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Cross-Layer Early Reliability Evaluation for the Computing cOntinuum

Faults in CPUs and GPUs: Same or Different Problems? Same or Different Solutions?

Presenter: Stefano Di Carlo

Dependable GPU Computing workshop 2014
Friday, March 28, 2014, Dresden, Germany
In conjunction with the ACM/IEEE DATE 2014 Conference

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FAULTS IN CPUs and GPUs

1 **Faults in CPUs and GPUs: same problems?**

2 **Faults in CPUs and GPUs: same solutions?**

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FAULTS IN CPUs and GPUs

1 **Faults in CPUs and GPUs: same problems?**

2 **Faults in CPUs and GPUs: same solutions?**

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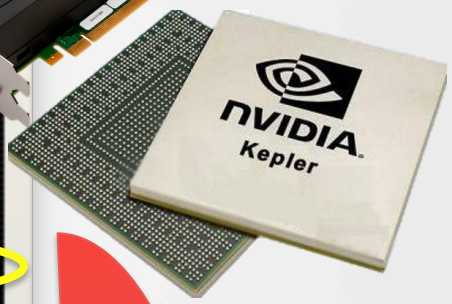
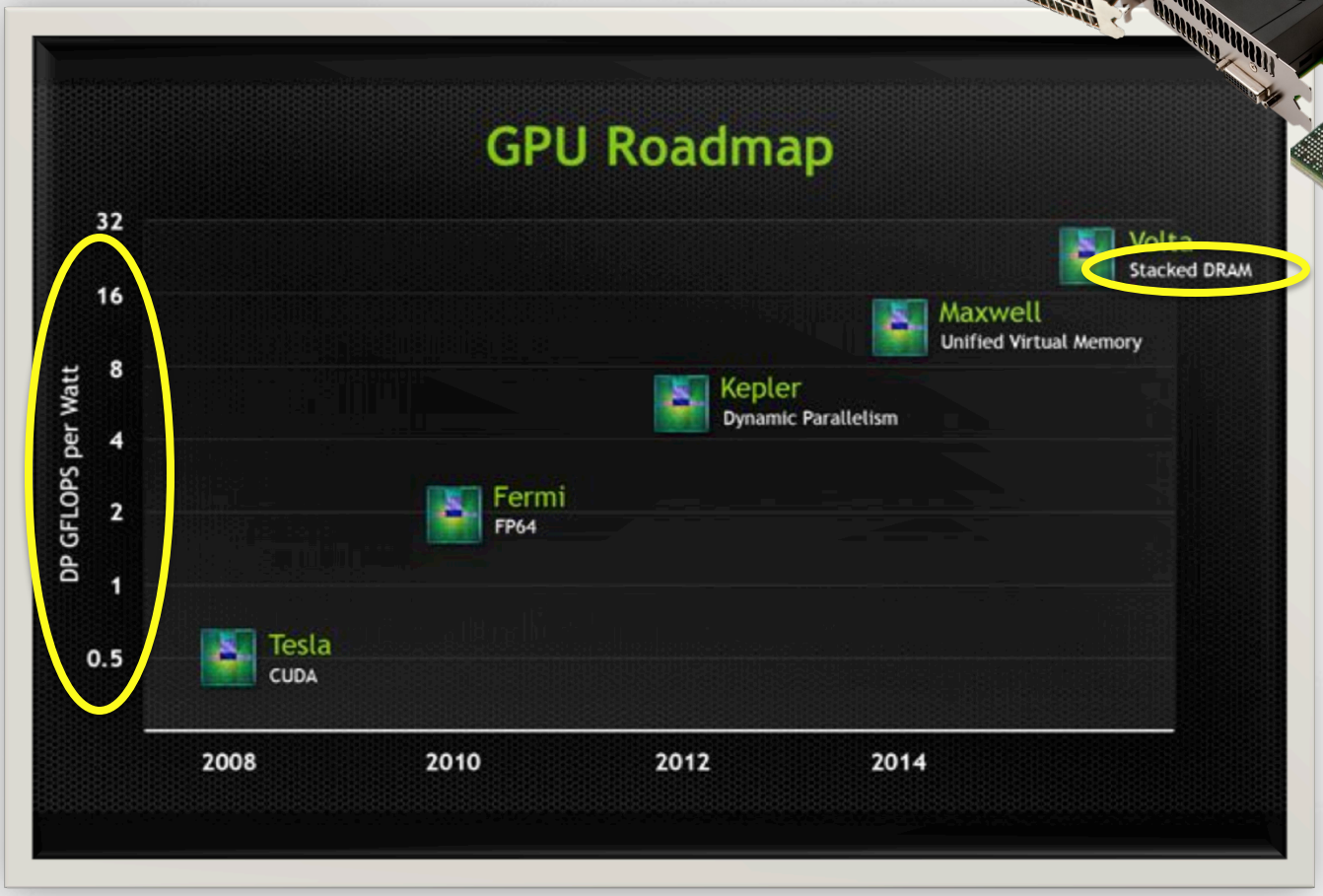
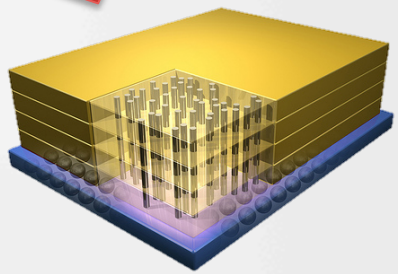
GPU ROADMAP

