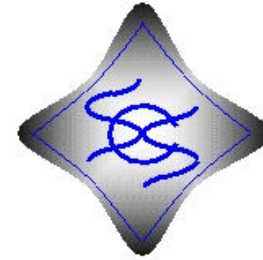




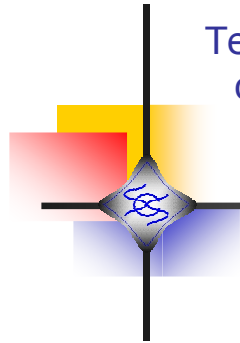
Technical University
of Iasi, Romania



Faculty of Electronics and
Telecommunications

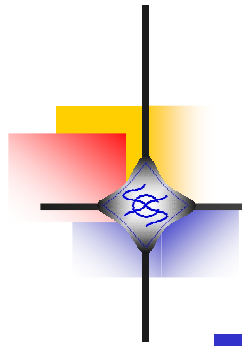


Signals, Circuits and
Systems laboratory



PROCESOARE GRAFICE PARALELE

Prof. Victor Grigoras



Cuprins

- Clasificare
- Arhitectura
- Progrese in implementarea blocurilor
- Performante

Clasificare Nvidia

Producatori: ATI, Nvidia
Tehnologii: Stream, CUDA
Generatii de procesoare Nvidia



400 Series

[GeForce GTX 480](#)
[GeForce GTX 470](#)

200 Series

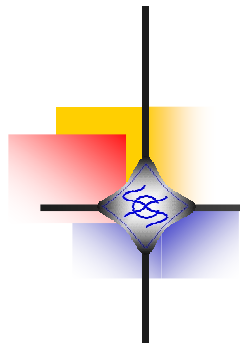
[GeForce GTX 295](#)
[GeForce GTX 285](#)
[GeForce GTX 285 for Mac](#)
[GeForce GTX 280](#)
[GeForce GTX 275](#)
[GeForce GTX 260](#)
[GeForce GTS 250](#)
[GeForce GT 240](#)
[GeForce GT 220](#)
[GeForce 210](#)

9 Series

[GeForce 9800 GX2](#)
[GeForce 9800 GTX+](#)
[GeForce 9800 GTX](#)
[GeForce 9800 GT](#)
[GeForce 9600 GT](#)
[GeForce 9600 GSO 512](#)
[GeForce 9600 GSO](#)
[GeForce 9500 GT](#)
[GeForce 9400 GT](#)
[GeForce 9400 mGPU](#)
[GeForce 9300 mGPU](#)

8 Series

[GeForce 8800 GTS](#)
[GeForce 8800 GT](#)
[GeForce 8600 GTS](#)
[GeForce 8600 GT](#)
[GeForce 8500 GT](#)
[GeForce 8400 GS](#)



Clasificare ATI

R700

Product Information

- ATI Radeon™ HD 5970
- ATI Radeon™ HD 5870
- ATI Radeon™ HD 5850
- ATI Radeon™ HD 5770
- ATI Radeon™ HD 5750
- ATI Radeon™ HD 5670

Enthusiast

- ATI Radeon™ HD 4870 X2
- ATI Radeon™ HD 4890

Performance

- ATI Radeon™ HD 4870
- ATI Radeon™ HD 4850
- ATI Radeon™ HD 4830
- ATI Radeon™ HD 4770

Mainstream

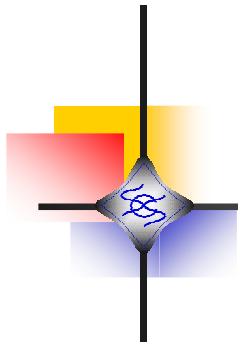
- ATI Radeon™ HD 4600

R600

Value

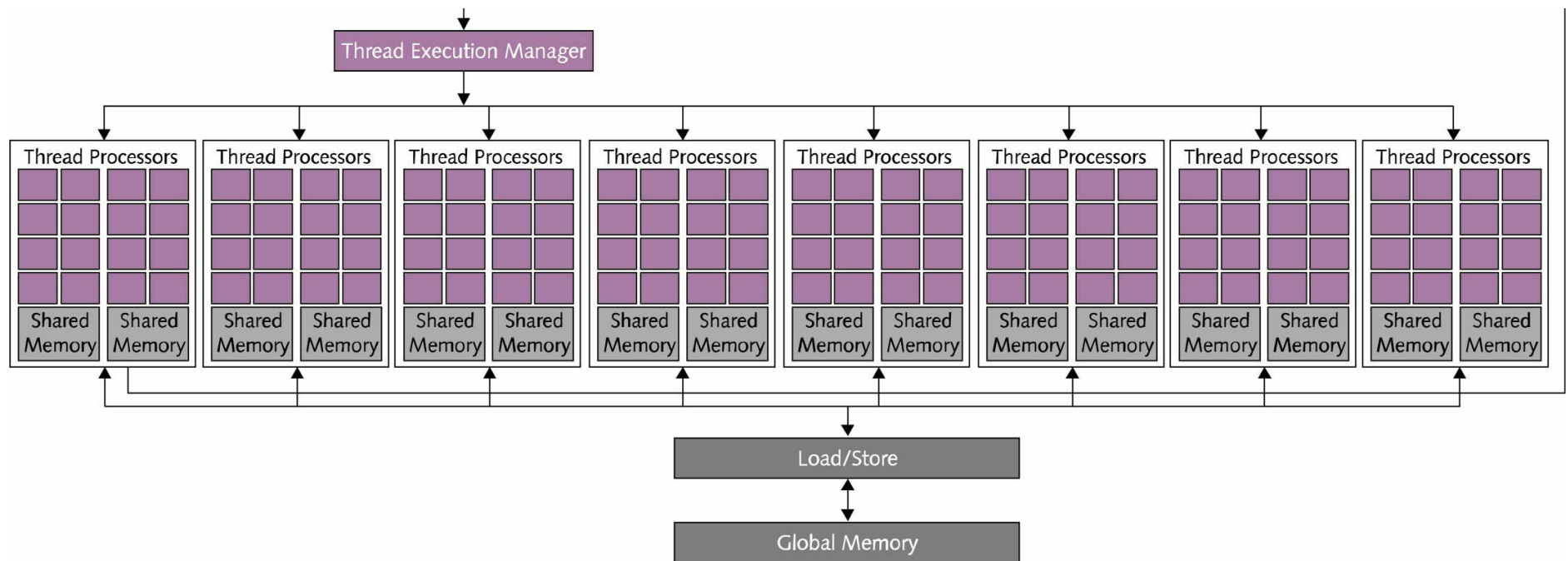
- ATI Radeon™ HD 4550
- ATI Radeon™ HD 4350



