ATI Stream Computing Update
Delivering the power of Fusion from the desktop to the datacenter

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Overview of ATI Stream
The Future is Fusion
AMD Balanced Platform Advantage

Balanced platforms deliver optimal performance for today’s heterogeneous workloads
Introducing ATI Stream

ATI Stream uses the massive parallel processing power of AMD graphics processors to deliver new capabilities to users that go beyond the traditional usage scenarios of graphics rendering and video processing.
ATI Stream Differentiators

**Pioneering Innovation**
AMD was the first to demonstrate GPU compute acceleration in 2006.
Helps expand and create new market opportunities for AMD and developers.

**Open Standards**
Giving developers the freedom to choose which hardware their software will run on, with the capability to write once and run on many.

**Performance Leadership**
AMD offers superior GPUs at all price points (ATI Radeon™ HD 4000 Series).
Works in balance with system CPU(s).
Open Standards for Developer Freedom

The industry wants open

- Apple Display Connector
- 3dfx
- Rambus
- NVIDIA Cg
- NVIDIA CUDA
- Unified Display Interface
Open Standards for Developer Freedom

Digital Visual Interface

The industry wants open

JEDEC

OpenGL

Certified DP

OpenCL

DirectX® Compute Shader

DirectX®
Pioneering Innovation for Mainstream Adoption

Folding @Home
Proof of concept reporting >30x speedup over CPUs

Stream Computing Development Platform
CTM for data parallel programming

2006

AMD Stream SDK
Open systems approach to help drive broad customer adoption

2007

AMD FireStream™ 9170
Stream Processor
First GPU Stream processor with double-precision floating point

2008

AMD FireStream™ 9270
Accelerates many HPC and commercial vertical applications

ATI Stream Enabled for mainstream

First Free Video Converter
Winning Accolades from Reviewers Worldwide

About the ATI Radeon™ HD 4000 series:

“ATI unveiled a bombshell…”

“Nvidia: You’re a dinosaur”
Taking it Mainstream
The Need for Speed

**Entertainment**
- Media-related apps
- Sound/music editing
- Graphics/design applications

**Desktop Productivity**
- Operating system functions
- Office applications
- Search

**Gaming**
- Superior special effects
- Advanced physics
- Artificial intelligence

**ATI Stream** gives users a new and better way to speed up the applications that need it most.
Giving the Millions of ATI Radeon Users the Power of ATI Stream - For Free

More than 2 million ATI Radeon™ HD 4000 series graphics cards sold

Unlock the built in ATI Stream capabilities with a free download

Give users a free application so they can immediately see benefit

User Base Grows

Software Base Grows

Give developers free, easy to use tools

Comprehensive strategy to simultaneously build worldwide user and software base
On December 10, AMD plans to release ATI Catalyst™ drivers version 8.12 designed to come with ATI Stream built-in.

Every user of a ATI Radeon™ HD 4000 series card automatically gains the ability to run ATI Stream-enabled applications.

Applications under development by a growing list of companies, including Adobe and Microsoft.

HD video applications by ArcSoft and CyberLink slated for release in 1Q09.

ArcSoft was able to add ATI Stream functionality in only 4 weeks using the ATI Stream SDK.
Giving Users an Immediate Benefit:
New, Free ATI Avivo™ Video Converter

**Up to 17x Faster Conversion than CPU Only***

**ATI Avivo™ Video Converter**
**ATI Radeon™ HD 4850**
**ATI Catalyst™ 8.12**

Rapidly convert HD or SD video to varying formats, for playing on multiple devices

* ATI Avivo Video Converter using ATI Stream technology converted 1 hour of MPEG2 1080p video to H.264 320x240 video in 12 min., while iTunes 8.0.1 with WinQuickTimeMPEG2 pack performed the same conversion in 3 hours, 23 minutes, demonstrating a 17x speed up. System specs: Intel Core 2 Duo QX9650 3.0 GHz processor / 6GB RAM / Windows Vista Ultimate® 64-bit SP1 / ATI Radeon™ HD 4850 512MB. Performance of ATI Avivo Video Converter will vary based on system configuration, ATI Radeon product, source file and output settings used.
ATI Avivo™ Video Converter: Winning Price, Performance and Power

An hour of high-definition video that used to take 3 hours+ to convert now takes just 12 minutes*

