



OpenCL

Khronos and the OpenCL Standard

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Who is the Khronos Group?

- **Consortium creating open API standards ‘by the industry, for the industry’**
 - Founded nine years ago - any company welcome to join
- **Enabling software to leverage silicon acceleration**
 - Low-level graphics, media and compute acceleration APIs
- **Strong commercial focus**
 - Enabling members and the wider industry to grow markets and sell products
- **Commitment to royalty-free standards**
 - Industry makes money through enabled products – not from the standards themselves
 - Khronos is a non-profit organization

Silicon
Community



Software
Community



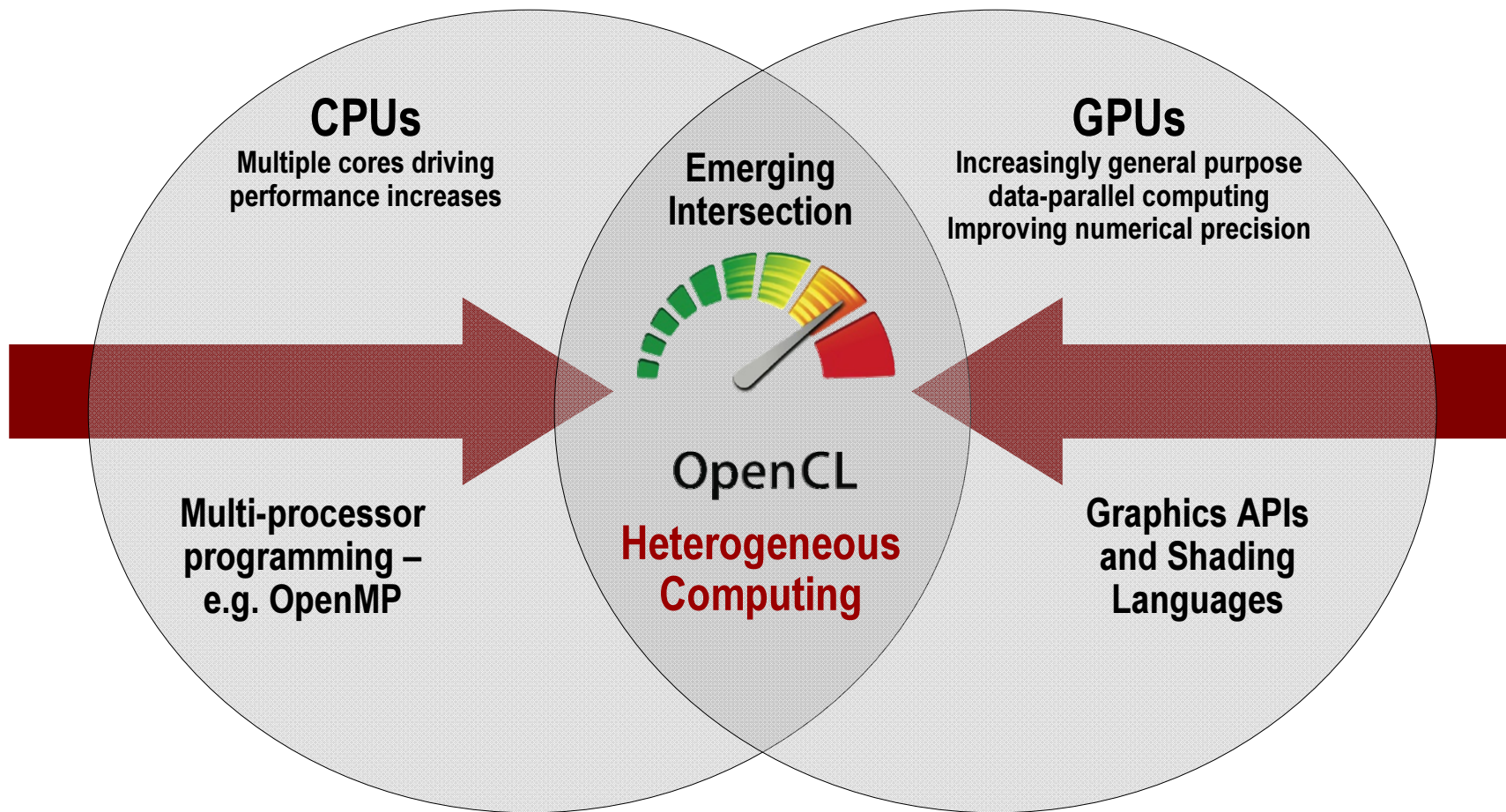


**Over 100 companies creating
authoring and acceleration standards**

Board of Promoters



Processor Parallelism



OpenCL Commercial Objectives

- **Grow the market for parallel computing**
 - Royalty-free, open standard for vendors of systems, silicon, middleware, tools and applications
- **Create a foundation layer for a parallel computing ecosystem**
 - Close-to-the-metal interface to encourage middleware and applications
- **Enable developers to exploit diverse parallel computation resources**
 - Unified programming model for CPUs, GPUs, Cell, DSP and other processors in a system
- **Support a wide diversity of applications**
 - From embedded and mobile software through consumer applications to HPC solutions
- **Provide application portability across diverse systems from many vendors**
 - HPC servers, desktop systems and handheld devices
- **Rapid market deployment**
 - OpenCL 1.0 designed to run on current generations of GPU hardware for fast roll-out
 - THEN expand specification to inspire future silicon capabilities

OpenCL Working Group

- **Diverse industry participation**
 - Processor vendors, system OEMs, middleware vendors, application developers
- **Many industry-leading experts involved in OpenCL's design**