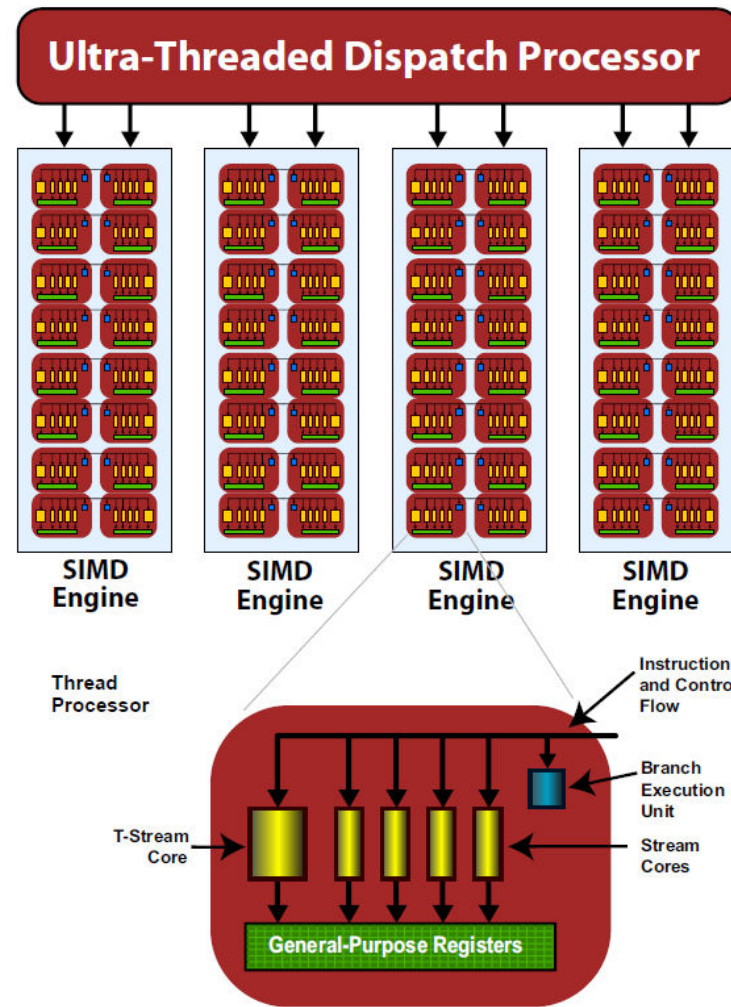


Arhitectura generala: Nvidia

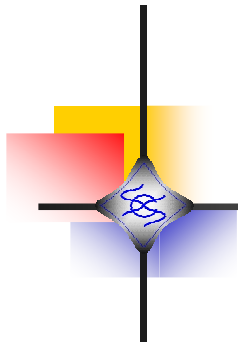
- Nvidia Fermi



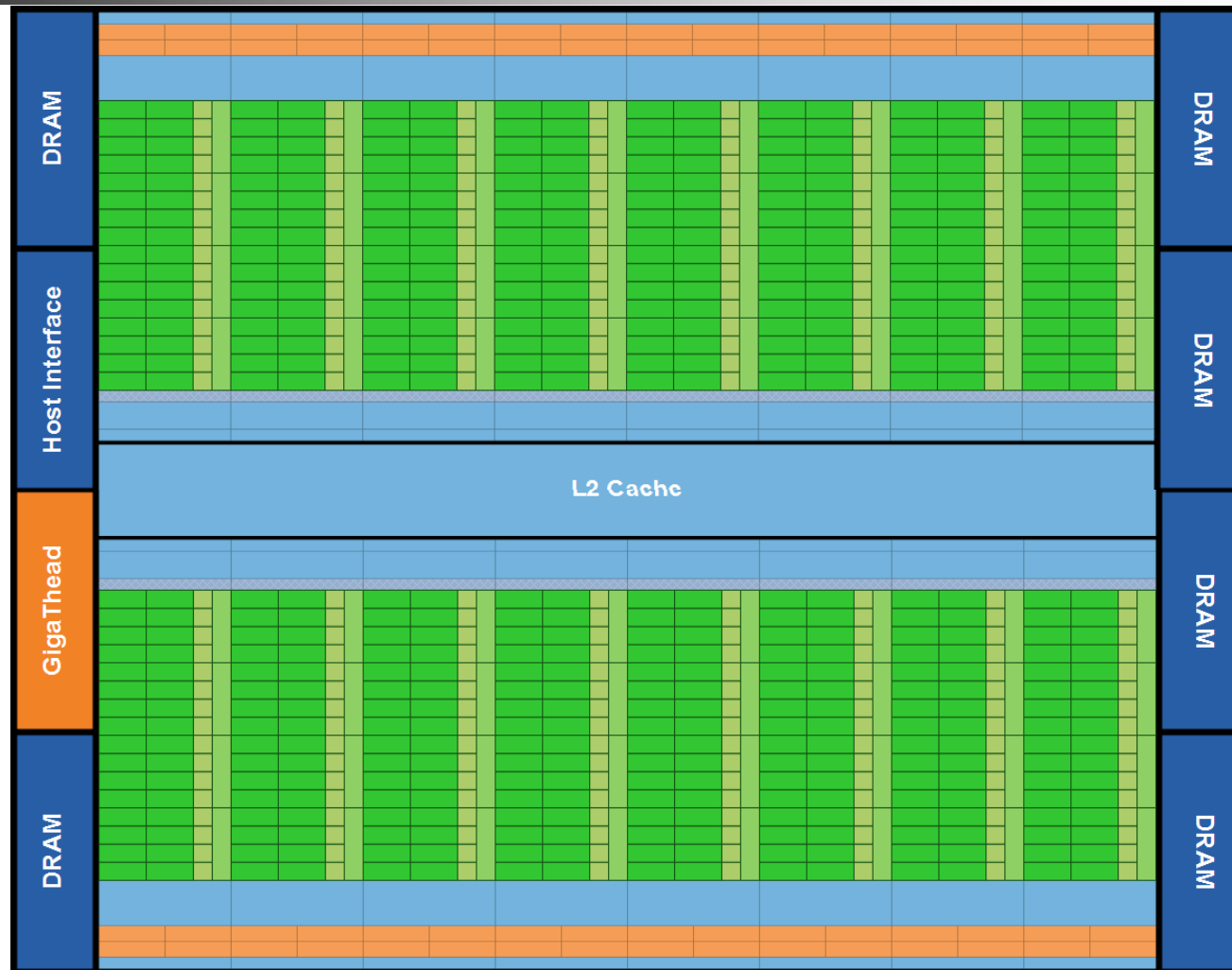
Arhitectura generala: ATI R700



PROCESOARE GRAFICE PARALELE