NVIDIA GPU Roadmap

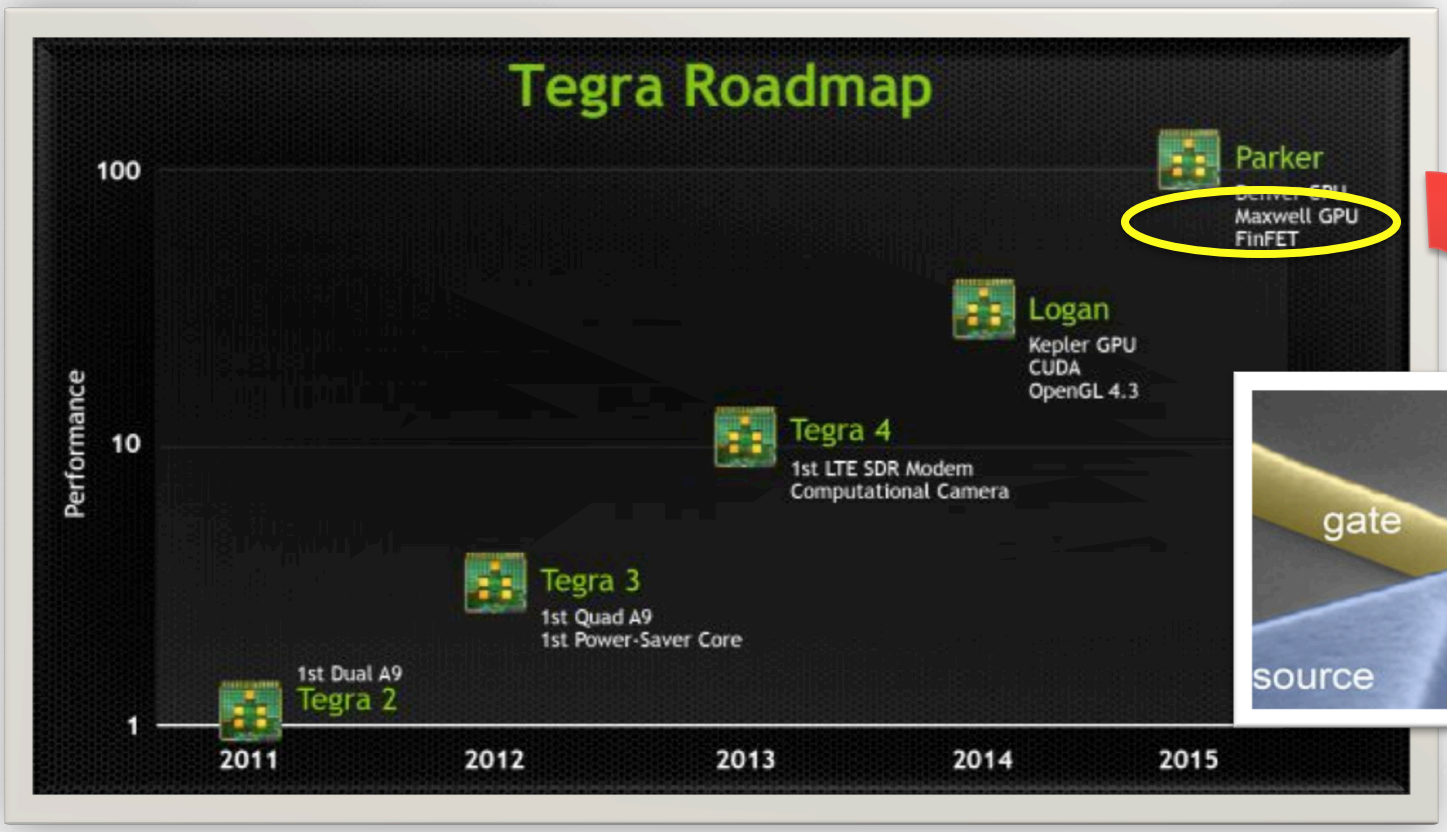


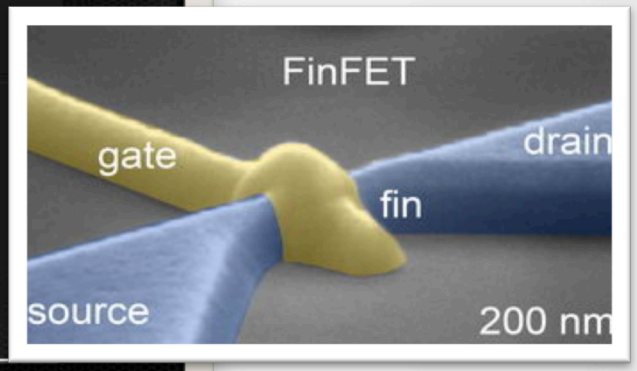




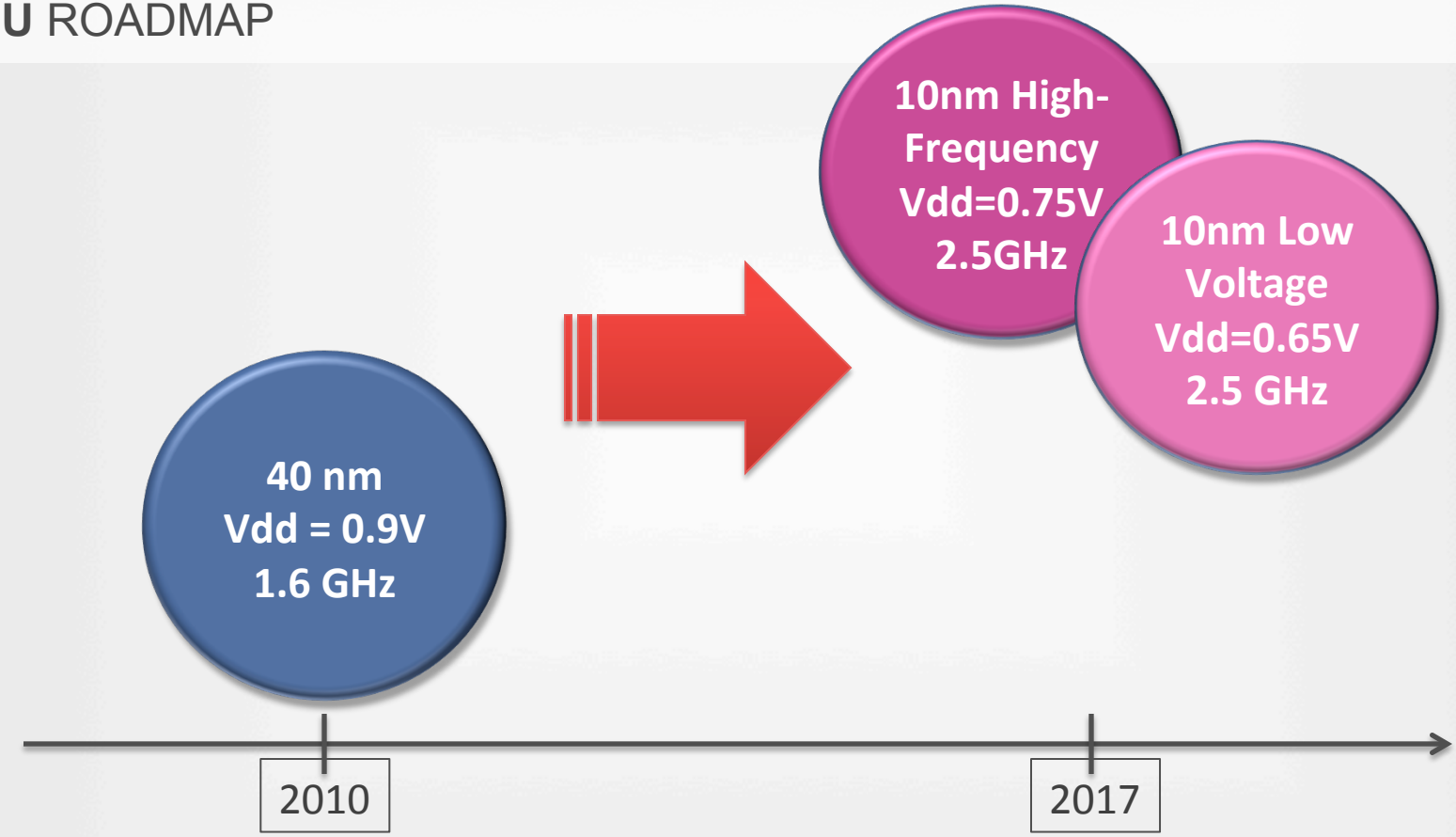
GPU ROADMAP

NVIDIA GPU Roadmap



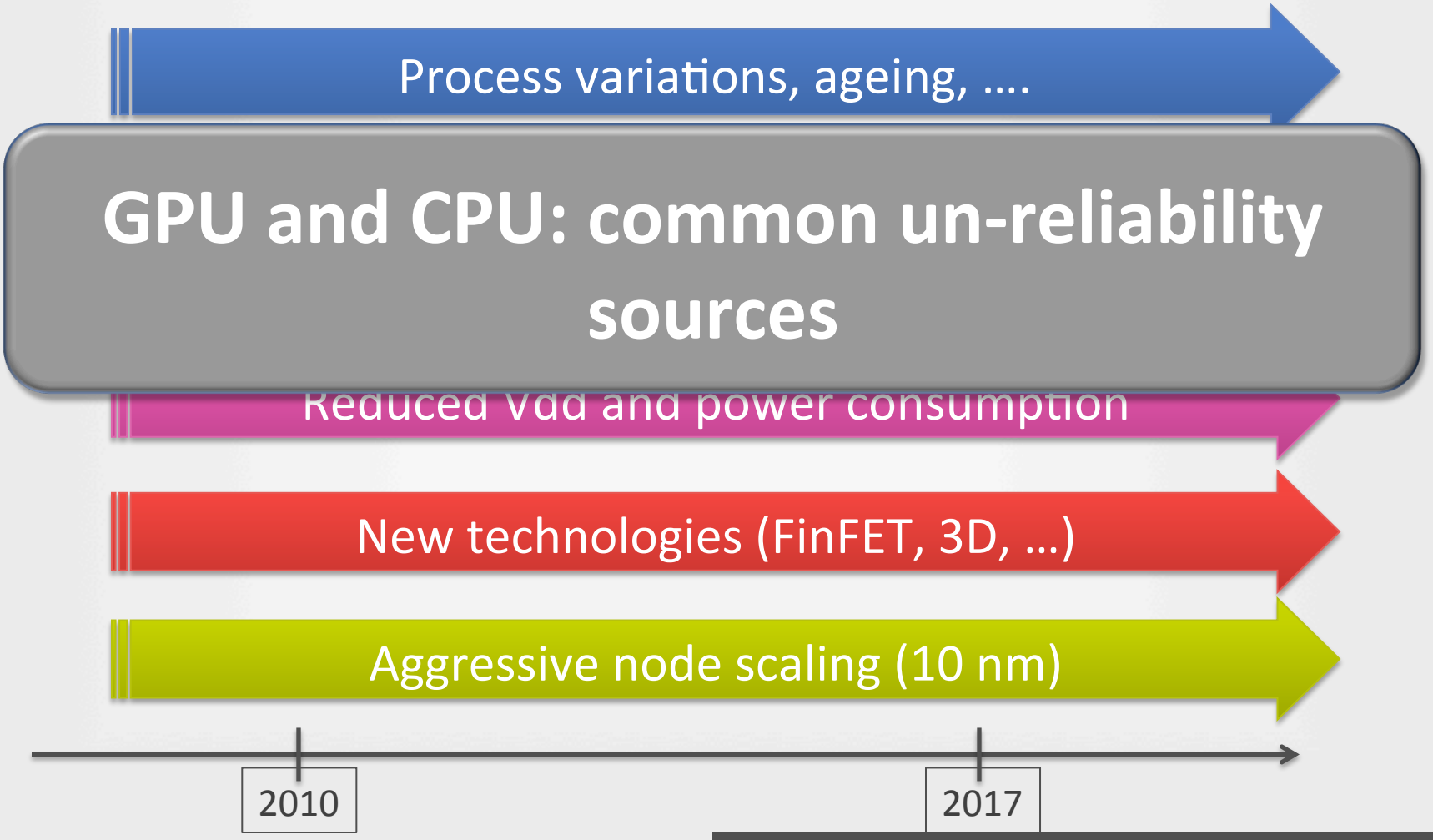


GPU ROADMAP



GPUs and the future of parallel computing,
