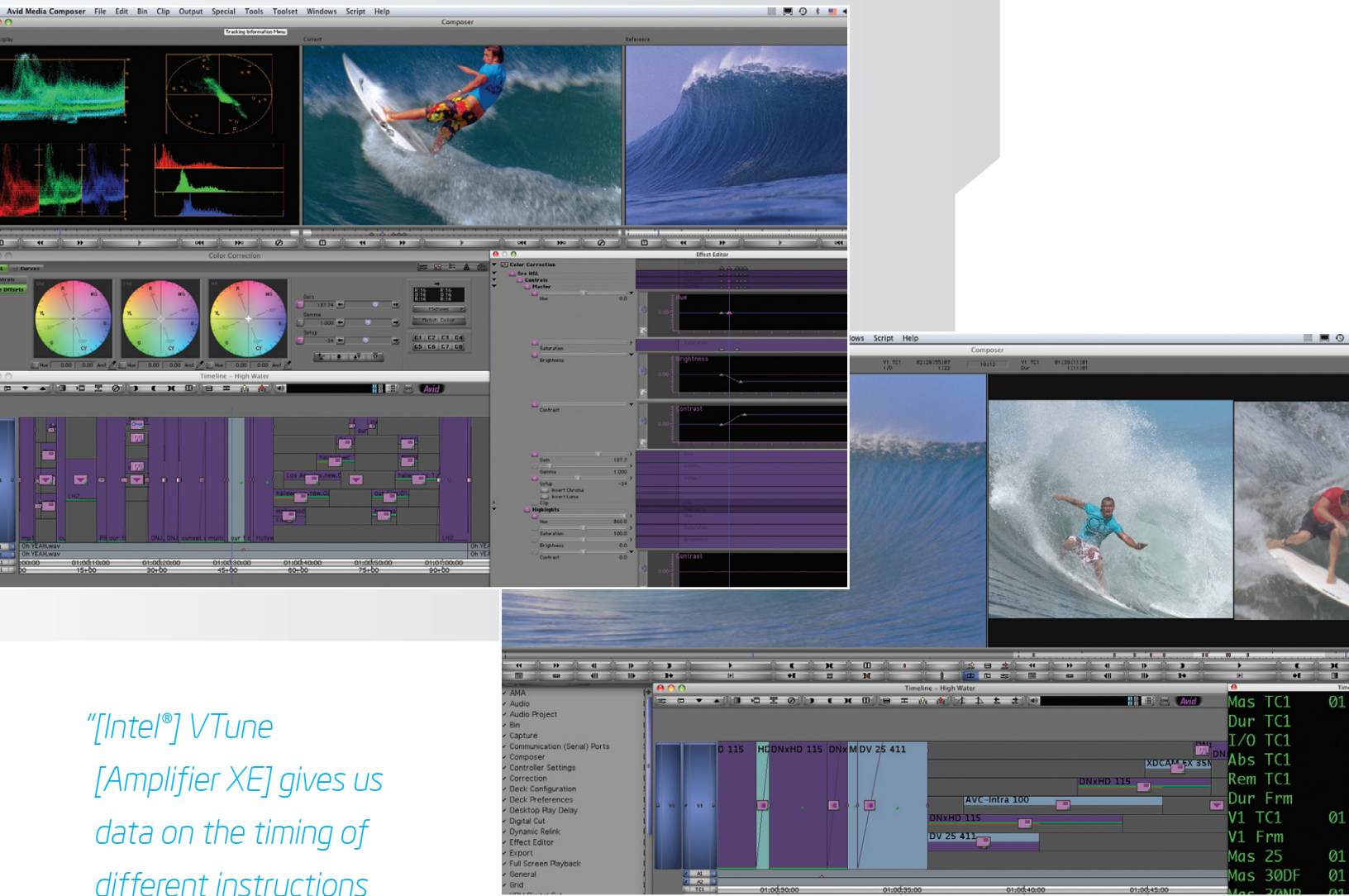
- Unique Implicit CPU Vectorization Module that seamlessly provides Intel® Advanced Vector Extensions (Intel® AVX) code generation, enabling full utilization of the single-instruction, multiple data (SIMD) vector width of 2nd gen Intel Core processors.
- The Intel OpenCL SDK Debugger Beta software, a Microsoft Visual Studio* 2008 plug-in that gives the ability to debug into OpenCL kernels using the familiar graphical interface of Microsoft Visual Studio 2008.
- The Intel OpenCL SDK Offline Compiler, a unique tool that offers full offline OpenCL language compilation, including an OpenCL syntax checker, platform-compilation support for cross-Intel hardware generation, low-level virtual machine (LLVM) viewer, assembly language viewer, and intermediate program binaries generator.