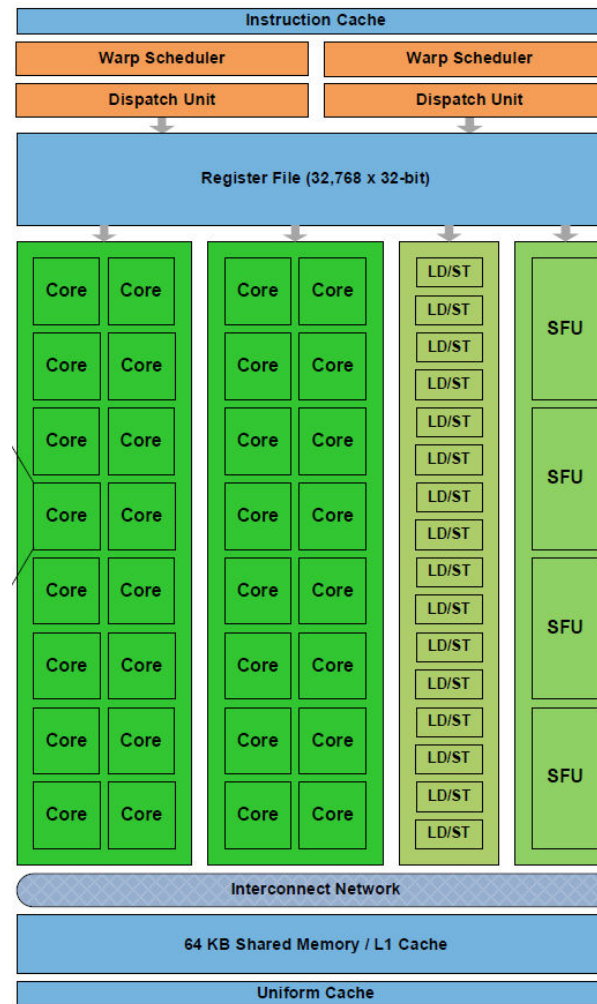
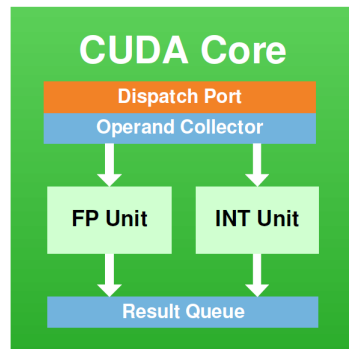
Layout Nvidia Fermi GT400



PROCESOARE GRAFICE PARALELE

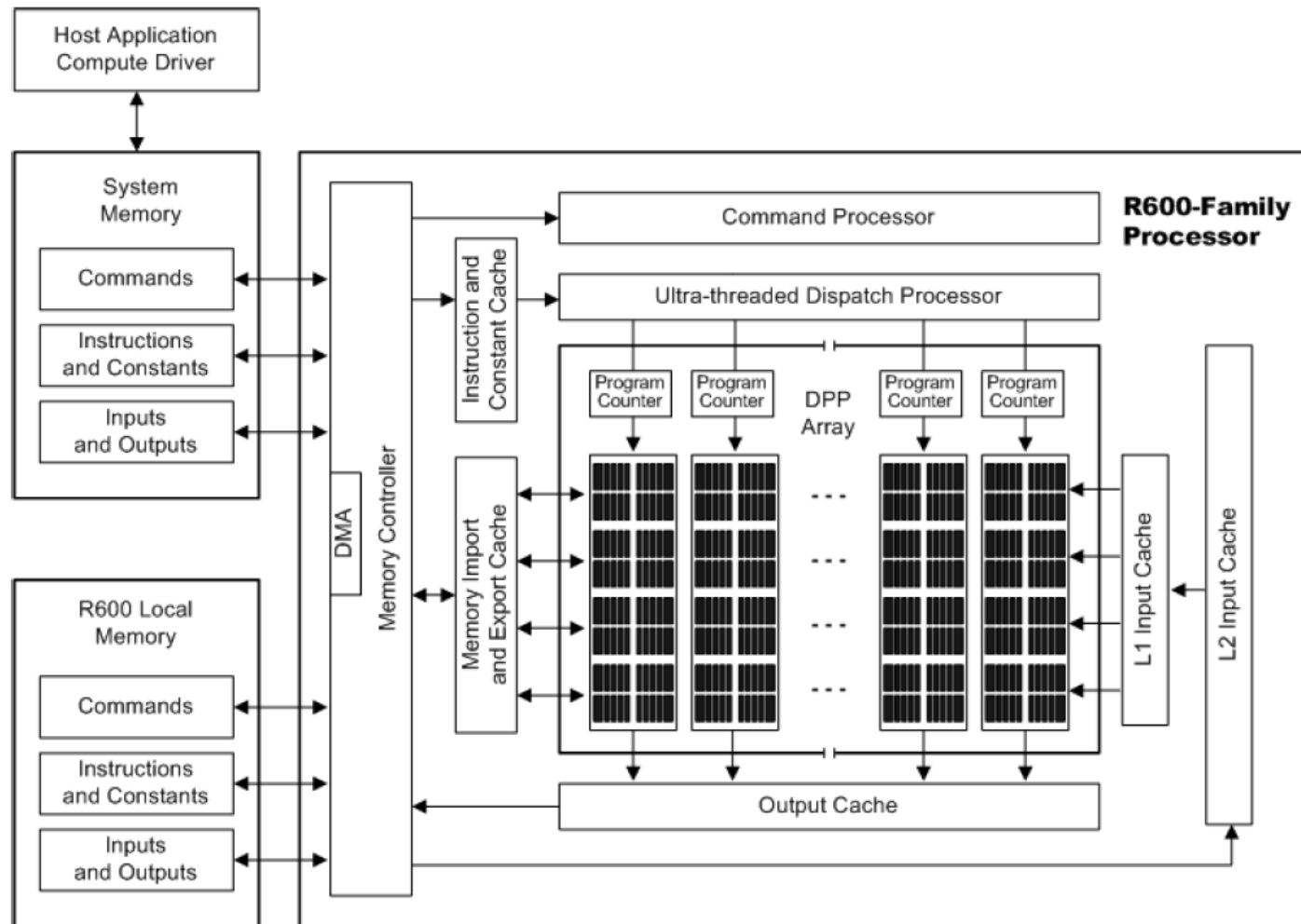
Architettura Streaming Multiprocessor (SM)