Keckler, Stephen W and Dally, William J and Khailany, Brucek and Garland, Michael and Glasco, David; IEEE Micro, Vol 31, No. 5, pp. 7-17, 2011

GPU ROADMAP


Process variations, ageing, ….
GPU and CPU: common un-reliability sources
Reduced Vdd and power consumption
New technologies (FinFET, 3D, …)
Aggressive node scaling (10 nm)
2010
2017

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FAULTS IN CPUs and GPUs

1

Faults in CPUs and GPUs: samep roblems?

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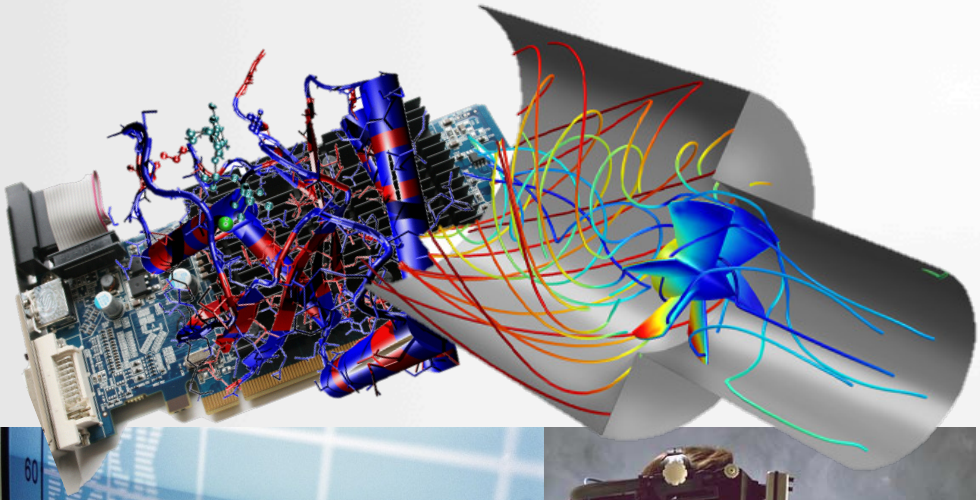
FAULTS IN CPUs and GPUs

1 Faults in CPUs and GPUs: same problems?

2 **Faults in CPUs and GPUs: same solutions?**

GPU APPLICATIONS



- Molecular Dynamics, Bioinformatics
- Quantum Chemistry
- Materials Science
- Numerical Analytics
- Physics
- Computational Finance
- Manufacturing: CAD and CAE
- …