“Avid is very interested in OpenCL,” senior consulting engineer Rob Gonsalves said. “It allows us to write code once and use it either on a CPU or a GPU. Today, we write code for, say, a video effect three times. We write a reference implementation in C, write another version that will be shipped in our products that is optimized using vector processing, and we create a third version using a shader language for use on a GPU. The promise of OpenCL is to write an algorithm once and use it on a diverse mix of parallel processors.”

“In the long run, OpenCL may replace our SIMD or SSE code, as it would afford us high-level programming that doesn’t need to be optimized separately for each platform,” added Dieter Huber, engineering manager of Avid’s Creative Enthusiasts Division. “If, in the future, we still have a bunch of MMX™ [instructions] code, we’ll have to decide whether it’s best to move it to SSE or OpenCL.”

Intel OpenCL SDK is available as a component of both the Intel® Media Software Development Kit 2012 and Intel® Graphics Performance Analyzers 2012.

ENHANCED FOR EXCEPTIONAL PERFORMANCE



*"[Intel® VTune
[Amplifier XE] gives us
data on the timing of
different instructions
within the program. With
that data we can pinpoint
the actual hotspot."*

— ROB GONSALVES, SENIOR CONSULTING ENGINEER, OFFICE OF THE CTO, AVID

"Our codec team's goal is to support the latest video formats and to support them efficiently. There is a lot of compression with both RED and H.264 HD video files. The best way to achieve good performance is by starting with objective data about where your actual bottlenecks are," Gonsalves said. "Our codec team uses Intel VTune [Amplifier XE] and Intel Thread Profiler to identify bottlenecks and fine-tune the efficiency of our code across multiple cores."

In the 1990s, Avid professional video-editing and -finishing systems employed specialized hardware for capturing and outputting digital and analog video. "Avid's initial HD editing systems used dedicated hardware chips for video processing. Today we're doing less and less of that and instead relying on the CPU and GPU to perform those functions," Gonsalves said.

As broadcasters move beyond television and deliver content to mobile and web-enabled devices, Avid is developing software-based technologies optimized to run on modern browsers. Avid Interplay* Central, for example, is an extension of Avid's Interplay production asset management system. Interplay lets enterprise-level video operations organize and share editable media assets between news, editorial, and business units. With Interplay Central, users can browse video, audio, and metadata assets using an Internet connection and a browser. The company is also evaluating applications that run on Intel® Atom™ processor-based tablets and notebooks.

No matter what innovations are on the horizon, Intel application engineers will continue to assist Avid engineers, using Intel software developer tools to optimize and benchmark applications, helping to deliver exceptional performance on Intel® processor microarchitecture. ■



FIEA DEVELOPERS RATE INTEL® SOLID-STATE DRIVES AN A+

BY GARRET ROMAINE

SOMETIMES ENGINEERS JUST HAVE TO SEE FOR THEMSELVES. They can read the specs and study the numbers, but until they actually perform experiments in a lab setting, they tend to be doubters. Various marketing literature and anecdotal evidence may suggest that solid-state drives are faster than conventional rotating drives, but maybe those tests were in uncommon configurations that don't equate to real-world settings. Or maybe the testers were biased.

It turns out that, based on easily duplicated tests taken from throughout the game-development process, Intel® Solid-State Drives (Intel® SSDs) offer performance improvements from top to bottom. Access times for standard, spinning hard-disk drives average about 5 to 10 milliseconds (ms), mostly because those heads have to move and wait for the data to rotate into position beneath the read/write head. Solid-state drives feature access times around 0.1 ms. The drives access data directly from the flash memory, resulting in dramatic speedups.

Recently, a team of bright graduate students from the Florida Interactive Entertainment Academy (FIEA) received a gift of Intel SSDs to perform rigorous testing against conventional hard drives. The team had recently completed an exhausting, eight-month, game-development exercise that resulted in a solid, professional-quality game demo. The students then decided to retrace their development steps and



compare the compile times, rendering tasks, and other chores between drives. For any PC enthusiast who has recently built his or her latest “dream machine” without an SSD, the results are sobering indeed.