Nvidia Fermi



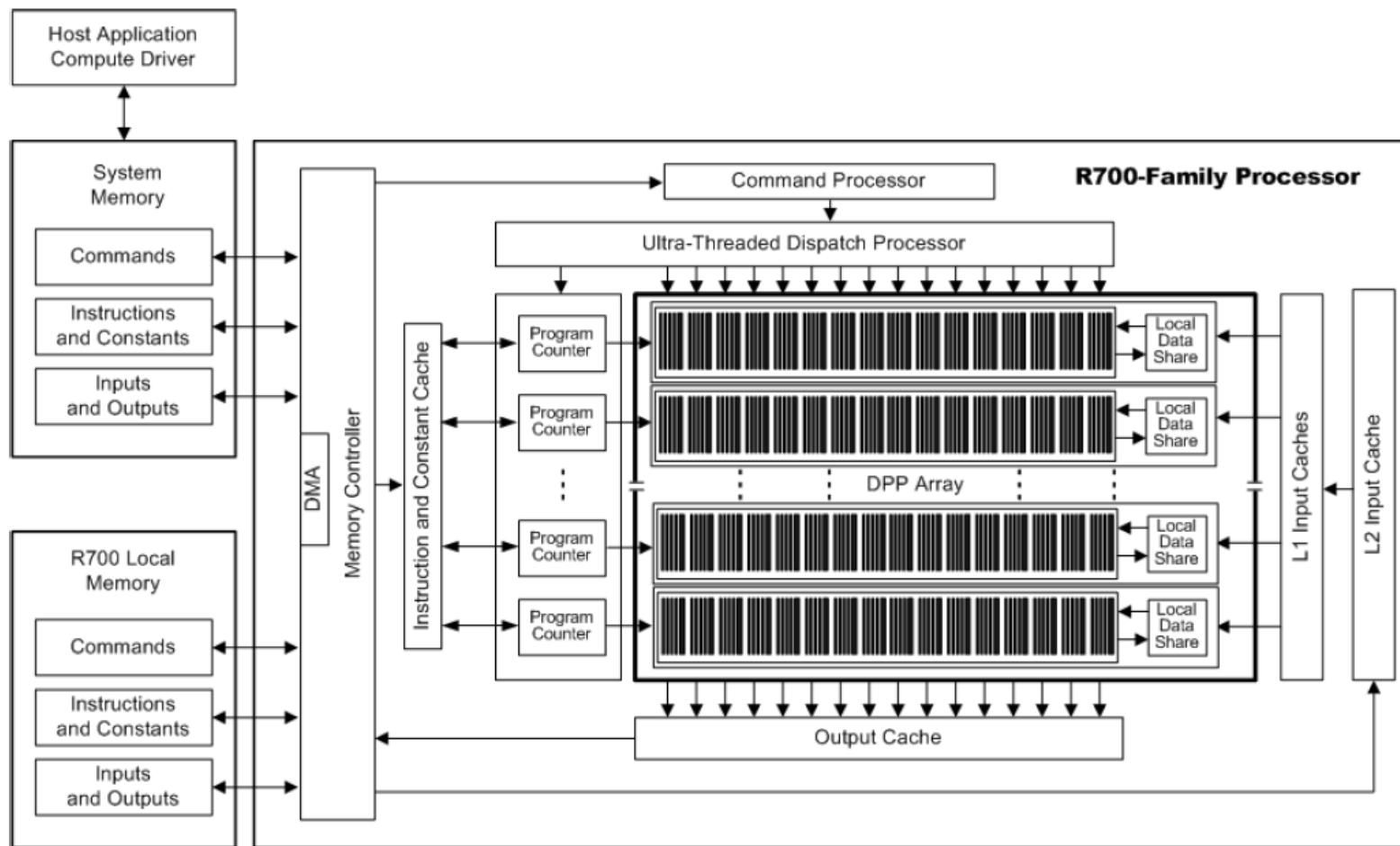
PROCESSORE GRAFICO PARALELO

Arhitectura unitatii SIMD ATI R600



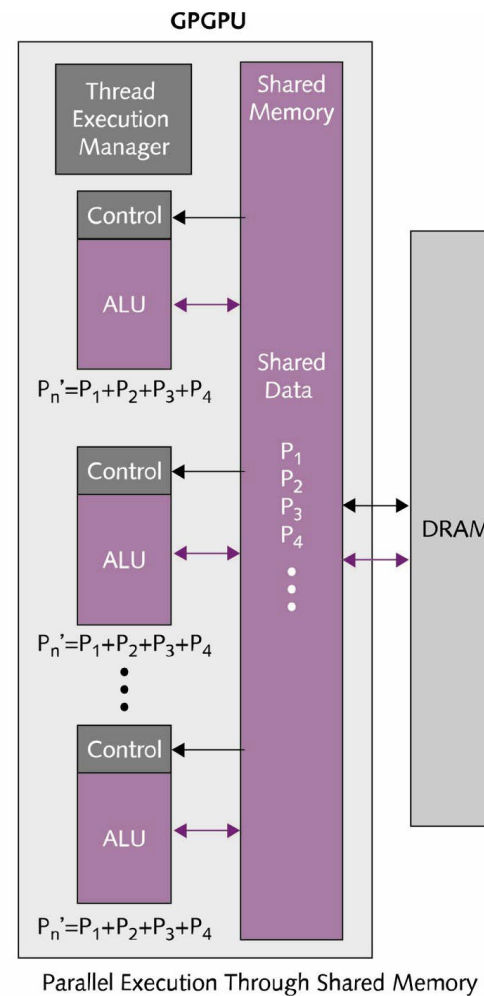
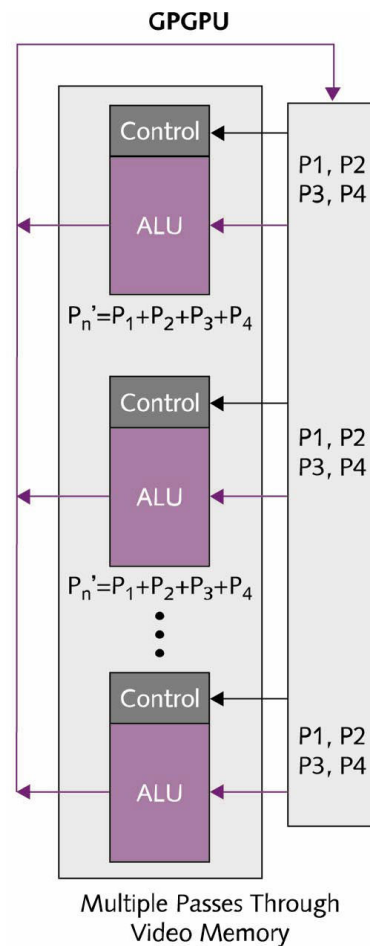
PROCESOARE GRAFICE PARALELE

