



Green Multicore

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Overview

- Fabless semiconductor company founded in 2005
 - VC backed (completing C-round today @ 12:00)
 - Focus on computational imaging and video
- Uniquely positioned for this market with a software-programmable media processor with state-of-the-art GOPS/W performance
 - Enables SW derivatives of the base silicon platform
 - Current 65nm product in mass-production and expected to ship 1-3M qty in 2012
 - Next gen 28nm product in design will deliver the power of a desktop GPU in a 8x8mm BGA @ 350mW

Myriad of Applications



Mobile phones



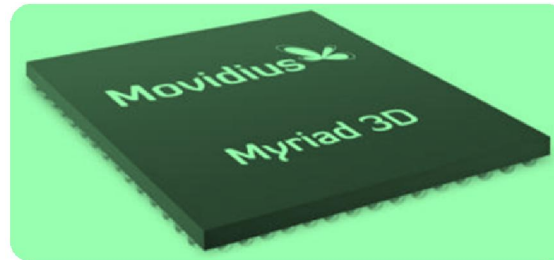
Consumer Electronics



Robotics



Video/DSC Cameras



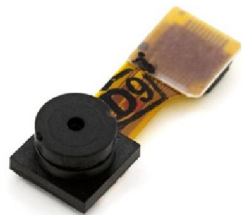
Computational Cameras



Automotive



Medical



Camera Modules



Wireless Cameras

Aerospace



HPC



Technology - Platform Approach



Applications

Software Modules

Silicon Platform

Foundation Technology

Products



3D Capture



3D Video



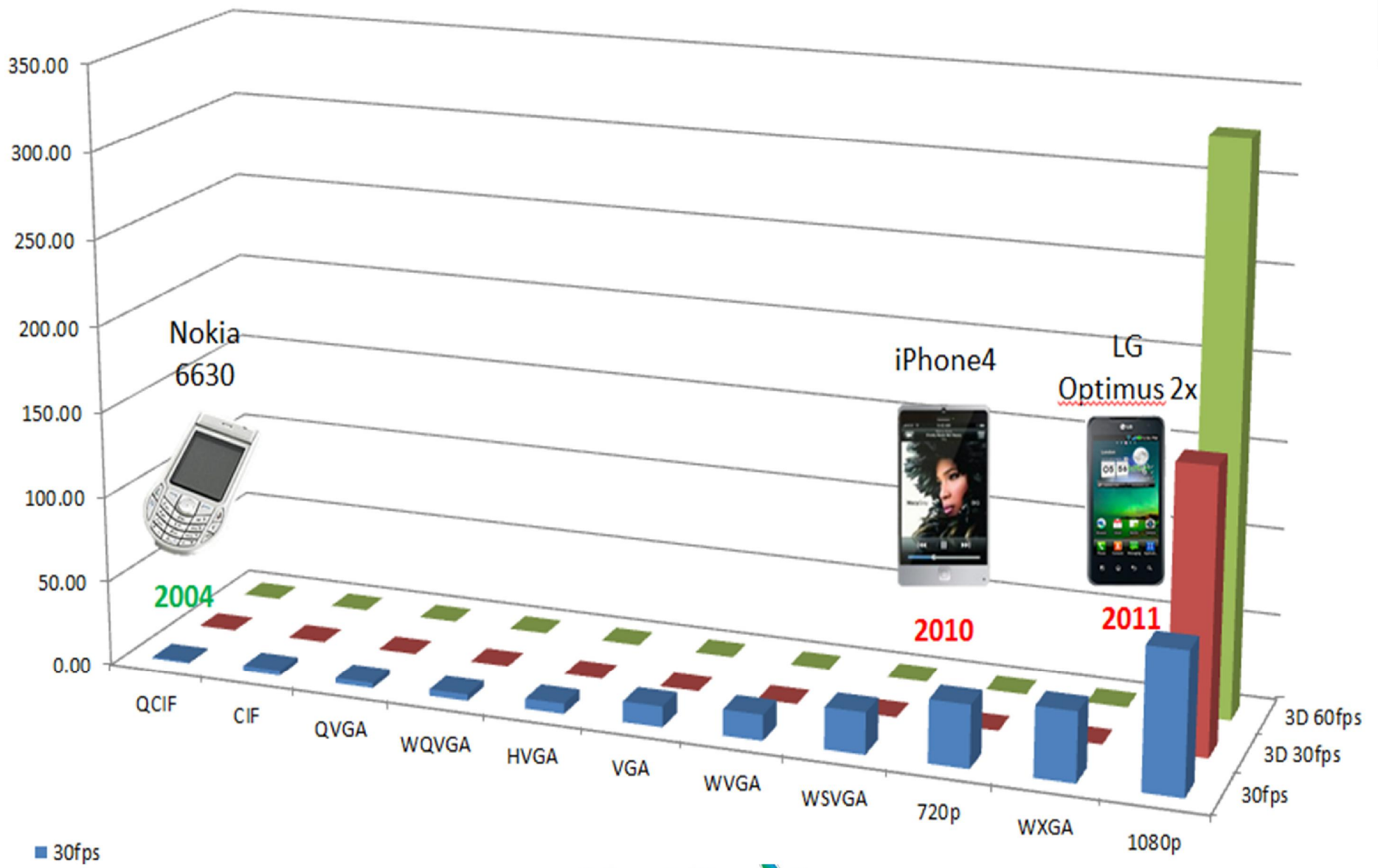
Video Edit



Anaglyph-3D

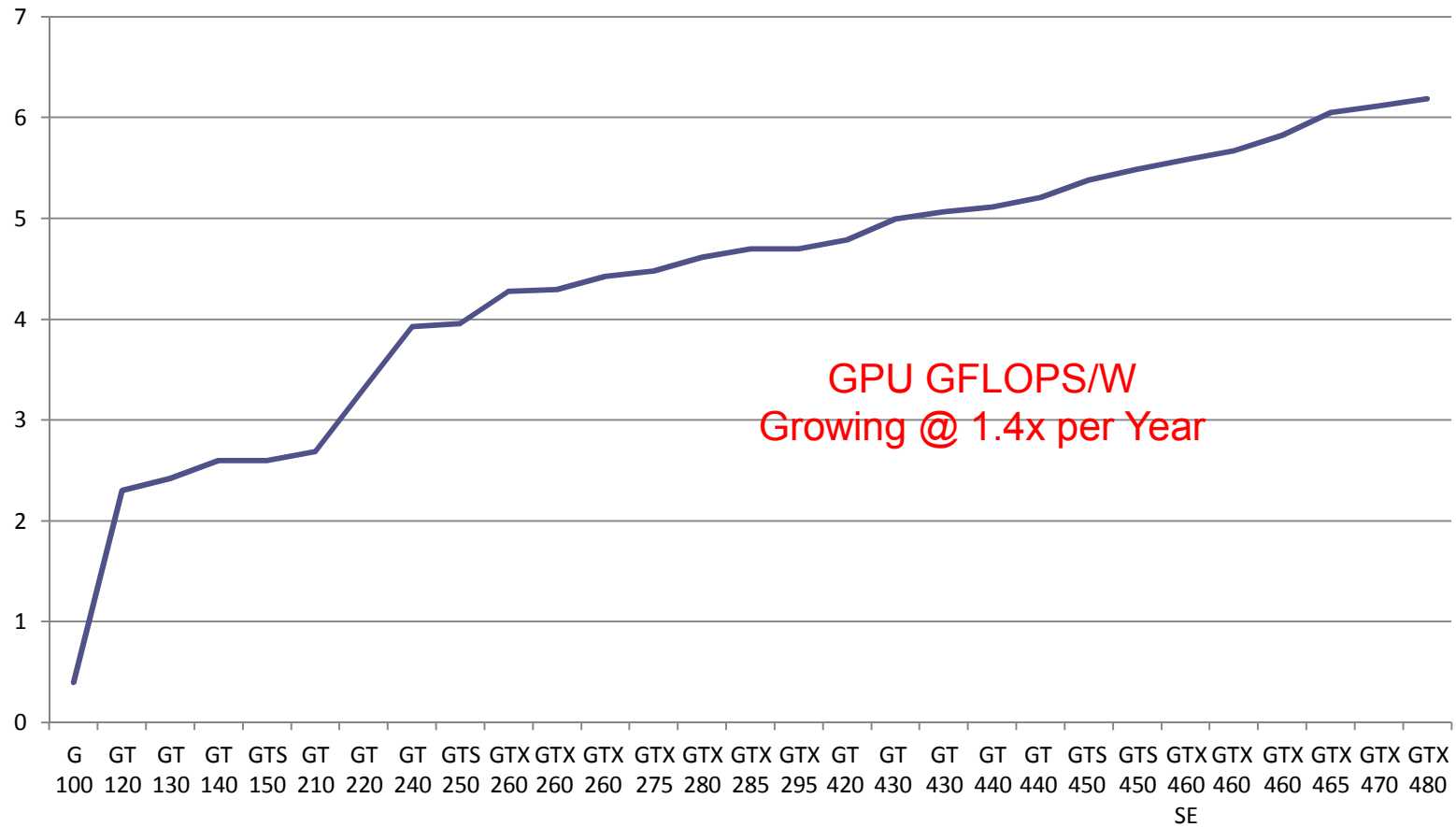


Mobile Video Processing Workload



GPU FLOPS/W Trend

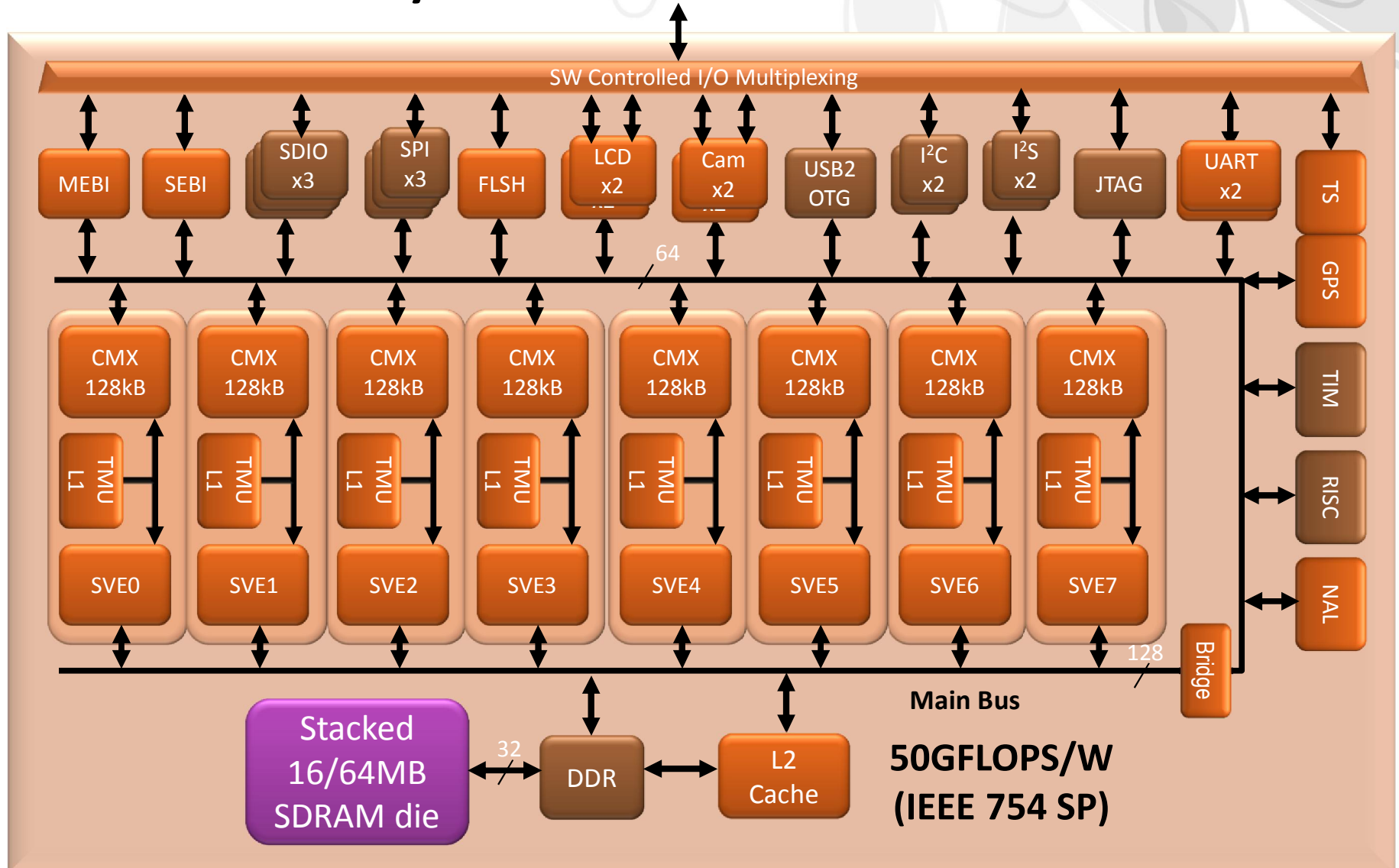
GPU GFLOPS/W Historical Trend