Free download scheduled for December 10

Low complexity, high value application

Can dramatically accelerate conversion of video files

Optimized for file sizes common with HD video

*ATI Avivo Video Converter using ATI Stream technology converted 1 hour of MPEG2 1080p video to H.264 320x240 video in 12 min., while iTunes 8.0.1 with WinQuickTimeMPEG2 pack performed the same conversion in 3 hours, 23 minutes, demonstrating a 17x speed up. System specs: Intel Core 2 Duo QX9650 3.0 GHz processor / 6GB RAM / Windows Vista Ultimate® 64-bit SP1 / ATI Radeon™ HD 4850 512MB. Performance of ATI Avivo Video Converter will vary based on system configuration, ATI Radeon product, source file and output settings used.
CyberLink PowerDirector 7 Update
Expected First Quarter 2009

Extensive features benefitting from ATI Stream acceleration

Beyond ATI Avivo™ Converter capabilities with multiple HD videos transcoding

Enhanced video editing, effects creation, playback and transfer

Working jointly to add acceleration to broader range of future applications
ArcSoft TotalMedia™ Theater
Expected First Quarter 2009

Features Arcsoft SimHD™ DVD upscaling technology enabled by ATI Stream

Up-scaling of standard definition video up to 1080p on PCs & notebooks*

Video enhancement occurs automatically, no special changes or settings required

Further ATI Stream enhancements planned for future releases

*1080p monitor required.
Adobe: Expanding Set of ATI Stream-Enabled Titles

Adobe Acrobat® Reader®
Up to 20%* performance improvement when working with graphically rich, high resolution PDF files when compared to using the CPU only

Adobe Photoshop CS4® Extended
Accelerated image and 3D model previewing (panning, zooming, rotation) and 3D manipulations to photos, for example mapping an image onto a 3D object

Adobe After Effects® CS4
Allows for the rapid application of special effects to digital media

Adobe Flash® 10
Dynamic, graphically engaging Web content designed with these capabilities in mind

*Claim of 20 percent performance improvement in Adobe Acrobat® 9 based on Adobe engineering benchmarks. Page rendering using the CPU alone took 71.289 seconds, but using GPU-acceleration took 64.43 seconds. Planning using the CPU alone took 232.539 seconds, but using GPU-acceleration took 207.63 seconds. System used was Intel Core 2 Quad 2.93GHz processor, Asus P5W64WS motherboard, 4GB DDR2 memory, Windows Vista 32-bit with Service Pack 1, and ATI Radeon HD 4870 card.
Microsoft: Accelerating Windows and Beyond

**Microsoft Windows Vista®**
Harness stream processing to make image adjustments on the fly in Microsoft’s Picture Viewer application.

**Microsoft Expression® Encoder**
Accelerated encoding of content for Microsoft® Silverlight™, Windows Media video and audio.

**Microsoft Office® PowerPoint 2007**
Acceleration of slideshow playback for smooth animations, transitions and slide display.

**Microsoft Silverlight**
Unlocking the full potential for web based multi-media and robust user experience and interface.
Summary

Adding yet another layer of value for ATI Radeon™ HD 4000 series users

Creating an ATI Stream user base of millions overnight with ATI Catalyst™ software release version 8.12

Demonstrating immediate benefit with the free ATI Avivo™ Video Converter

Working with a growing number of developers set to deliver ATI Stream enabled applications in the coming months

Driving ATI Stream into mainstream adoption and usage
The Software Challenge: Making it Easier for Developers
Effective Compute Offload Requires Advanced Hardware, and Also Software

ATI Stream-enabled Software Applications

Serial and Task Parallel Workloads

Data Parallel Workloads

Graphics Workloads

Developers need powerful tools and industry standard APIs
The Free and Open ATI Stream SDK

AMD is the first company to offer a freely-downloadable, open set of programming tools for stream programming.

Adoption of Stream SDK, launched in 2006, continues to grow.

Open systems approach to enable developers: published interfaces from top to bottom; open source Brook+.