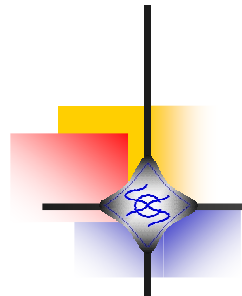
Arhitectura unitatii SIMD ATI R700



PROCESOARE GRAFICE PARALELE

Modalitati de utilizare Nvidia Fermi





Caratteristiche comparative Nvidia

GPU	G80	GT200	Fermi
Transistors	681 million	1.4 billion	3.0 billion
CUDA Cores	128	240	512
Double Precision Floating Point Capability	None	30 FMA ops / clock	256 FMA ops /clock
Single Precision Floating Point Capability	128 MAD ops/clock	240 MAD ops / clock	512 FMA ops /clock
Special Function Units (SFUs) / SM	2	2	4
Warp schedulers (per SM)	1	1	2
Shared Memory (per SM)	16 KB	16 KB	Configurable 48 KB or 16 KB
L1 Cache (per SM)	None	None	Configurable 16 KB or 48 KB
L2 Cache	None	None	768 KB
ECC Memory Support	No	No	Yes
Concurrent Kernels	No	No	Up to 16
Load/Store Address Width	32-bit	32-bit	64-bit



Evolutia metodelor de calcul MAC

Multiply-Add (MAD):

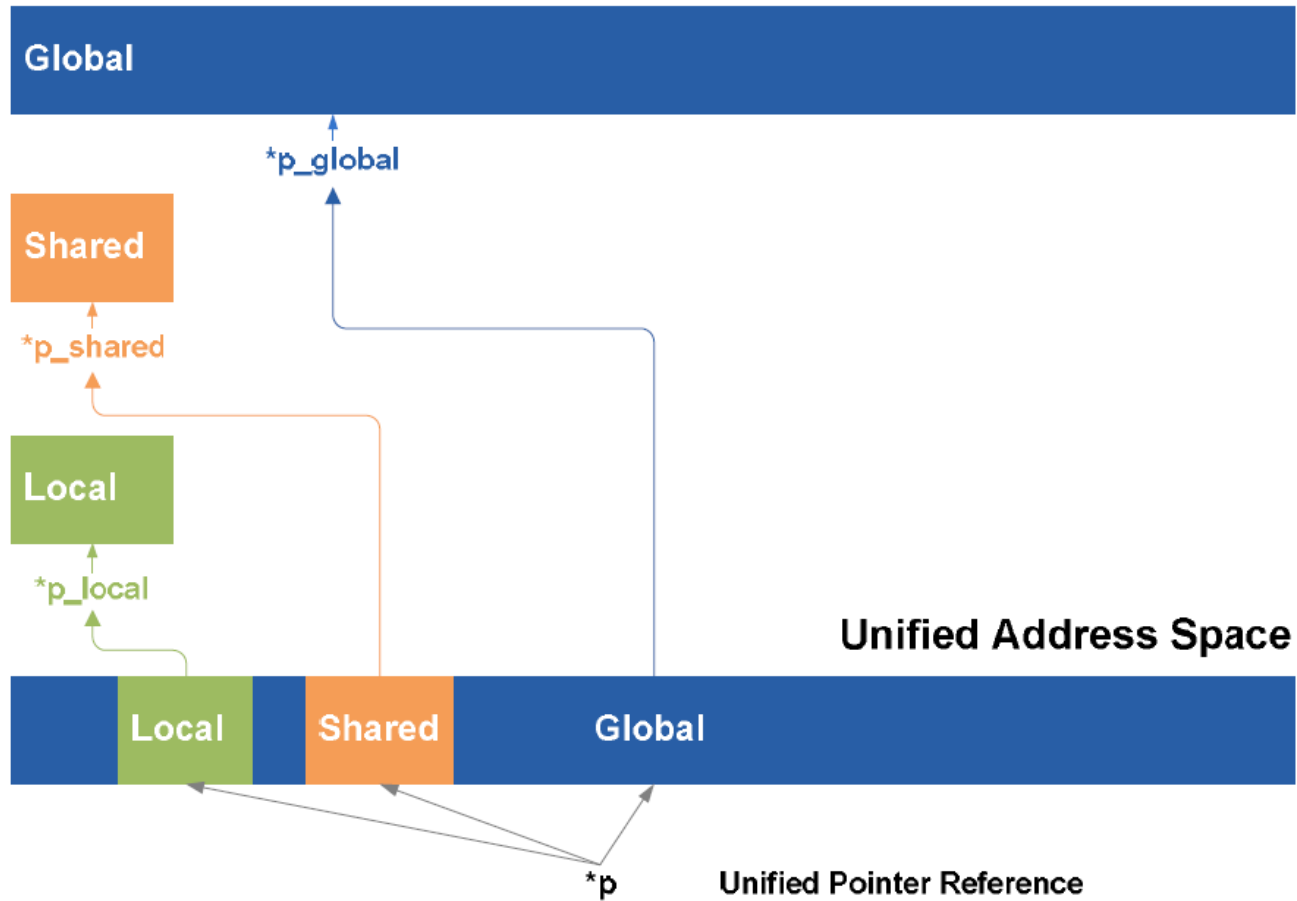
$$\begin{array}{c} \boxed{A} \times \boxed{B} = \boxed{\text{Product}} \text{ (truncate extra digits)} \\ + \\ \boxed{C} = \boxed{\text{Result}} \end{array}$$

Fused Multiply-Add (FMA)

$$\begin{array}{c} \boxed{A} \times \boxed{B} = \boxed{\text{Product}} \text{ (retain all digits)} \\ + \\ \boxed{C} = \boxed{\text{Result}} \end{array}$$