Four Guys and a Dream

Like other universities with game-development curriculum, FIEA requires graduating students to complete a grand, unifying capstone project that puts to use their newly gained knowledge. For eight months, team members perform as if they work at a real game studio, mapping out levels, creating original art, perfecting the artificial intelligence, and completing dozens of other tasks. The ultimate goal is to create a professional-quality demo, or portfolio piece, that is ready to show off. Doing so requires a lot of PC horsepower, performing some tasks repeatedly in a grueling, iterative process.

Intel® Visual Adrenaline caught up recently with students Joey Hannes and Alan Landau, who

walked us through the project. Landau said the game actually started taking shape far ahead of the first day of class. “It was basically four guys in a room—Andrew Bertino, Andrew Gassen (who became the lead designer), Tim Tryzbiak (who became the lead programmer), and myself, who became the project lead—and we were just talking and throwing ideas around. We had to come up with a large-scale game for our graduate school program. We found out quickly that the game we each wanted to make was relatively similar.” Other students, including Joey Hannes, producer and lead level designer, soon joined the team, and the project gained momentum.

Eventually, what took shape was a game called *Nexus*, a third-person puzzle and platforming action game built on the Unreal* Development Kit and featuring a journey through the hidden ruins of a forgotten civilization. Players fight adversaries and solve puzzles to escape before the ultimate collapse of the ancient ruin. To create the game, the students used Dell Precision* M6500 laptops with 4 gigabyte (GB) RAM and Hitachi Travelstar* 7K500 hard drives, all powered by the 2nd generation Intel® Core™ processor family.

Landau said the student team felt they had the PC horsepower to strive for some lofty goals. “We wanted to create a student game that was as close in quality as possible to an industry game. We really focused on quality and user experience over quantity of levels and time played. At the beginning, we all had high aspirations and we wanted to create four hours of content, but it wound up coming down to about 30 to 45 minutes of awesome game experience.”

The four-man team grew to 19 different students at one point, and they borrowed the art and graphics expertise as needed. Course requirements

included some modest documentation, marketing plans, and even packaging.

Although the game was successfully completed, the team found that during the process their PCs often got bogged down with compute-intensive tasks, resulting in increased program lag time, longer load times, and frame hitching. “It can be tough to stay on task when you’re uploading a level build, and it seems like you’re waiting forever for it to finish. You start getting distracted and work on other things such as e-mail or social media. At the end of the day that lost productivity adds up,” said Hannes.

And as interesting as their final grade was on their transcripts, they were curious to take their title “on the road” and get some feedback from active gaming professionals. Eventually, the team met up with Intel representatives. According to Landau, “We were showing it at the SIGGRAPH conference in Vancouver, and that was where we met with Intel’s Kevin Crow. He saw the game and he was impressed.” The team and Kevin talked for quite a while about the various tasks they had performed, and soon enough the hardware specs for their development system came up.

The team was curious to know how a solid-state drive would increase productivity during the development process. Could they render scenes, update levels, and increase overall team productivity? And would Intel SSDs be able to reduce lag time to improve gameplay?

Crow saw an opportunity for real-world, bona fide comparison testing, or as he calls it, a “proof point.” He asked the team if they were interested in replacing their conventional spinning hard drives with new Intel SSD components, in order to perform “before and after” tests using the

“When you add up all of the time saved, it is not necessarily going to be an instant impact . . . it might be a 50 percent savings, but that savings might only be two seconds. But if it is a larger savings, like 30 seconds while you open a file . . . and you do that 300 times a day . . . it adds up to many man-hours saved. And in the game production cycle, that means more time to work on a game and less money spent on producing that game.”

– ALAN LANDAU, NEXUS PROJECT LEAD

team’s code. After exchanging information and handshakes, the team went back to Florida and started checking their mail daily, looking for that special package.

Pick Apart a Laptop

In days, the FIEA students found themselves unwrapping brand new Intel SSD 320 Series. “The laptops that we have are pretty much desktop replacements. They’re like workstations with SATA drives built in,” Landau said. “So it was a pretty easy exchange.”

But before they could make the swap, they needed baseline data. Landau said they began their investigation before the drives arrived. “We started doing tests based on our usual typical tasks for artists, programmers, and producers, and that’s where we did all the comparisons. We set up our initial task list, and we started with the original spinning hard drives. We ran through the typical scenarios we were already familiar with, because we did those tests on a daily basis during development.”

Then it was time to swap out the hardware. While some of the most seasoned PC enthusiasts loathe taking apart a laptop, fearing the act of removing the case, the students weren’t fazed. “We just had to take a couple of screws out and actually remove a hard drive, but it was pretty much plug and play,” Landau said, shrugging it off.