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GPU APPLICATIONS

- Embedded gaming machines
- Digital signage
- Medical imaging
- Commercial aerospace
- Conventional military
- …

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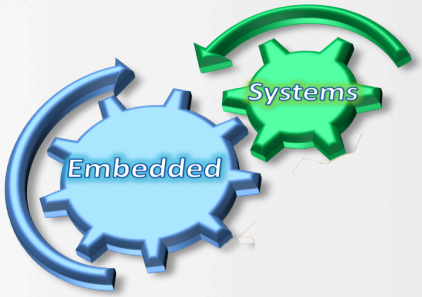
GPU APPLICATIONS



Quasi-exact computation

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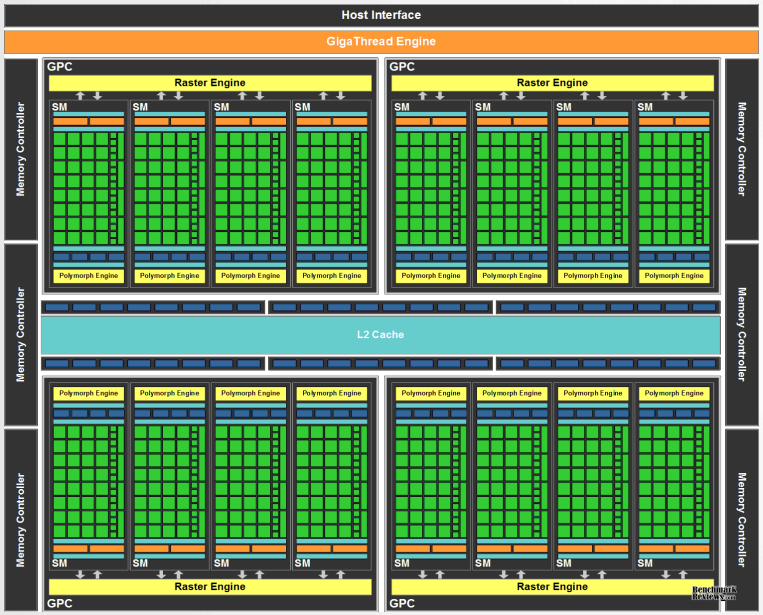
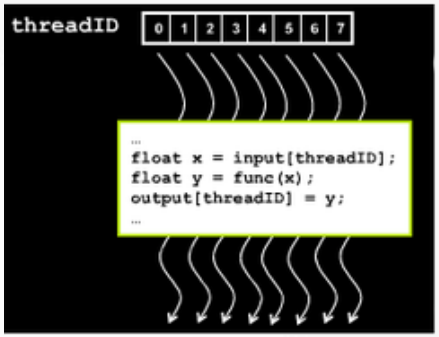
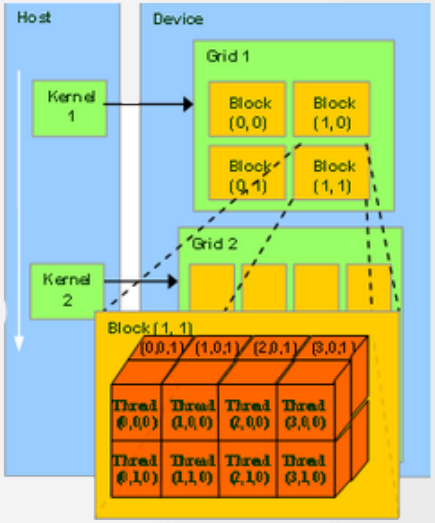
GPU AND REDUNDANCY

NVIDIA TESLA Architecture



GPU execution model





Spatial and temporal redundancy is massively available in GPUs

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FAULTS IN CPUs and GPUs

2

Faults in CPUs and GPUs: same solutions?

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FAULTS IN CPUs and GPUs

1 **Faults in CPUs and GPUs: same problems?** Yes!

2 **Faults in CPUs and GPUs: same solutions?** No!

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THANK YOU FOR YOUR ATTENTION