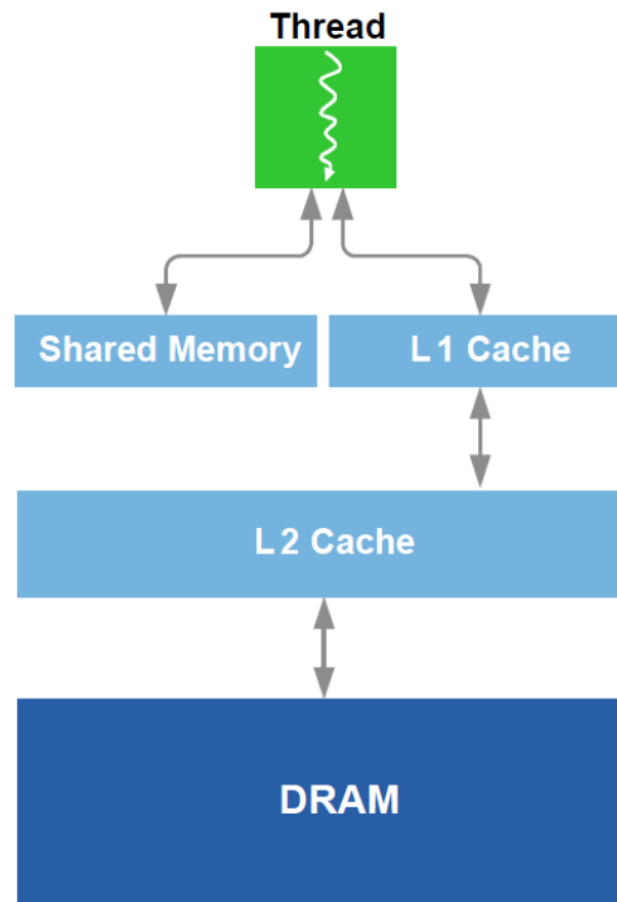
Evolutia metodelor de adresare

Separate Address Spaces

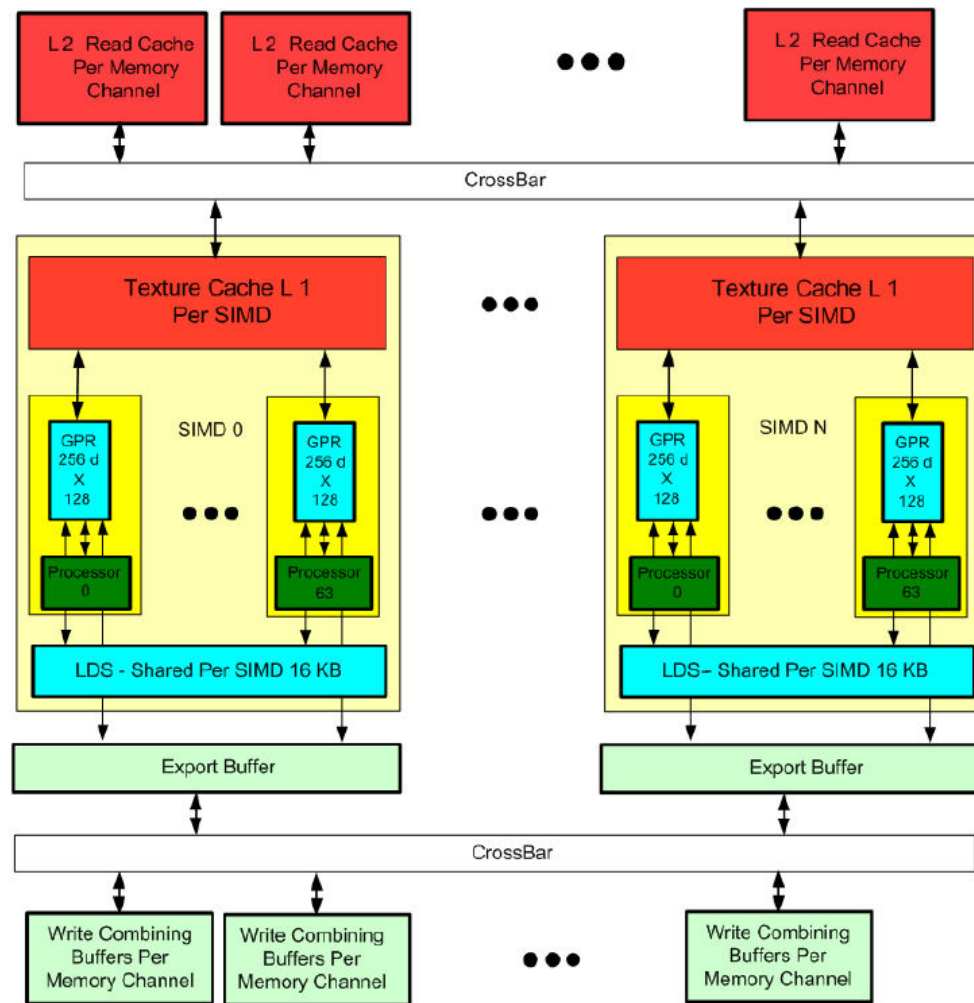


Evolutia ierarhiei de memorie Nvidia

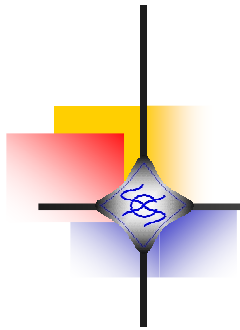
Fermi Memory Hierarchy



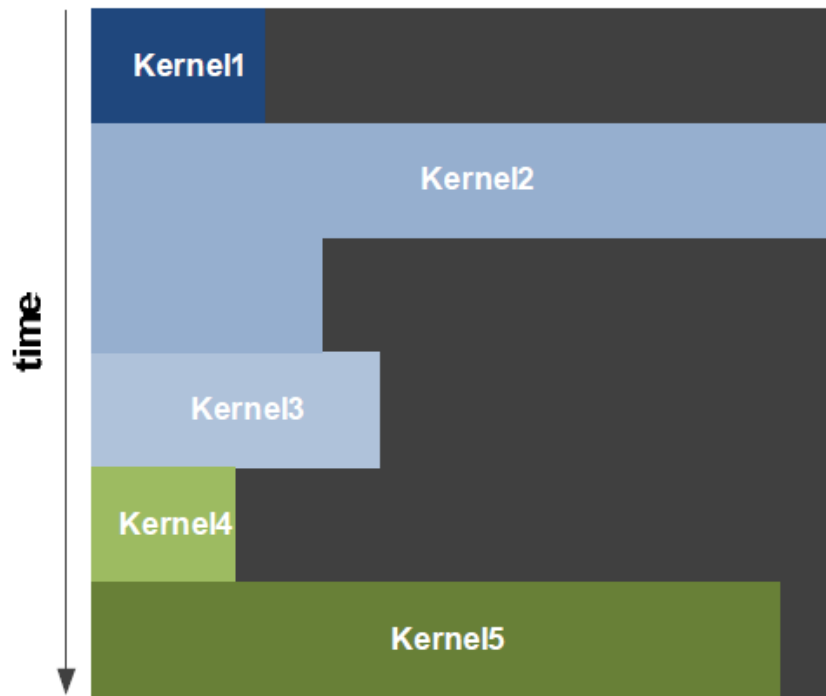
Structura ierarhiei de memorie ATI R700



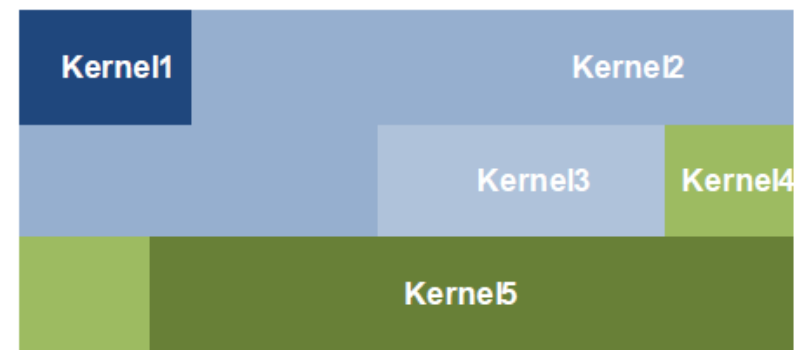
PROCESOARE GRAFICE PARALELE



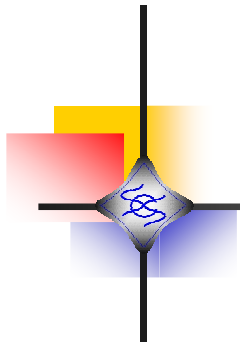
Evolutia Metodelor de executie a nucleelor de calcul