Movidius SHAVE Processor

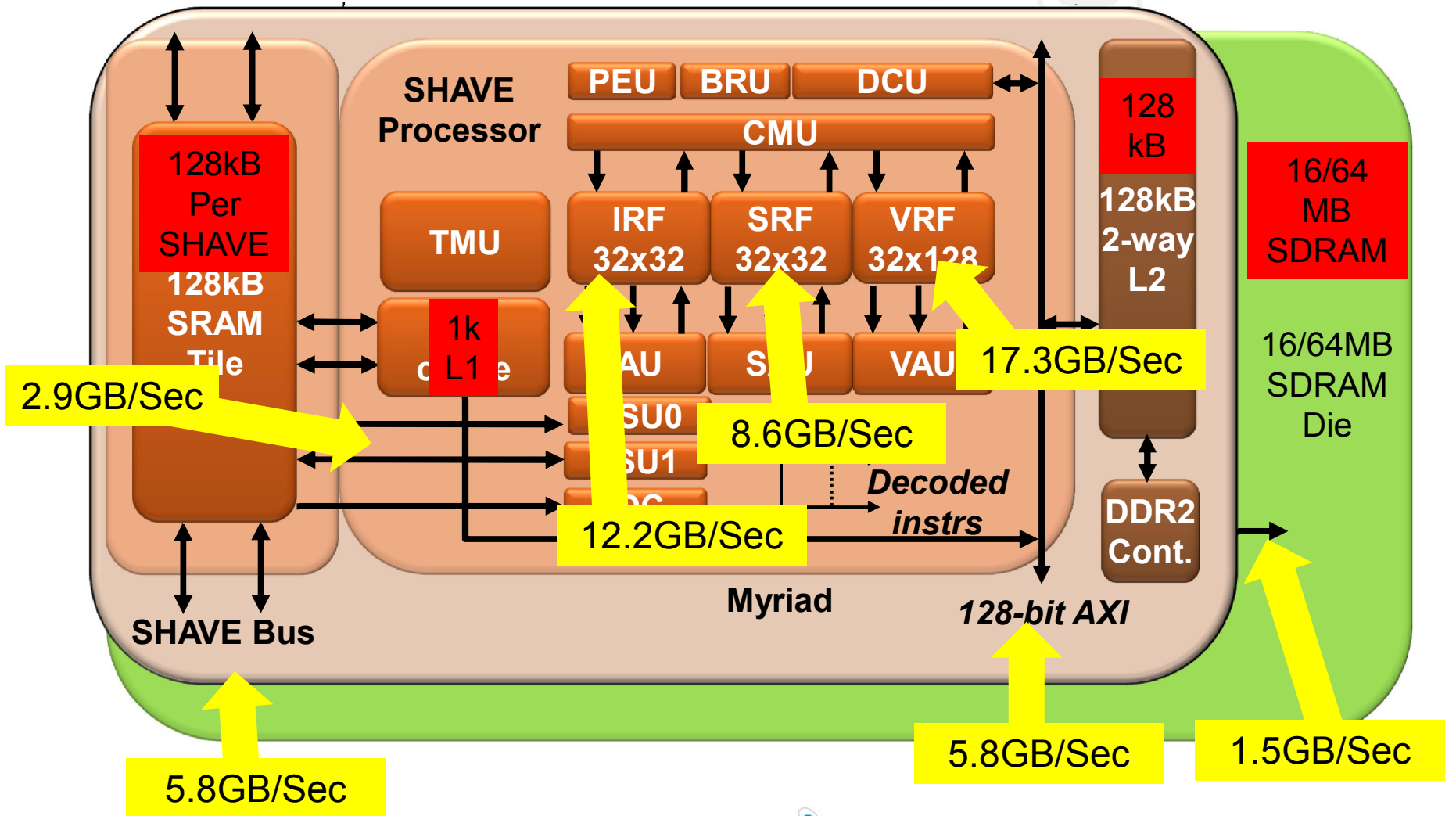
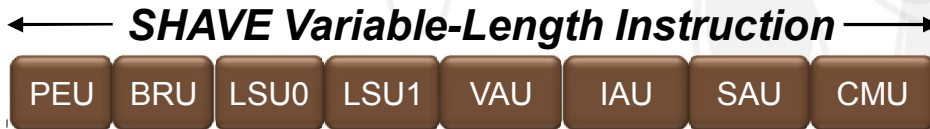
- Unique proprietary architecture
 - **Tailored to streaming workloads and architected for outstanding OPS/mW/\$ performance**
- **Steaming Hybrid Architecture Vector Engine
 - Hybrid of RISC, DSP, VLIW & GPU architectural features
 - 128-bit vector arithmetic: 8/16/32-bit INT & fp16/fp32**
- Excellent Graphics and matrix mathematics support
 - HW texture unit for good graphics performance
 - Predicated execution to eliminate branches
 - Compiler-friendly architecture
 - HW support for compressed data-structures (ex. matrices)