Next came the same experiments with the new drives, which were formatted and provided with a software image identical to the original. The tests involved a variety of common developer tasks, such as timing how long it takes to have the

game demo ready from a cold PC boot, performing a full sync of project game files, making scene adjustments, and packaging up an executable demo build for their project lead to review. They also compared the two PCs for gameplay to see if there was a noticeable difference in user experience. “We did the same tests with the [Intel] SSDs and saw a couple of differences here and there, but they weren’t really that far off. They were all within the same ballpark of the results that we showed earlier,” said Landau.

But when they moved to the tests that were hammering the hard drive repeatedly, the results were dramatic. There were big reductions in time for rendering, for example. Joey Hannes said, “That

was one of the heavier tasks, and overall with everything we did, it was usually about a 50 percent or better difference in how long it took. Then from there it just went up exponentially as the time went out. It was more noticeable on something that took an hour before and now takes only 30 minutes.”

Landau said that there were subtleties in the time differences as they kept testing. “What is really evident when you add up all of the time saved, it is not necessarily going to be an instant impact. Like Joey said, it might be a 50 percent savings, but that savings might only be two seconds. But if it is a larger savings, like 30 seconds while you open a file or something like that in [Autodesk] Maya*, and you do that 300 times a day and you have 15 artists, it adds up to many man-hours saved. And in the game production cycle, that means more time to work on a game and less money spent on producing that game.”

More RAM versus Solid-States Drives

The team also tested their 4 GB RAM PC with an Intel SSD against a more powerful 8 GB RAM PC with a Hitachi Travelstar 7K500 hard drive to really put it to the test. They compared PC

TEST	PC WITH HARD DRIVE	PC WITH INTEL® SSD	TIME SAVED WITH INTEL SSD
Perform cold boot to have game demo ready	6 min 19 sec	1 min 51 sec	4 min 28 sec
Full sync of project game files	1 min 30 sec	1 min 4 sec	26 sec
Perform scene adjustment and update level	3 min 24 sec	2 min 29 sec	55 sec
Create fully packaged level .exe demo build	24 min	16 min 15 sec	7 min 45 sec

TEST	PC WITH 8 GB RAM AND HARD DRIVE	PC WITH 4 GB RAM AND INTEL SSD	TIME SAVED WITH INTEL SSD
Batch rendering of dynamic animation	1 hr 49 min	1 hr 5 sec	48 min 55 sec



Comparison of image texture 1.5 seconds after loading a level: PC with hard drive (LEFT); PC with Intel® Solid-State Drive (RIGHT). (See lines on coat, detail in cube, and detail inside the structure.)

performance when batch rendering a dynamic animated element. The results from the game-development tests were clear, with the performance of the Intel SSD surpassing the Hitachi drive.

"Intel SSDs give you back time that you didn't realize you could have in your day, enabling you to stay focused and really dive into your work," said Hannes.

Landau agreed, saying, "Intel SSDs allowed our team to move faster, and with greater agility and productivity. If we had Intel SSDs for our entire eight-month project, we could have gone even further."

The performance boost the Intel SSDs offered also improved gameplay. Their video game loaded and ran faster, even with multiple programs open. When playing the game on a PC with a traditional hard drive, they periodically experienced a lag in game visuals and effects. Intel SSDs delivered a smoother gameplay experience. And with video-game worlds becoming more complex and visually rich, Intel SSDs provide the performance boost to help users truly immerse themselves in the experience.

What's in Your Dream Machine?

Landau said there are three reasons why developers have traditionally been reluctant to upgrade to SSDs. "There's the size of the drive," he said, noting that spinning drives are routinely into the 2 terabyte range now. Then there's price. "SSDs are still relatively expensive for their size, although they are getting a lot cheaper," Landau noted. And finally, there is performance. "Are they really that much faster? That's what we were wondering. I think it is a definite upgrade for any enthusiast, designer, or developer, as well as just a normal PC user—or an [Apple] Mac* user for that matter."

Landau took the plunge after the experiments were so convincing. "I personally, just two or three weeks ago, built a new dream machine. It is powered by the 2nd gen Intel Core processor. It has 16 GB of DDR 3 RAM, is liquid-cooled, and has a 2-terabyte hard drive. Everything was 7.7, 7.8, 7.9 on the [Windows*] Index, except for my hard drive, which was 5.4. So I added an Intel SSD 320 Series, and now it is a 7.7."