Serial Kernel Execution

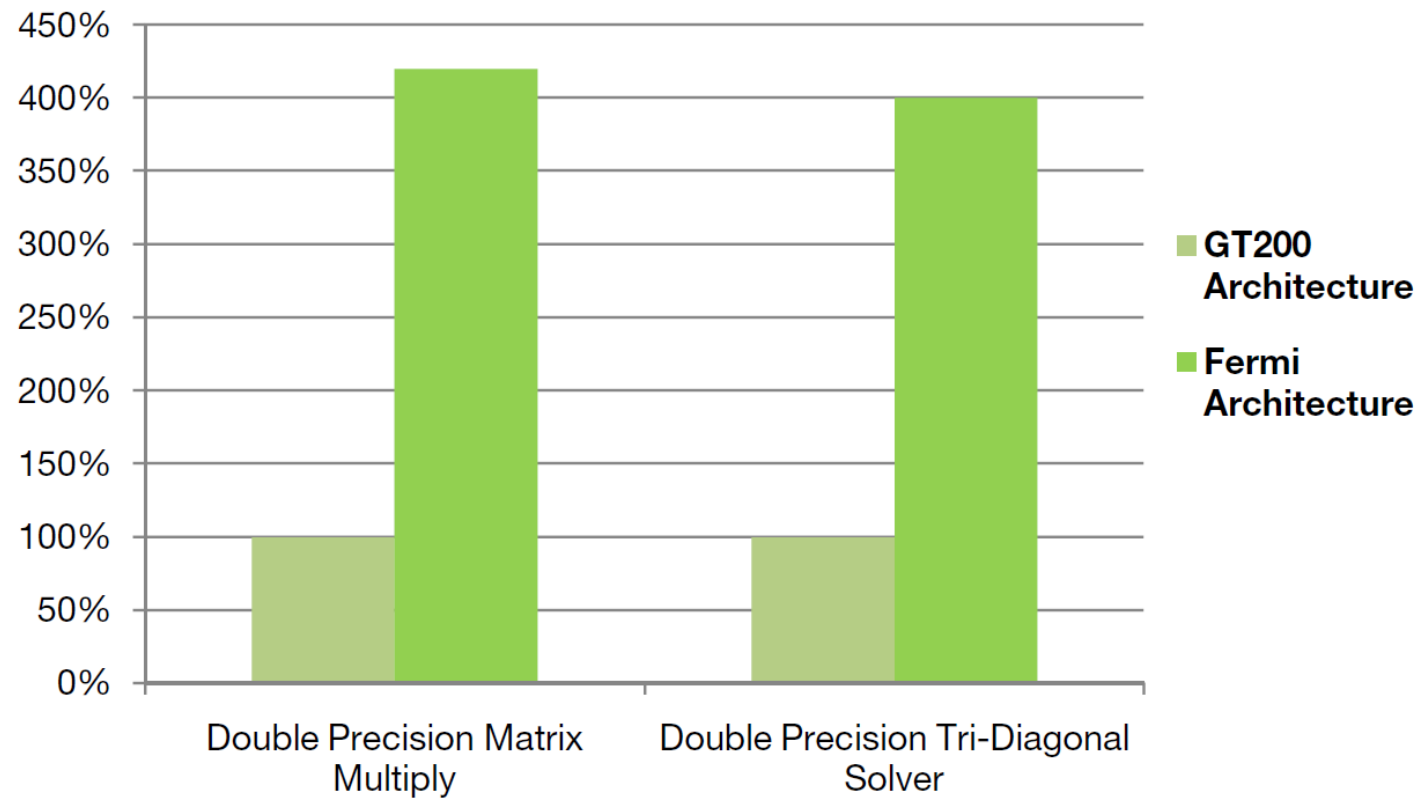


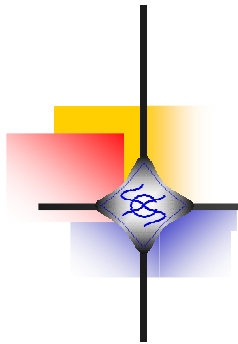
Concurrent Kernel Execution



Performante comparative Nvidia

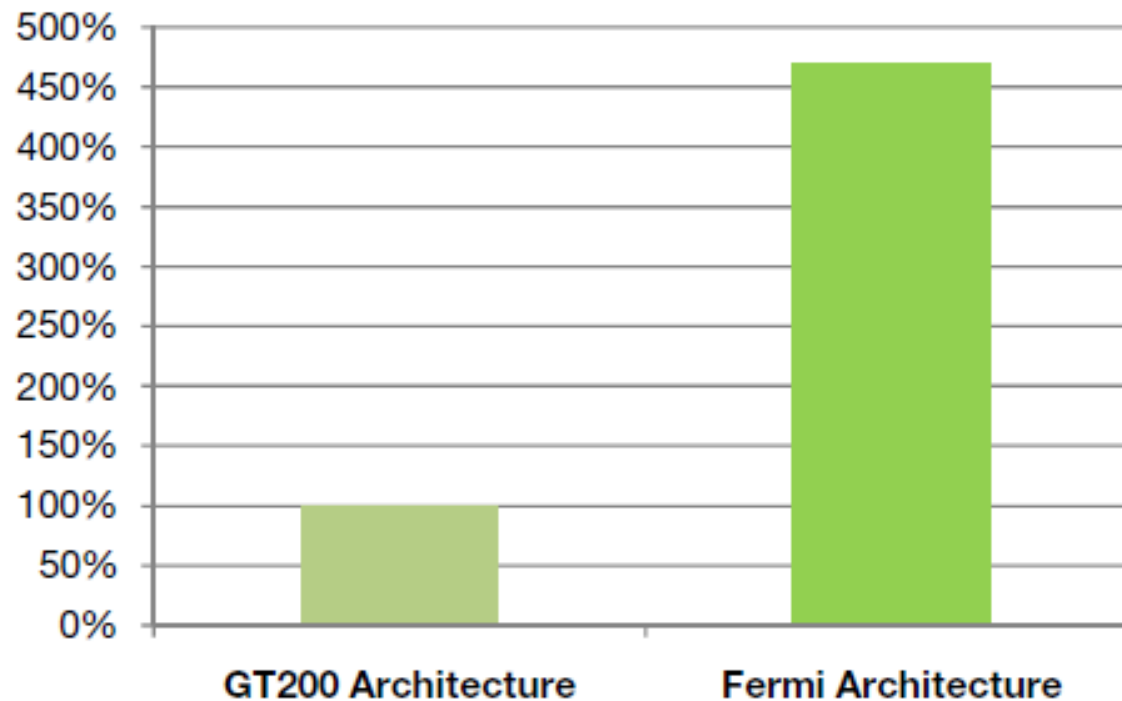
Double Precision Application Performance



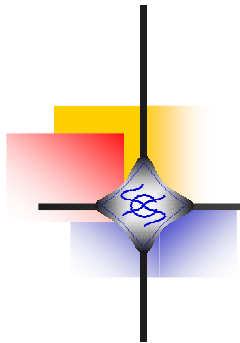


Performante comparative Nvidia

Radix Sort using Shared Memory

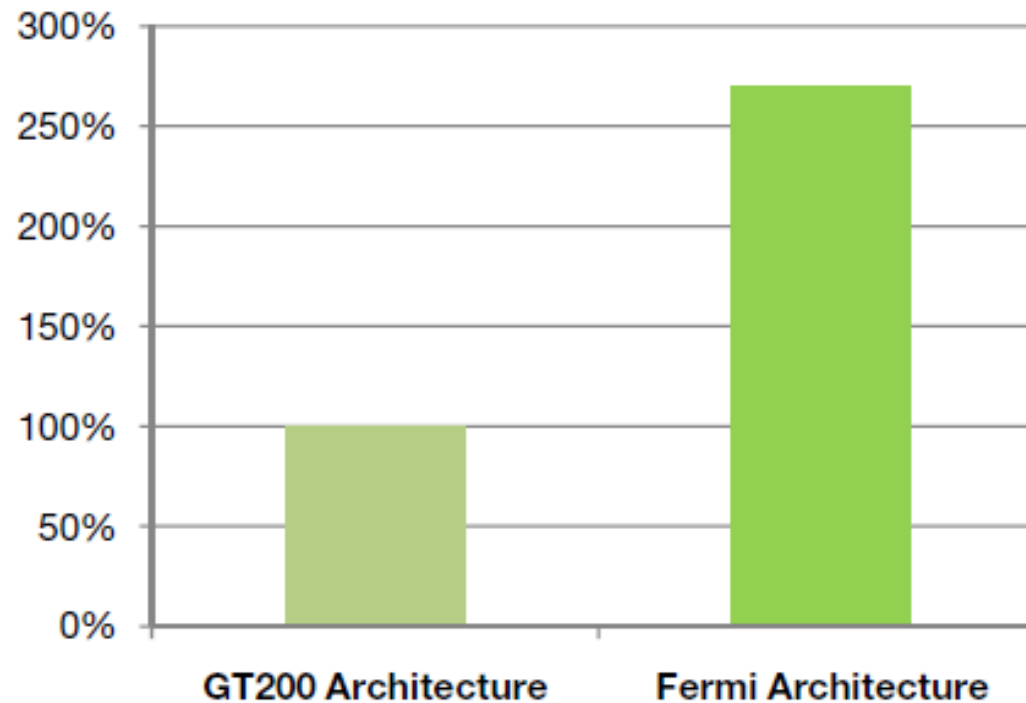


When using 48 KB of shared memory on Fermi, Radix Sort executes 4.7x faster than GT200.

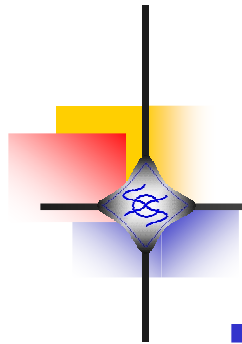


Performante comparative Nvidia

PhysX Fluid Collision for Convex Shapes



Physics algorithms such as fluid simulations especially benefit from Fermi's caches. For convex shape collisions, Fermi is 2.7x faster than GT200.



Concluzii

- Procesoarele grafice sunt masiv paralele (40 – 1600 proc.)
- In general sunt MIMD: 1 SM este SIMD, 1 proc. 2 – 16 SM
- Au evoluat de la procesoare orientate numai pe grafica, programabile in limbaje specifice (OpenGL, OpenCL, DirectX) la procesoare de uz general, programabile in C/C++ si drivere CUDA
- Performantele cresc exponential de la o generatie la alta