Myriad Silicon Platform

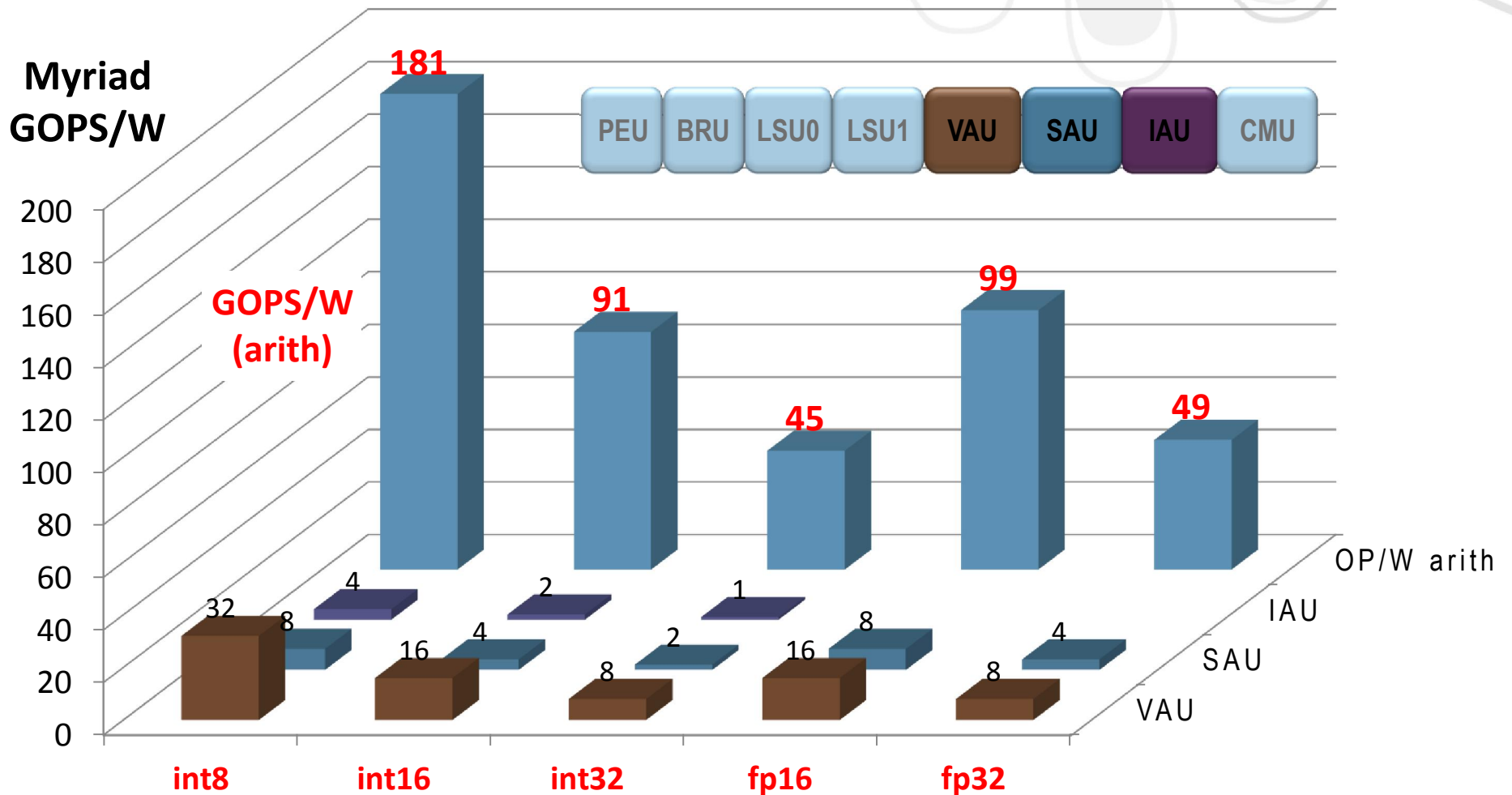


65nm Myriad SoC

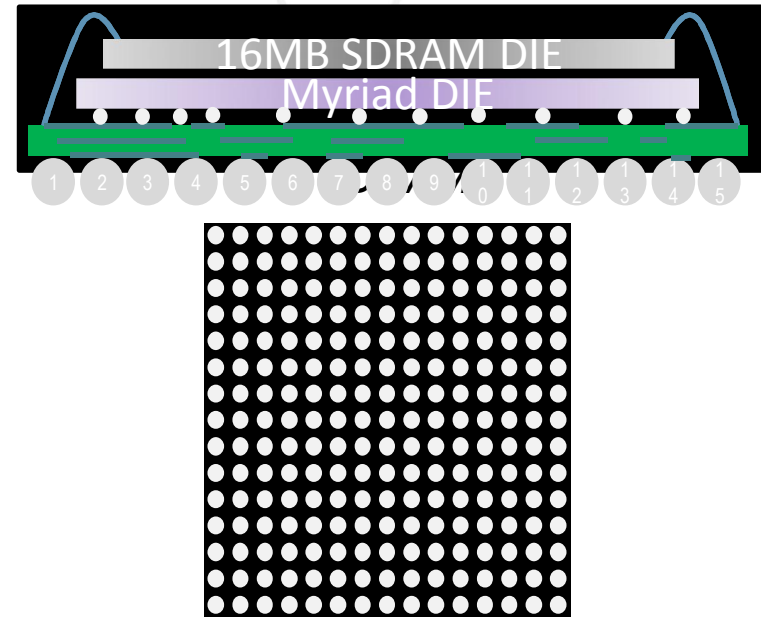
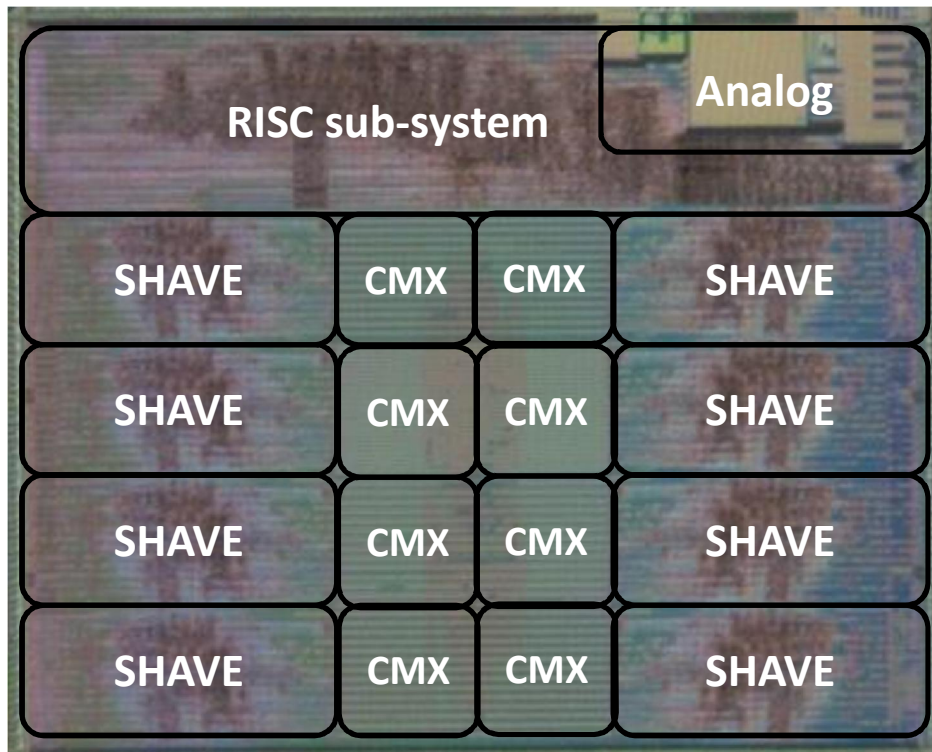
180MHz



Myriad GOPS/Watt (Arithmetic)