"Once you experience gaming and development with Intel SSDs, you'll have a hard time going back to your old hard drive," said Landau. "Once you go SSD, it is an instant change. You notice it in everything you do, especially if you turn your computer off and on a lot, bring it to hibernate, or do repetitive tasks, such as opening and closing programs or files. For example, artists who open a texture and change something, and then close it and open another one and do that 200 times a day will see a very noticeable change. I would definitely suggest investing in an SSD over buying more RAM. Both don't hurt, but I would pick an SSD before RAM."

Still, you should probably check it all out for yourself. ■



About the Author

Garret Romaine is a senior writer, working for Rose & Her Minions, from Beaverton, Oregon. Garret started in gaming as a beta tester for Epic Megagames and has been a columnist, editor, and reviewer ever since. Garret is a Fellow in the Society for Technical Communication, and he teaches technical communication at Portland State University.

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For more information on Intel GPA, go to:
www.Intel.com/software/gpa

Learn more about Zombie Studios at: www.zombie.com



PAGE 5: Optimize for Silicon: Tapping into the Full Power of the 2nd Generation Intel® Core™ Processor Family with Intel® Software Development Tools

For more information on Intel® Graphics Performance Analyzers, visit: www.Intel.com/software/gpa

To get details on Intel® Media SDK 2012, visit:
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Learn more about Intel® VTune Amplifier XE at:
www.Intel.com/software/products/vtune

For details on ArcSoft video editing, sharing, and conversion software, visit: www.arcsoft.com

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PAGE 10: Players Take the Wheel in *TrackMania² Canyon**: French Game Developer Nadeo Puts the Players Firmly in the Driving Seat

To learn more about Nadeo and *TrackMania² Canyon*, go to:
www.nadeo.com



PAGE 15: Prophet Margin: Intel's Futurist Looks at the Mobile Landscape

Check out Brian David Johnson's blog at:
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The photograph of Brian David Johnson is from:
www.origo.hu/techbazis/hightech/20111114-aki-mar-iseri-a-jovo-iphonejat-is-interju-brian.html



PAGE 17: The Ultrabook™ Device: A Compelling Foundation for Modern Mobile Computing

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PAGE 21: The Future of Visual Entertainment Looks Three Dimensional

To see what's happening at the CAMERON | PACE Group, visit: www.cameronpace.com/v2/index.php

For 3D gaming insights and information on the TriDef® 3D product, see: www.ddd.com/

Learn more about visual technology and Intel® products:
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To order the "3D TV Market and Future Forecast Worldwide (2010-2014)" report, go to: www.researchandmarkets.com/reports/1525112/3d_tvmarket_and_future_forecast_worldwide_2010



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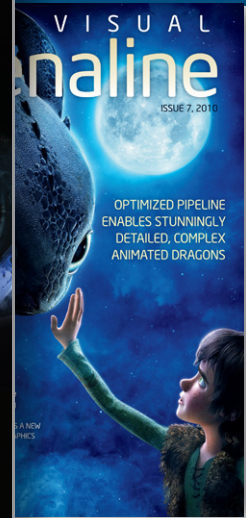
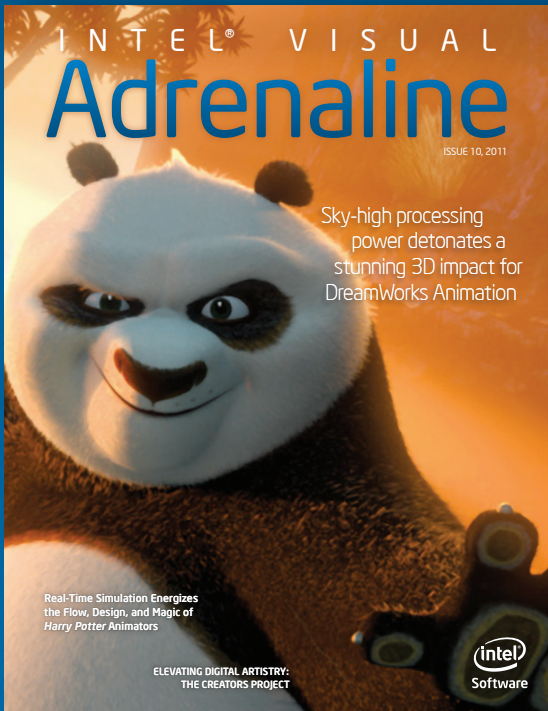
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