James A. McCombe
San Francisco, California

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Objective: Develop meaningful technologies that require solving fundamental problems

Profile and Skills

- 20+ years of experience in technical leadership, system architecture and hands-on engineering
- Algorithm design, performance optimisation and debugging from application to hardware level
- Development of sophisticated models for complex hardware and algorithms
- Experience with imaging sensors, camera ISP and calibration
- Intimate understanding of ray tracing and rasterised graphics
- Enjoy team building, mentoring and learning new skills and technologies
- Presentation skills: Apple's WWDC, GDC, SIGGRAPH, Talks@Google and investor presentations
- Extensive GPGPU development experience, including CUDA and OPENCL
- Experience implementing and using OPENGL(ES) and GLSL
- Fluent in C, C++, OBJECTIVE C
- Experience with revision control systems: GIT, PERFORCE, CVS
- Working knowledge of analysis and visualisation tools: TABLEAU, EXCEL, GNUPLOT, GRAPHVIZ
- Hardware bring-up experience: EARLY SILICON, FPGA, JTAG, power measurement
- Hobbyist experience with ARDUINO / ATMEL AVR
- Other skills include: Car engine design, TIG welding, piano performance, basic fabrication

Work Experience

Distinguished Engineer   2022 – Present
Apple – Cupertino, California

- Bridging software and hardware architecture for VPG with focus on graphics, imaging, displays and power efficiency

CTO + Co-Founder   2014 – 2022
ViewMagic – San Francisco + Berlin

- Led the development of a fully real-time 6DOF (Degree-of-Freedom) streaming video system enabling immersive content for AR/VR and solving the eye-contact problem in video calling with 2D displays by allowing the camera to be virtually moved behind the display
- Built and worked with tiny team of some of the best engineers in the world
- Implemented the algorithms to compute UHD resolution per-pixel depth probability distributions in real-time using the GPU
- Implemented automated DFM (Design for Manufacturing) camera calibration process to measure camera optical properties and spatial alignment with sub-pixel accuracy at 4K resolution
- Implemented high performance multi-camera ISP in software on the GPU

Director of PowerVR Ray Tracing   2011 – 2014
Imagination Technologies – San Francisco + London

- Led transition of the start-up I founded, Caustic Graphics, Inc., into the acquiring company.
- Led integration efforts between the GPU architecture team at Imagination in England and the ray tracing team in San Francisco to merge the hardware designs, OpenGL ES API, firmware and drivers. The PowerVR GPU was in use within the iPhone and iPad along with many other tablet and smartphones in the industry and thus backward compatibility was essential
- Mentored many engineers, helping them understand the ray tracing technology
- Personally developed the algorithmic model for the new hardware pipeline that performed streaming bottom-up 3D spatial acceleration structure assembly while keeping all intermediate BVH node shuffling within on-chip SRAM alongside the ray storage used for Caustic coherence gathering algorithm

Consultant Engineer   2010 – 2010
Broadcom Corporation – Sunnyvale, California

- Rescued a project involving optimizing 2D user-interface compositing performance on a forthcoming Broadcom SOC integrating the VideoCore 4 DSP architecture
- Developed "CompositionEngine" to bypass triangle rasterisation and perform tile-based texture blending in the 2D register file of a complex hardware DSP to minimise external bandwidth and hit 60FPS with low power consumption. Almost all developed directly in a specialised vector assembly language

CTO + Founder   2006 – 2011
Caustic Graphics – San Francisco, California

- Founded a company to bring cinema quality ray tracing to the mainstream
- Built a team of 30 individuals including many engineers in both software and hardware
- Co-invented several key algorithms to improve memory bandwidth and SIMD efficiency when processing scattered rays for real-time performance in consumer applications
- Led a team through API design and implementation of "OpenRL" and its publicly launched SDK, a proposed industry standard graphics API for ray tracing. Managed complex trade-offs between diverse rendering algorithm needs, necessary constraints to maximise hardware efficiency and enabling GPU and CPU implementations
- Personally developed the algorithmic models for coherence gathering thread scheduler
- Deployed algorithms in both 90nm ASIC @ 350Mhz and FPGA form

Mobile 3D Graphics Architect   2004 – 2006
Apple – Cupertino, California

- Implemented a high performance OpenGL ES tile-based software renderer for the Broadcom VideoCore II DSP – a 150Mhz, 16bit integer, 16 wide SIMD vector chip originally designed for MPEG decoding
- The result was an energy efficient OpenGL ES software stack with fill rates exceeding 80Mpixels/second
- This enabled the graphics and mobile gaming on the 5th generation iPod Video and the upper level OpenGL stack was used on the iPhone

Senior 3D Graphics Engineer
2001 – 2004

Apple – Cupertino, California

- Implemented the OpenGL software renderer for Mac OS X including complete support for GLSL which was used for final rendering in Final Cut Pro and Motion before the GPU hardware was capable
- Developed JIT shader compiler that stitched my hand written PowerPC/Altivec assembly code segments
- Developed OpenGL Shading Language specification and its earlier precursors as a member of the Khronos standards group, working with individuals at several graphics hardware companies
- Designed and implemented "ShaderBuilder", a tool to allow real-time shader development and debugging, which shipped with Mac OS X

Software Engineer
2000 – 2001

Firepad – Mountain View, California

- Designed and implemented a vector graphics engine and encoding scheme optimised for PalmOS devices
- This enabled street maps and 3D wireframes to be viewed in real-time on low cost mobile devices

Partner
1999 – 2000

Sinewave Computing – Belfast, Northern Ireland

- Developed "Dreadling", the world's first fully texture mapped, multi-level grayscale 3D game for the Palm Pilot, featured in the New York Times
- Developed "Vexed", a popular puzzle game for PalmOS, now an open-source project on many platforms

Programmer
1997 – 1998

TGM Computer Systems – Hillsborough, Northern Ireland

- Developed "Kingswood Sheep", a Windows GUI based pedigree sheep farm management program, written in Borland Delphi with SQL database links

Other Side Projects

Motorcycle Road Trip Computer – An Arduino-based trip computer integrating I^{2}C MEMS compass, lean-angle display, altimeter and thermometer all presented with fluid 60Hz graphics using a dot-matrix vacuum fluorescent display

Tsunami – A tool to introduce software developers to VCD-based hardware waveform debugging tools to help isolate difficult timing or multithreading bugs and optimize performance

GLterminal – Award winning terminal emulator that simulates old CRT display anomalies and reduced baud rates. Implemented a high performance text rendering engine all running on the GPU.

iKaleid – Real-time kaleidoscope simulation screensaver using the GPU

4A-GE Turbo – Developed and hand crafted complete turbo charger and engine manage system to augment the famous Toyota 4A-GE within a Toyota MR2 MkI.

IP

40+ granted patents in the areas of parallel computation, hardware and computer graphics
5+ granted patents in the area of light-fields and immersive communication user-interfaces

Education

Methodist College Belfast   1993 – 2000
1 Malone Road, Belfast, Northern Ireland

A-levels in Pure Mathematics, Electronics and Computer Science

Pianoforte
Associated Board of the Royal Schools of Music

Grade 8, Hon.