Myriad 65nm CMOS LP Die



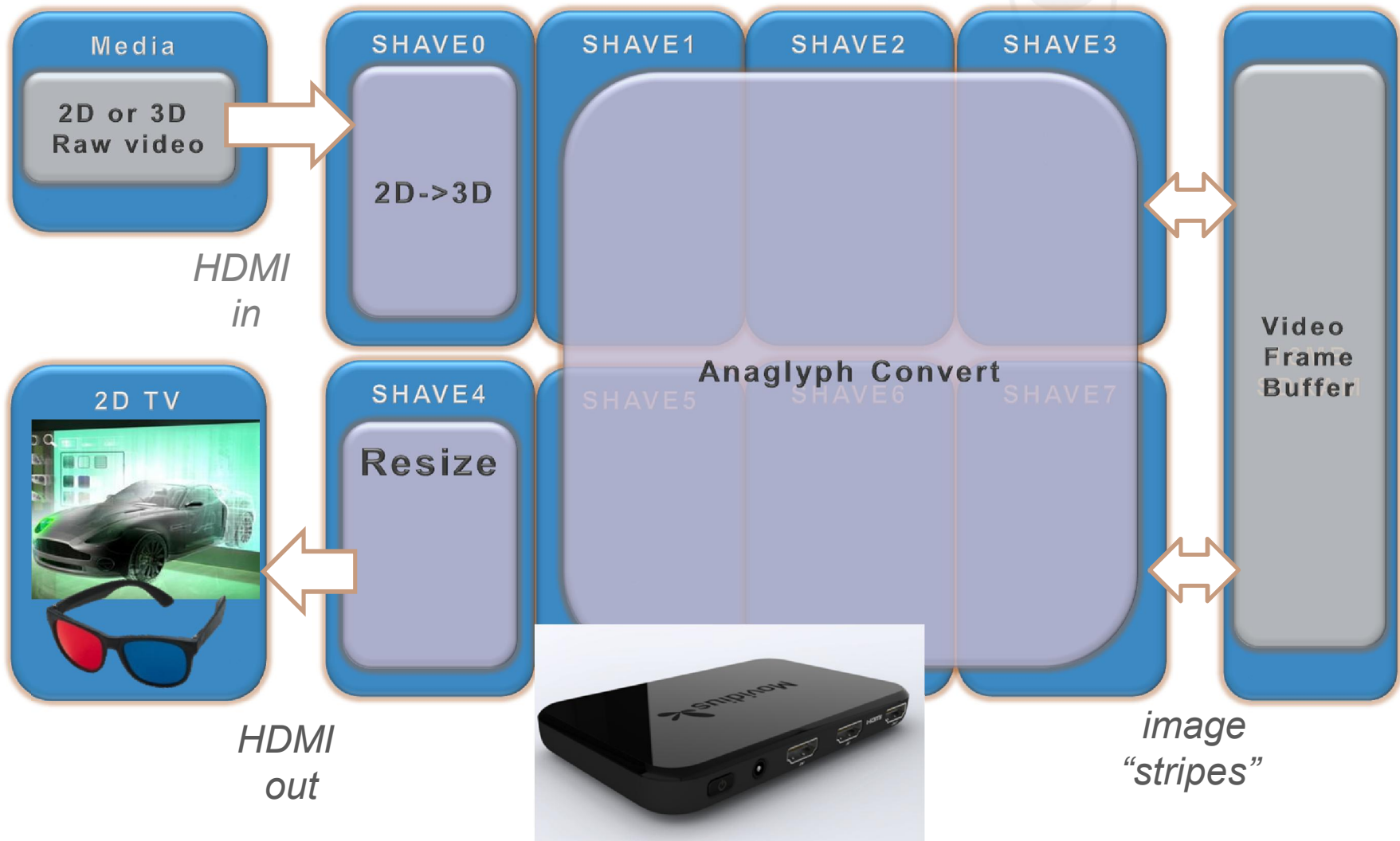
	Author	Year	FLOPS/core	Cores	GFLOPS	W	GFLOPS/W
Myriad	Movidius	2011	12	8	17.28	0.35	49.4
(1	KAIST	2011			5.8	0.28	21.1
(2	Intel	2007		80	1000	98.00	10.2
(4	Adapteva	2010	2	16	24.96	1.00	25.0



*Now I've got a
Green Compute Platform*

What can I do with it?

