

Compute Cores Enabled by HSA

Groundbreaking technology for more responsive compute performance

AMD introduces the world's first APUs with Heterogeneous System Architecture. This revolutionary architecture is designed to unlock your system's full potential and provides **up to 12 compute cores* (4 CPU cores + 8 GPU cores) for more processing power and compute performance.**^{1,2,3}

Why do cores matter?

Historically, cores process data inside a processor. **The more cores you have working together, the faster a computer will perform tasks** and the better multitasking power it will enable.

- **CPU cores were designed for serial tasks** (one task after another) such as workloads like email, Microsoft® Excel and other productivity applications.
- GPU cores were designed for graphic-intensive tasks such as streaming videos, editing photos, playing games and modern Web browsing (i.e., Google Chrome and Mozilla FireFox®). **GPU cores are better suited to run parallel workloads** (tasks are broken into pieces and performed by GPU cores simultaneously).

Traditionally, the CPU has been the focus of the operating system and the number of CPU cores has determined the computing capacity and performance of a PC. App developers tried to get the last bit of serial performance from the CPU cores, **while the huge potential parallel capability of the GPU cores was virtually unutilized.**

Unlock your system's full potential and join the new era of computing.

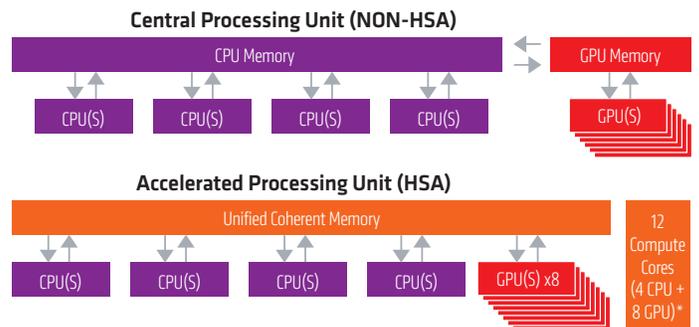
Visit: www.amd.com/computecores

*See amd.com/computecores for details.

What are compute cores?

AMD's latest revolutionary processing architecture – Heterogeneous System Architecture, or **HSA**, **bridges the gap between CPU and GPU cores and delivers a new innovation called compute cores.**

This groundbreaking technology allows CPU and GPU cores to speak the same language, and to share workloads and the same memory. **With HSA, CPU and GPU cores are designed to work together, creating a faster, more efficient and seamless way to accelerate modern applications while delivering great performance and rich entertainment.**



With HSA, AMD Radeon™ GPU cores can now operate in a manner comparable to a CPU core, in that it can initiate and assign tasks like the CPU, and are now fully utilized.³

AMD raises the bar with GPU-accelerated performance you will notice

In Photoshop CC – The AMD A10-7800 APU with 12 compute cores is up to 69% faster than Intel Core i5-4460.⁴

In LibreOffice – The AMD A8-7600 APU with 10 compute cores is up to 7x faster than Intel Core i3-4360.⁵

When loading JPEG images – The AMD A6-7400K APU with 6 compute cores is up to 65% faster than Intel Pentium G3450.⁶

Enjoy the power of CPU and GPU cores working together.



AMD

What are the benefits of compute cores* and HSA?

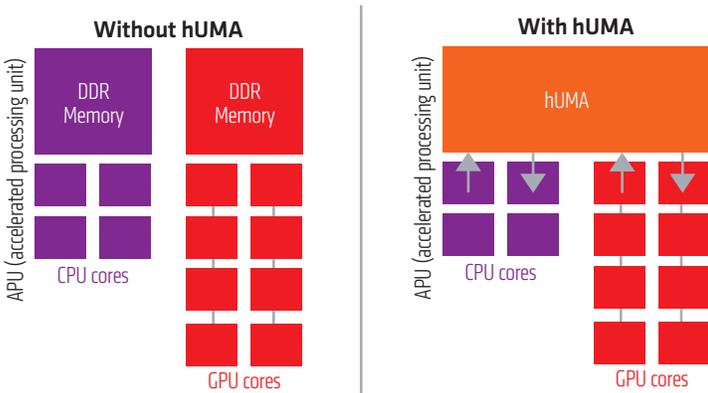
- Designed to deliver more processing power and compute performance.^{1,2,3}
- Simplified app development by allowing programmers to continue to program in the languages they prefer (i.e., C++, Java, etc.).
- AMD and other industry leaders are driving HSA across different platforms and hardware including x86 and ARM, such that phones and tablets will also gain the benefits of this revolutionary architecture.

What is the technology behind compute cores?*

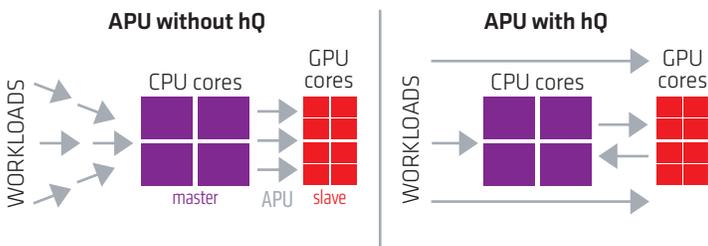
Heterogeneous System Architecture is a new standard in processor design enabling the CPU and GPU to share the same memory and workloads.