 - A healthy diversity of industry perspectives
- **Apple made initial proposal and is very active in the working group**
 - Serving as specification editor



OpenCL 1.0 Embedded Profile

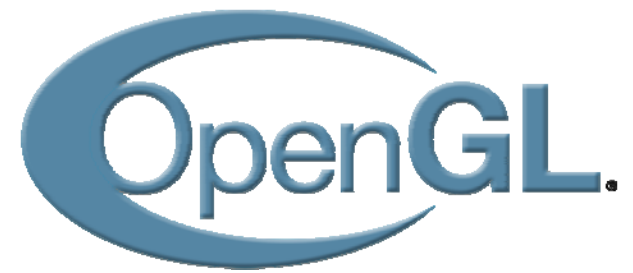
- **Will enable OpenCL on mobile and embedded silicon**
 - Relaxes some data type and precision requirements
 - Avoids the need for a separate “ES” specification
- **Khronos mobile API ecosystem defines mixed compute, imaging/graphics**
 - Enabling advanced applications e.g. augmented reality
- **OpenCL will enable parallel computing in new market areas**
 - E.g. mobile phones, automotive, avionics



A GPS phone processes images to recognize buildings and landmarks and uses the internet to supply relevant data

OpenCL / OpenGL Interoperability

- **OpenCL can efficiently share resources with OpenGL**
 - Applications use the API that best fits their problem domain
- **Data is shared, not copied between the two APIs**
 - OpenCL objects are created from OpenGL objects
 - Textures, Buffer Objects and Renderbuffers
- **Applications can select compute device(s) to run OpenGL and OpenCL**
 - Efficient queuing of OpenCL and OpenGL commands into the hardware
 - Flexible scheduling and synchronization
 - Works on single GPU and multi-GPU systems



The Khronos API Ecosystem

Desktop 3D Ecosystem

COLLADA
3D Asset Interchange Format

OpenGL
Cross platform desktop 3D

Parallel computing and visualization in scientific and consumer applications



OpenCL

Hundreds of man years invested by industry experts in coordinated ecosystem

Streamlined APIs for mobile and embedded graphics, media and compute acceleration

OpenMAX
Streaming Media and Image Processing

OpenGL|ES
Embedded 3D

OpenVG
Vector 2D

OpenSL|ES
Enhanced Audio

EGL
Surface and synch abstraction

OpenCL - the center of an visual computing ecosystem with parallel computation, 3D, video, audio and image processing on desktop, embedded and mobile systems