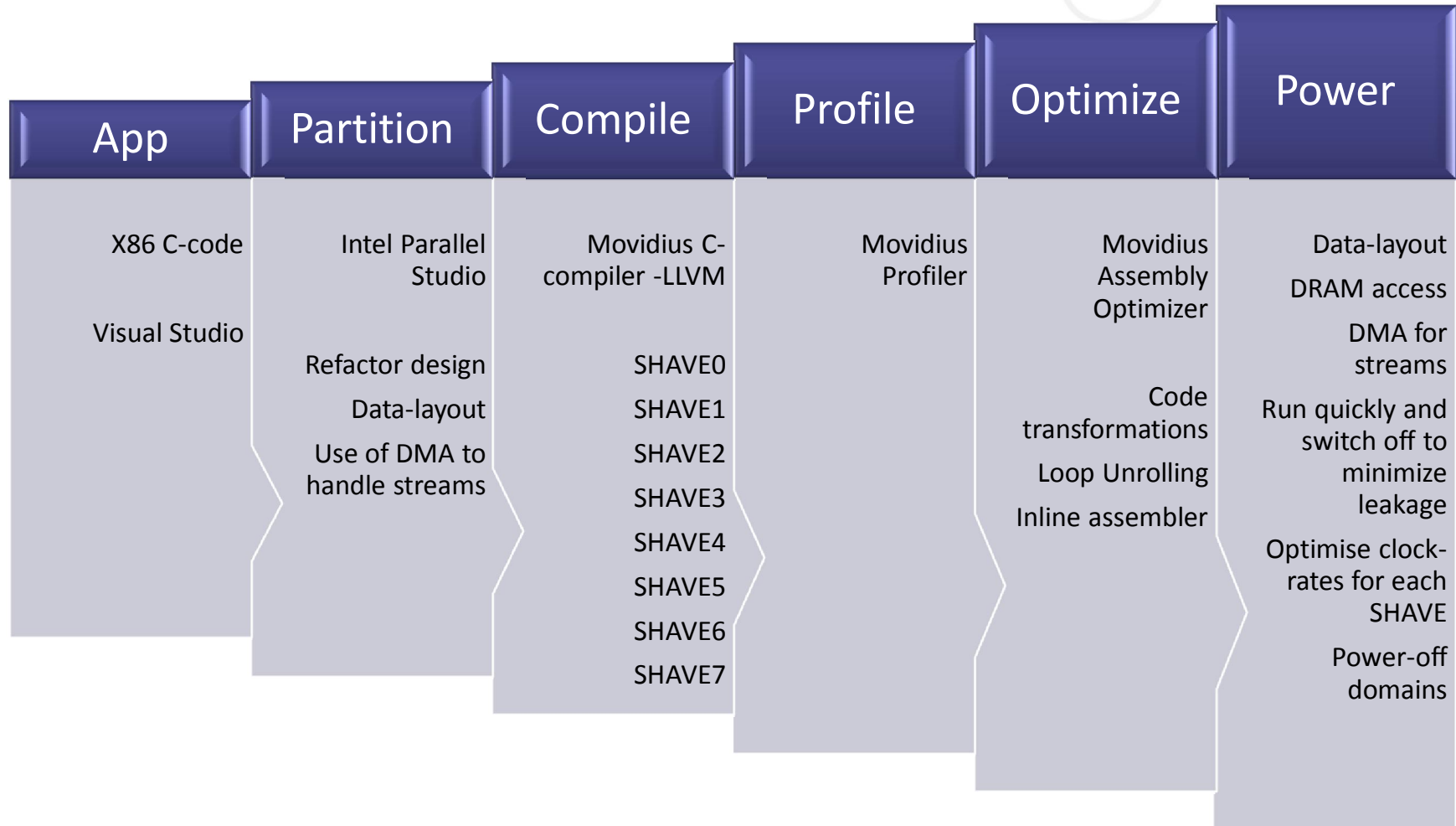
MA1135 - 3D Converter Box Application



Myriad Example Applications

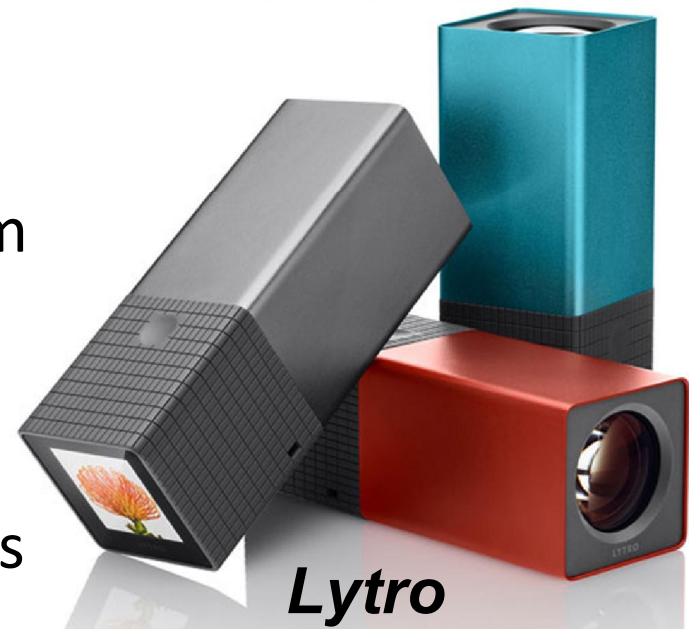


Application Development

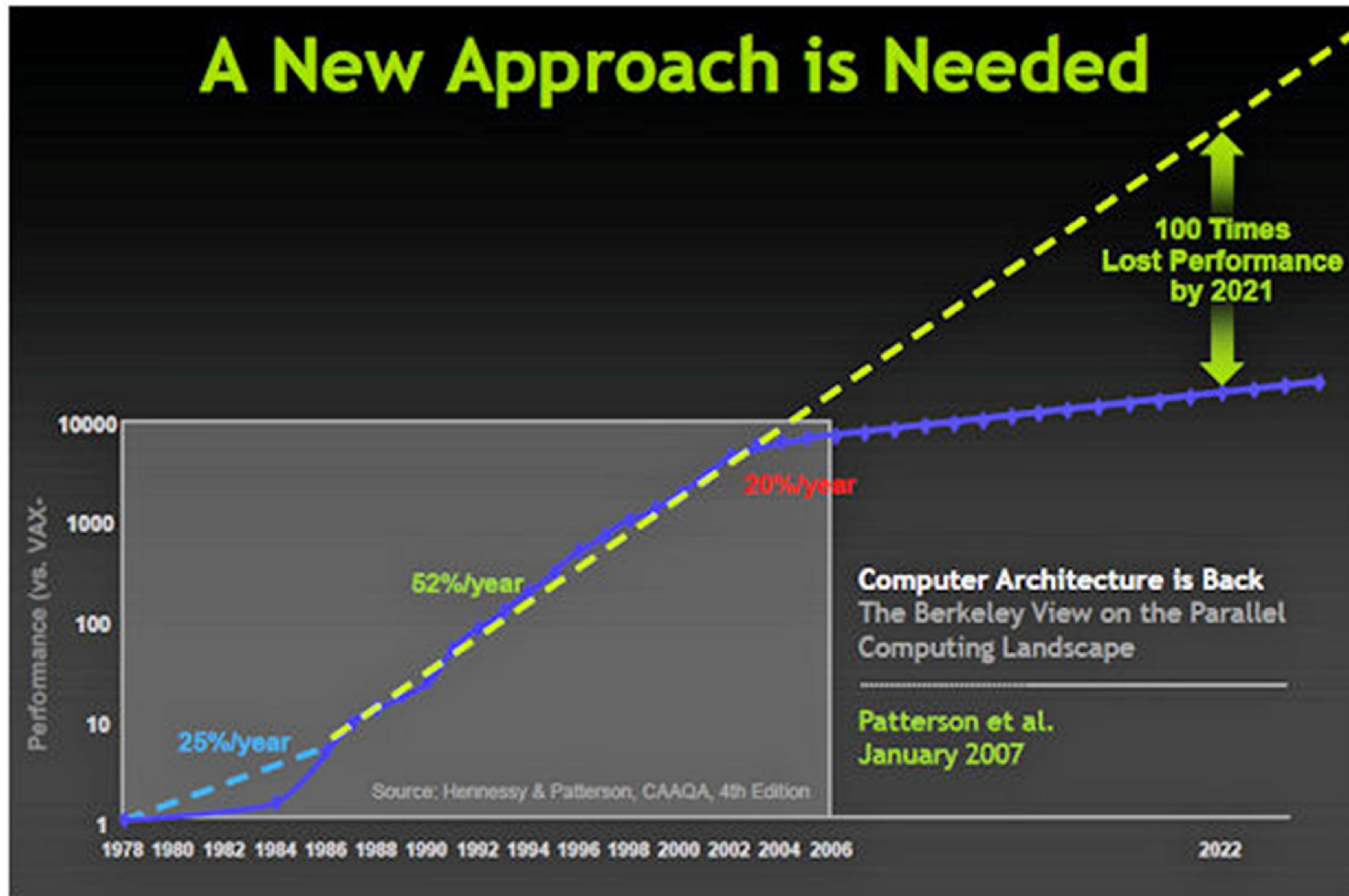


Lightfield Requirements

- Replaces glass with SW
 - CUDA implementation of Giorgiev (Adobe) LF algorithm
 - Very computationally expensive
 - Interpolation key kernel
 - Geforce GT120 at 130 GFLOPs and 50W (2.6GFLOPs/W)
 - http://en.wikipedia.org/wiki/Geforce_100_Series
 - GPU completes refocusing in 30ms (33.3fps)
 - 4fps on Myriad 65nm