AMD’s Stream Developer Forum is the most active developer forum at AMD.
ATI Stream SDK 1.3 – Scheduled for Release in Q4

Integration of AMD’s compute abstraction layer (CAL) into the popular ATI Catalyst™ drivers

Significant performance enhancements to Brook+

Support of new ATI Stream hardware
- AMD FireStream™ 9270
- ATI Radeon™ HD 4600
- ATI Radeon™ HD 4550
- ATI Radeon™ HD 4350
ATI Stream SDK: Applications Can be Written Once, and Run on a Broad Range of ATI Hardware

HPC
- Research
- Oil and Gas
- Finance
- CAE
- Defense

Consumer
- Games
- Video
- Productivity

Workstation
- Medical Imaging
- Professional Video
- Rendering

ATI Stream Software Developer Kit
“We turned to ATI Stream technology as a means to enhance ArcSoft SimHD™, DVD upscaling technology of ArcSoft TotalMedia™ Theatre. Working with the developer tools provided in the ATI Stream SDK, in less than one month we were able to instruct our application to draw upon the compute power of the GPU to give viewers close-to-HD video from standard definition multimedia files and DVDs, resulting in a sharper and more vivid picture in real time. We were able to complete the project in less time than expected due to the performance enhancements AMD has made to the Brook+ runtime language in the SDK, which allowed us to more efficiently program our software in a C-like environment.”

Emphasis Added

— George Tang, ArcSoft VP and GM of Video and Home Entertainment Group
Moving Past Proprietary Solutions for Ease of Cross-Platform Programming

It is time to move past proprietary interfaces, developers want industry standards.
OpenCL Compliance Giving Programmers a Fully Open Cross-Platform Interface

The OpenCL Working Group consists of major industry players like AMD, Apple, IBM, Intel and Nvidia.

The Working Group is on track to ratify and publish the specification later this year.

OpenCL compliant implementation will begin rolling out next year.

AMD is participating in the Khronos OpenCL Working Group to help define an industry standard for GPU programming.
DirectX® and the Compute Shader

- A new processing model for GPUs
- Data-parallel programming for compute-intensive applications that address the mass market
- Integrated with Direct3D for efficient interoperability in client scenarios
- Helps enable broad installed base

DirectX® brought 3D gaming to the masses, it can do the same for ATI Stream
Serving the Unique Needs of the Enterprise
Why the Datacenter is Different

**DENSITY**
High performance, small form factor

**POWER**
High performance/watt

**COST**
High performance/$ for superior ROI

**PRECISION**
Technical applications require double-precision computations
### AMD FireStream™ 9270 stream processor:
#### 2x Double Precision Performance*

<table>
<thead>
<tr>
<th>AMD FireStream™ 9270</th>
<th>$1499 MSRP</th>
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<tbody>
<tr>
<td><strong>Compute Power</strong></td>
<td>1.2 teraFLOPS</td>
</tr>
<tr>
<td><strong>Core Clock Speed</strong></td>
<td>750 MHz</td>
</tr>
<tr>
<td><strong>Single/Dual Slot</strong></td>
<td>Dual Slot</td>
</tr>
<tr>
<td><strong>Memory Type</strong></td>
<td>GDDR5 3.6 Gbps</td>
</tr>
<tr>
<td><strong>Memory</strong></td>
<td>2GB</td>
</tr>
<tr>
<td><strong>Typical Board Power</strong></td>
<td>160W</td>
</tr>
</tbody>
</table>

- HPC-class performance deployable anywhere
- 240 double precision GFLOPS
- Optimal performance-per-watt

*Claim based on comparison of the AMD FireStream 9270 stream processor vs. the Nvidia Tesla C1060 Computing Processor. The AMD FireStream 9270 delivers upwards of 240 GFLOPS double precision floating point peak performance while the Tesla C1060 claims 78 GFLOPS double precision floating point peak performance based on published information.
“Increased competitive pressure is driving companies to adopt high-bandwidth, compute-intensive solutions to facilitate better business decision making. The combination of AMD FireStream GPU-based accelerator cards with HP ProLiant servers enables customers to accelerate application performance, ultimately leading to faster development and time to market of products.”