This is possible because of the following technologies:

Heterogeneous uniform memory access (hUMA) allows the two sides of an AMD APU (the GPU and CPU) to share data and access memory seamlessly.



Heterogeneous queuing (hQ) transforms the current CPU/GPU relationship from master-slave to a distributed workload balance where each core performs tasks for which it is best suited. This helps deliver greater efficiency, performance and responsiveness.



How is AMD leading the HSA revolution?

The HSA Foundation was formed as an open industry standards body to unify the computing industry around a new common approach to computing. The foundation's members, AMD, ARM, Qualcomm, Samsung and other well-known companies are working together to build the right hardware to bring the benefits of HSA and enable software developers to **“write once and run everywhere”** regardless of platform.

Key founders of the HSA Foundation



Three key takeaways:

1. Historically, cores process data inside a processor. The more cores you have working together, the faster a computer will perform tasks.
2. HSA allows CPU and GPU cores to share workloads and the same memory enabling all cores to become 'compute cores.'
3. HSA is designed to unlock your system's full potential and provides up to 12 compute cores* (4 CPU cores + 8 GPU cores) for more processing power and compute performance.^{1,2,3}

*See amd.com/computecores for details.

1. Testing conducted by AMD Performance Labs on optimized AMD reference systems. PC manufacturers may vary configuration yielding different results. The 2014 AMD Performance Platform APUs, code named "Kaveri", demonstrated improved compute performance over the previous generation product using BasemarkCL. The 2014 AMD A10-7300 APU scored 44.73 and the 2013 AMD A8-5545M equivalent scored 36.95; the 2014 AMD FX-7600P scored 52.36 and the 2013 A10-5750M equivalent scored 35.22. The 2014 APU Performance platform is based on the "Balina" reference design with the AMD A10-7300 APU with AMD Radeon™ R6 Series graphics and the FX-7600P APU with AMD Radeon R7 graphics, each using 4G DDR3L-1600 Memory, HDD (SATA) - 250GB 5400rpm and Windows 8 64bit, 13.35 beta7 driver. The 2013 APU data is based on the "Pumori" reference design with the A10-5750M with AMD Radeon™ HD 8650G graphics and the AMD A8-5545M with AMD Radeon™ HD 8510G graphics, each using 4G DDR3L-1600 Memory, HDD (SATA) - 250GB 5400rpm and Windows 8 64bit, 12.100.0.0 rct1 driver. KVN-6
2. Testing conducted by AMD Performance Labs on optimized AMD reference systems. PC manufacturers may vary configuration yielding different results. Basemark CL score divided by TDP (W) is used to simulate system performance per watt; the 20W AMD A10-7300 APU scored 56 while the 25W AMD A10-5745M APU scored 37. KVN-89
3. Available only on HSA enabled applications
4. Testing by AMD Performance labs with an AMD A8-7600 with Radeon™ R7 graphics, 2x4GB DDR3-2133, 1TB HDD, Windows 8.1, Driver 14.20 Beta 19. Intel system Intel Core i5 4460 with internal HD 4600 graphics used 2x4GB DDR3-1600, 1TB HDD, Windows 8.1, Driver 3621. Photoshop CC v15 build 58 tested using IMG_1072.jpg @ 4000x3000 upscaled 400% , with Preserve Details and 100% Reduce Noise. AMD system took 16 seconds with default OpenCL™ enabled. Intel Core i5 4460 took 27s with OpenCL™ enabled. (4 CPU + 8 GPU cores) See amd.com/computecores for details. KVD-23
5. Testing by AMD Performance labs with an AMD A8-7600 with Radeon™ R7 graphics, 2x4GB DDR3-2133, 1TB HDD, Windows 8.1, Driver 14.20.1004. Intel system Intel Core i3 4360 with internal HD 4600 graphics used 2x4GB DDR3-1600, 1TB HDD, Windows 8.1, Driver 3621. LibreOffice 4.3 beta 2 public tested using Demo1 v13 script consisting of a 3000 row worksheet and measured by the average time to calculate. AMD A8-7600 based system took 233.9 ms with default OpenCL™ enabled. Intel i3 4360 took 1863ms with OpenCL™ enabled. (4 CPU + 6 GPU cores) See amd.com/computecores for details. KVD-27
6. Testing by AMD Performance labs using an AMD A6-7400K with Radeon™ R5 graphics, 2x4GB DDR3-1866, 1TB HDD, Windows 8.1, Driver 14.20.1004. Intel Pentium G3450 with internal HD graphics used 2x4GB DDR3-1600, 1TB HDD, Windows 8.1, Driver 3621. JPEG Decode tested using AMD benchmark that loads 24 20MP (high) images. AMD A6 7400K system took 3.3s with OpenCL™ enabled. Intel Pentium G3450 took 5.45s with OpenCL™ enabled. (2 CPU + 4 GPU cores) See amd.com/computecores for details. KVD-31

© 2014 Advanced Micro Devices, Inc. All rights reserved. AMD, the AMD Arrow logo and combinations thereof are trademarks of Advanced Micro Devices, Inc. in the United States and/or other jurisdictions. Other names are for informational purposes only and may be trademarks of their respective owners. PID 55247A