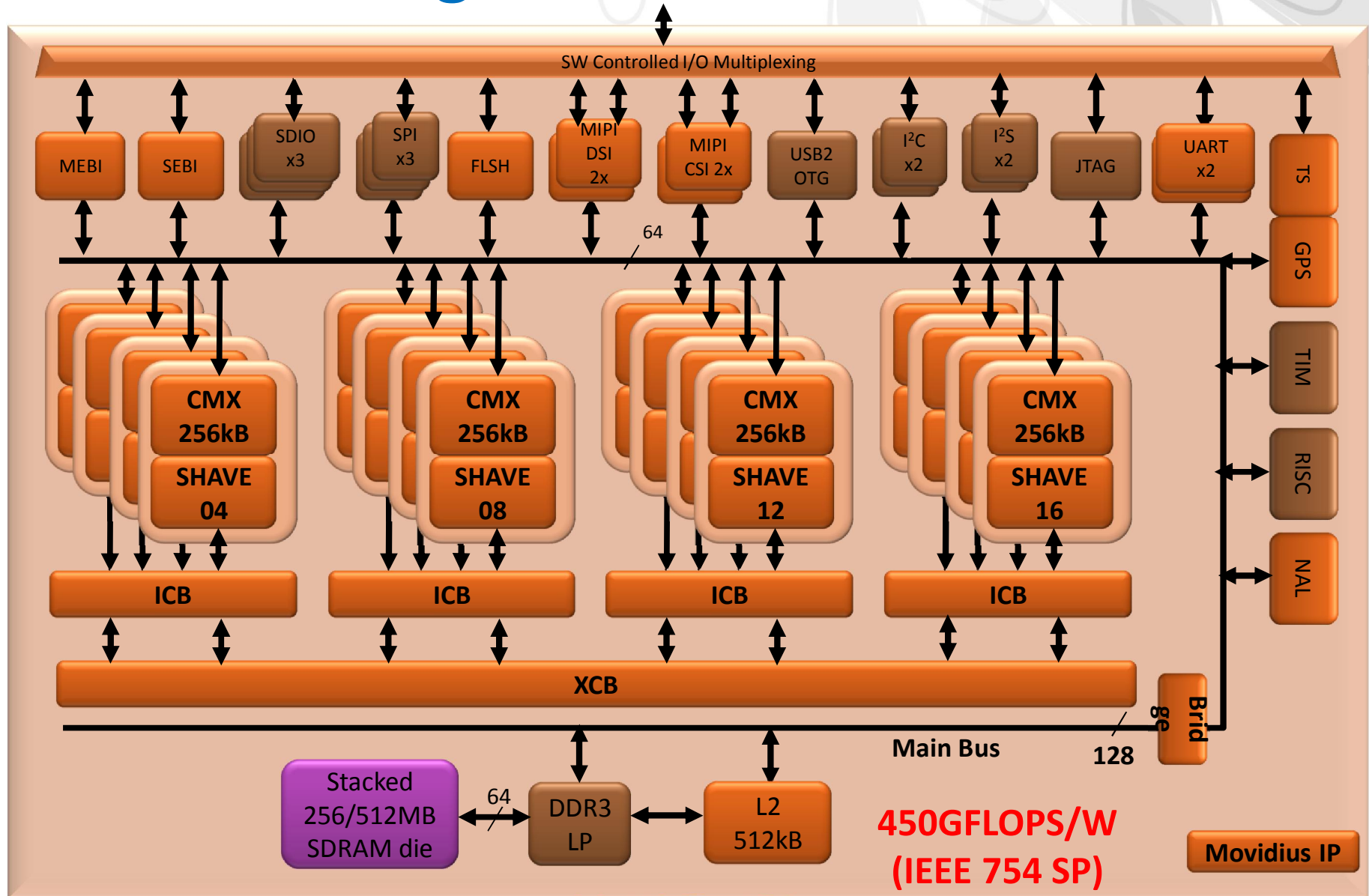
Performance Roadmap (Nvidia)