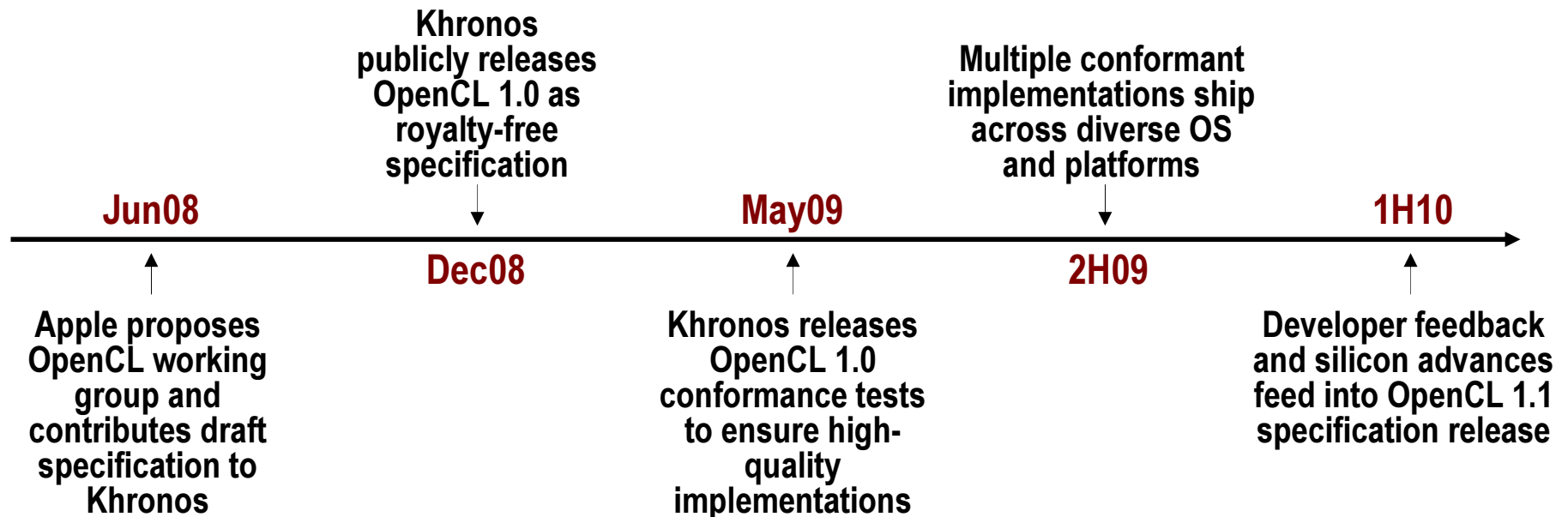
OpenKOGS
Integrated Mixed-media Stack

OpenKODE
Mobile OS Abstraction

Umbrella specifications define coherent acceleration stacks for mobile application portability

OpenCL Timeline

- **Six months from proposal to released OpenCL 1.0 specification**
 - Due to a strong initial proposal and a shared commercial incentive to work quickly
- **Apple's Mac OS X Snow Leopard will include OpenCL**
 - Improving speed and responsiveness for a wide spectrum of applications



Khronos OpenCL Resources

- OpenCL is 100% free for developers

- OpenCL Registry

- www.khronos.org/registry/cl/

- OpenCL Reference Card

- PDF version www.khronos.org/files/opencvl-quick-reference-card.pdf

- Pick up your physical copy today!

- Man pages coming soon!

- OpenCL Developer Forums

- www.khronos.org/message_boards/

- Give us your feedback!

- Implementer's Conformance Test Suite

- Exhaustive precision and functionality testing

- Full source access for small fee

- Peer review of results by OpenCL working group

- Passing implementations licensed to use the

- OpenCL trademark



The Industry Impact of OpenCL

- **For software developers**
 - Multi-vendor, royalty free API for portable parallel programming
 - Ecosystem foundation for a wider choice of parallel compute tools, libraries, middleware
- **For silicon vendors and OEMs**
 - Catalyze a wide range of software and tools to drive hardware demand
 - Exhaustive OpenCL Conformance Test Suite
- **.. and most importantly - end-users will benefit**
 - A wide range of innovative parallel computing applications
- **If this is relevant to your company please join Khronos and have a voice in OpenCL's evolution!**



OpenCL