— Ed Turkel, Product Marketing Manager, Scalable Computing & Infrastructure, HP
**AMD & Aprius: Massive Computational Muscle**

**Aprius Computational Acceleration System (CA8000)**

- **Form Factor**: Rack mount 4RU chassis
- **Compute Power**: 9.6 TFLOPS, 1.9 DP TFLOPS
- **Memory**: 16 GB
- **# of Graphics Cards**: 8 x AMD FireStream™ 9270

- Easy, in-rack installation and maintenance
- Transparent support for all OS environments
- PCIe Optics Innovation: Multi-fiber optical cable with MTP connectors up to 50m lengths
- Up to four PCIe 2.0 x16 buses
ATI Stream™ Commercial Applications: Server & Workstation

Research

Computer-Aided Engineering

Financial modeling and risk assessment

Oil & gas exploration

Defense

Medical Imaging

Rendering

Professional video
“Using the ATI Stream SDK and Brook+ compiler, we’ve obtained GPGPU benchmarks on a range of algorithms, from electromagnetic and seismic wave solvers to particle-based calculations. These are important algorithms for modeling and simulation that impact wireless communication, oil and gas exploration, and physics and chemistry research. We’ve seen tremendous acceleration, in some cases more than a 120x. The results have generated a lot of interest from customers. The raw compute power of the AMD FireStream™ technology offers tremendous theoretical performance for computationally intensive applications. The SDK allows customers to see how that potential translates into real acceleration for their applications.”

— David Richie, president of Brown Deer Technology

Claim based on algorithm implementation on AMD FireStream 9250. When run without the assistance of the AMD FireStream 9250, the calculation completed in 1626.9 seconds using a single-core implementation. With accelerated assistance using the AMD FireStream 9250, the calculation completed in 13.1 seconds. System specifications: AMD Phenom X4 9950 Black Edition quad-core processor (2.6GHz), Windows XP 32-bit, ATI Stream SDK version 1.3 pre-release version, and AMD FireStream 9250 stream processor.
Key Takeaways

Delivering on the promise of Fusion from the desktop to the datacenter

Using a differentiated approach that stresses balanced platforms and industry standards

Driving ATI Stream into mainstream adoption and usage

Making it easier for ISVs to develop ATI Stream enabled applications

Serving the unique needs of the enterprise with AMD FireStream™
ATI Stream: delivering on the promise of Fusion from the desktop to the datacenter

On December 10, a simple Catalyst download is scheduled for release and instantly unlock the power of ATI Stream for the millions of ATI Radeon™ users worldwide

Adobe, ArcSoft, CyberLink, Microsoft and others are lining up to deliver new ATI Stream-enabled applications as early as 1Q09

So ATI Radeon™ users can immediately experience ATI Stream benefits, on 12/10/08 AMD plans to make the powerful ATI Avivo™ Video Converter available via free download

To ease application development, AMD is updating its free and open ATI Stream SDK, setting a path to DirectX® and OpenCL compliance

Serving unique enterprise needs, AMD is also unveiling the AMD FireStream™ 9270, a datacenter-class solution for peak performance and maximum data handling
Backup
AMD Accelerated Video Transcoding Goals

First consumer application of **ATI Stream™** technology

Faster than real-time transcoding of **full 1080p** videos

**H.264** and **MPEG-2** GPU-accelerated encoding

Leveraging **ATI Radeon™ HD 4800/ATI Radeon™ 4600 series GPUs**

Encode targets: **files, DVD and portable devices**

Encode target resolutions: **QVGA (320x240) to 1080p**

AVT will be initially enabled on **ATI Video Converter & Cyberlink***

*Cyberlink’s press release June 30, 2008  (Windows Vista & XP)  
Multiple usage scenarios for transcoding

- Archived personal videos
- Camcorder
- Broadcast / PVR
- Online videos
- Archive edited videos
- Portable media players

Enabling usage scenarios is dependant on 3rd party software applications
## Transcoding: features comparison

<table>
<thead>
<tr>
<th>Feature</th>
<th>AMD</th>
<th>NVIDIA/Elemental*</th>
</tr>
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<tbody>
<tr>
<td>QVGA (iPod/iPhone/PSP)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>H.264</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>1080p input (decode)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>MPEG-2 (for BD &amp; DVD)</td>
<td>✓</td>
<td>×</td>
</tr>
<tr>
<td>Full HD 1080p output (encode)</td>
<td>✓</td>
<td>×</td>
</tr>
<tr>
<td>HDV (MPEG-2 1440x1080)</td>
<td>✓</td>
<td>×</td>
</tr>
<tr>
<td>Availability</td>
<td>Free</td>
<td>$30</td>
</tr>
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</table>

* source: [http://www.badaboomit.com](http://www.badaboomit.com)
PVR Usage Scenario with AMD Platform

TV/DVR Application
Windows Vista™ Media Center

Transcoding App or Plug-In
Partners: Cyberlink, Corel, ...