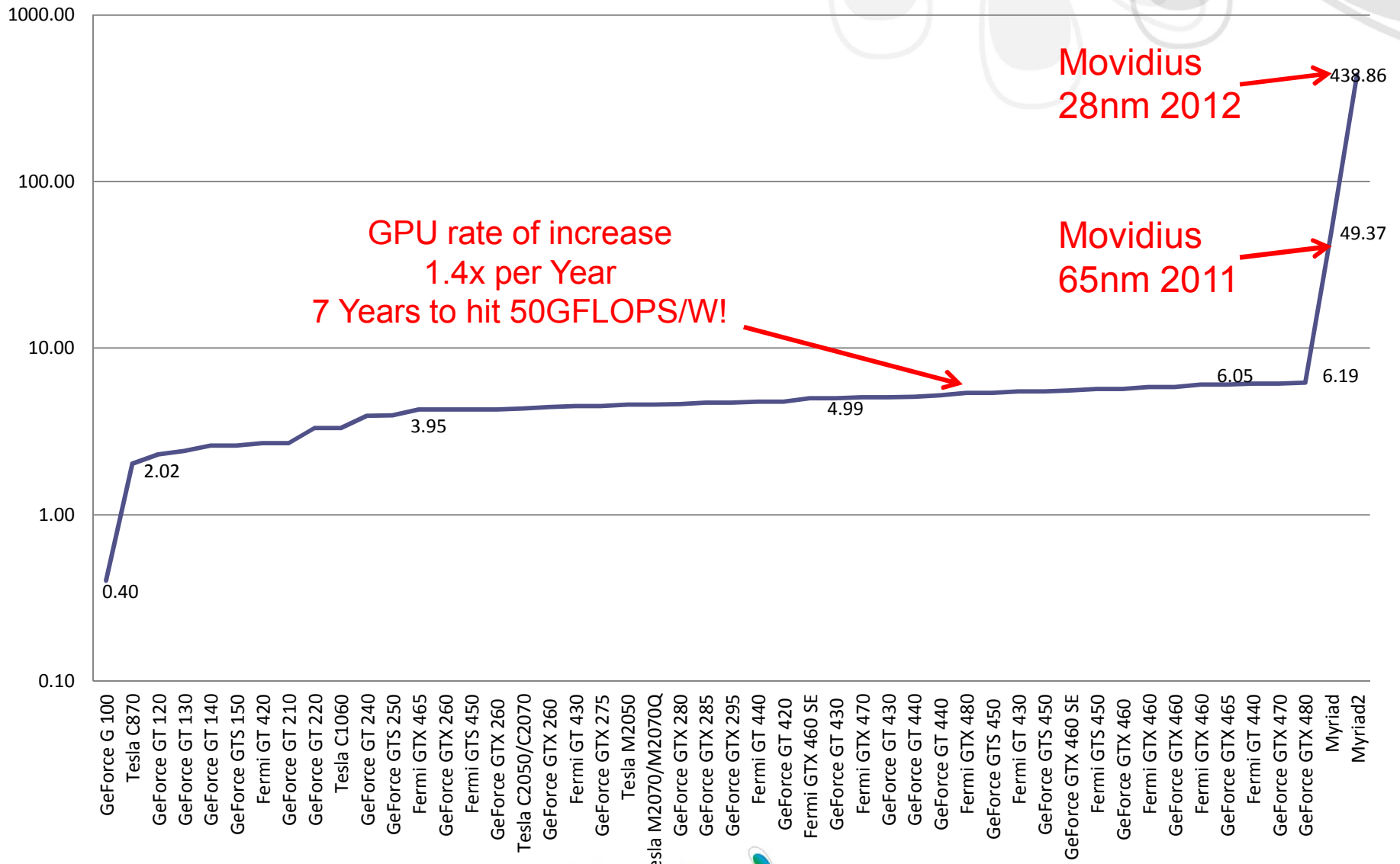
<http://bit.ly/t6zo2j>

Movidius 

Fragrak 28nm Platform



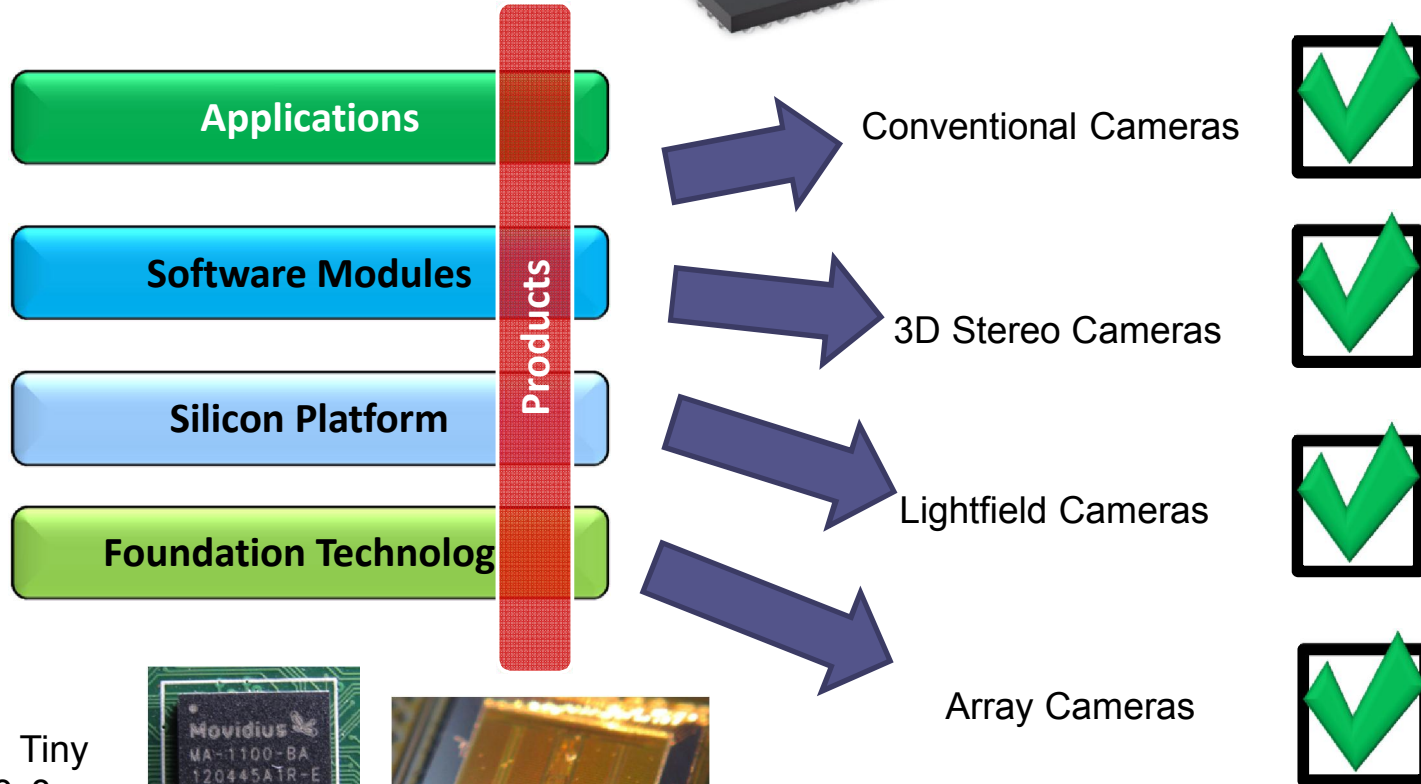
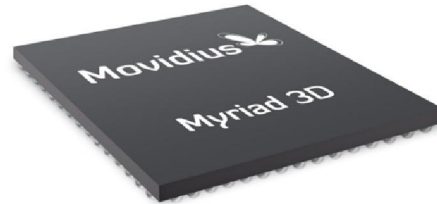
GFLOPS/W in Context



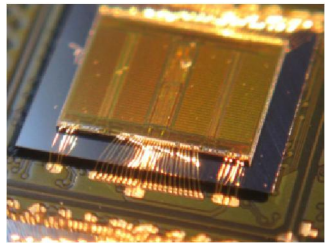
Myriad of Cameras – 1 Platform

- Standard camera
 - All optical focusing: bulky lenses & autofocus for close-ups
 - Wide aperture good for low-light but limits depth-of-field
 - Scale and cost due to established manufacturing processes
- Lightfield camera (Plenoptic = Lightfield)
 - Post-capture refocusing in software (Lytro)
 - Computationally expensive (GPU-based = cloud)
 - Decouples aperture from Depth of Field (DoF)
- Array Camera (Stereo is a 2x1 special case)
 - Uses array of MxN completely focused cameras
 - Composite & interpolate array of low-res cameras (Levoy)
 - Individual camera control allows: HDR capture, fault-tolerance, slow-motion, power-saving etc.

Movidius Computational Imaging



Tiny
8x8mm
Myriad
BGA



Summary

- Movidius 65nm silicon platform
 - Ground-breaking functionality in SW
 - Enabled by ground-breaking GFLOPS/W
 - Compact form-factor
 - In mass-production today
 - ***10x better GFLOPS/W than GPU***
- Next generation 28nm SoC
 - 9x perf/watt available in 2012
 - ***100x better GFLOPS/W than GPU***



Any questions?

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References

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- 2) S.Vangal, J.Howard, G.Ruhl, S.Dighe, H.Wilson, J.Tschanz, D.Finan, P.Iyer,A. Singh, T.Jacob, S.Jain, S.Venkataraman, Y.Hoskote and N.Borkar, "An 80-Tile 1.28TFLOPS Network-on-Chip in 65nm CMOS", Proc. ISSCC 2007, pp.5-7
- 3) A. Olofsson, R. Trogan, O. Raikhman, "A 25 GFLOPS/Watt Software Programmable Floating Point Accelerator", HPEC 2010, 15-16 Sep 2010
- 4) C.Y. Park, N.I. Cho, "A fast algorithm for the conversion of DCT coefficients to H.264 transform coefficients", ICIP 2005 Proceedings, pp.664-7