Accelerated Video Transcoding Interface

Auto-Sync Recorded TV to Portable Media Player

Accelerated Video Transcoding (AVT)
The combination of an ATI Radeon™ HD 4850 512MB graphics card (~$159) + ATI Avivo™ Video Converter (free) compared to the combination of GeForce® GTX 280 graphics card (~$449) + Badaboom™ Media Converter 1.0 ($29.99), and combination of Intel QX9650 CPU (~$999) with QuickTime 7 Pro +MPEG-Pack (~$60) shows that 90 minutes of MPEG2 1080p video is converted to H.264 iPod video on the AMD solution in 23 minutes, and is converted on the Nvidia/Badaboom solution in 38 minutes, and converted on Intel solution in 4 hours and 34 minutes. Prices based on average Newegg.com pricing as of November, 5, 2008.

System specifications: AMD Phenom™ X4 9950 CPU 2.6GHz / 2GB RAM / Windows Vista Ultimate® 32-bit SP1 / ATI Radeon™ HD 4850 512MB / ATI driver 8.56 (beta) and ATI Video Converter; or GeForce® GTX 280 1GB / Badaboom™ Media Converter 1.0 / CUDA driver 178.08 INT, Intel QX9650 @3.0GHz/ G45 IGP system/ 2GB RAM/ Windows Vista Ultimate® 32-bit SP1 / QuickTimePro 7 with MPEG-2 Pack.

Performance will vary based on system configuration, ATI Radeon product, source file and output settings used.
The AMD Stream Advantage: Transcoding

The combination of an ATI Radeon™ HD 4850 512MB graphics card (~$159) + ATI Avivo™ Video Converter (free) compared to the combination of GeForce® GTX 280 graphics card (~$449) + Badaboom™ Media Converter 1.0 ($29.99) , and combination of Intel QX9650 CPU (~$999) with QuickTime 7 Pro +MPEG-Pack (~$60) shows that 92 sec of MPEG2 1080p video is converted to H.264 iPod video on the AMD solution with average of 120FPS, and is converted on the Nvidia/Badaboom solution with average of 70.8FPS, and converted on Intel solution with average of 9.7FPS. Prices based on average Newegg.com pricing as of November, 5, 2008.

System specifications: AMD Phenom™ X4 9950 CPU 2.6GHz / 2GB RAM / Windows Vista Ultimate® 32-bit SP1 / ATI Radeon™ HD 4850 512MB / ATI driv er 8.56 (beta) and ATI Video Converter; or GeForce® GTX 280 1GB / Badaboom™ Media Converter 1.0 / CUDA driv er 178.08 INT; Intel QX9650 @3.0GHz/ G45 IGP sy stem./ 2GB RAM Windows Vista Ultimate® 32-bit SP1 / QuickTimePro 7 with MPEG-2 Pack. Performance will vary based on sy stem configuration, ATI Radeon product, source file and output settings used. Tests were done with pre-release software not yet available.
Transcoding Systems Details

**AMD Platform w/ ATI Avivo Video Converter**
- CPU: AMD Phenom™ X4 9950 2.6GHz
- GPU: ATI Radeon™ HD 4850 512MB GDDR3 (625e/993m)
- Drivers: ATI Catalyst™ software version 8.56 (beta)
- RAM: 2GB
- OS: Windows Vista Ultimate 32-bit

**NVIDIA w/ Elemental Badaboom**
- CPU: AMD Phenom X4 9950 2.6GHz
- GPU: XFX GeForce GTX280 1GB GDDR3 (602e/2210m)
- Drivers: ForceWare 178.08
- RAM: 2GB
- OS: Windows Vista Ultimate 32-bit

**INTEL w/ QuickTimePro + MPEG-2 Pack**
- CPU: Intel Core2 Extreme Processor QX9650 3.0GHz
- GPU: Intel G45
- Drivers: n/a CPU only transcoding
- RAM: 2GB
- OS: Windows Vista Ultimate 32-bit
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