Integración de tecnologías de virtualización de GPUs en el planificador de recursos SLURM

Federico Silla

Universitat Politècnica de València

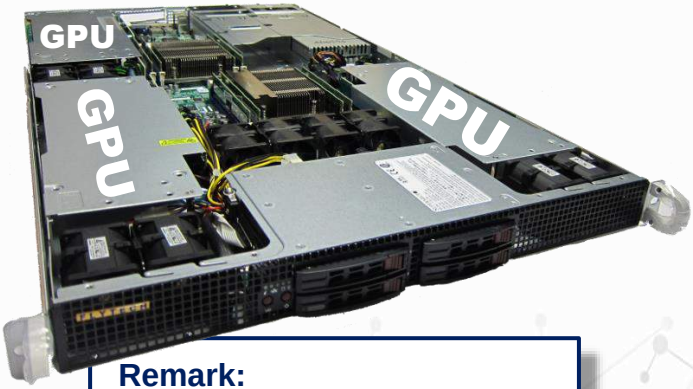
Presentation funded by Agencia Valenciana de la Innovación (Generalitat Valenciana)

What is rCUDA?

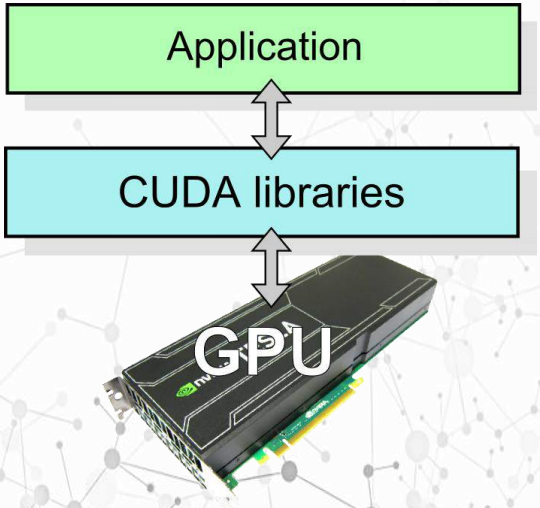
Presentation funded by Agencia Valenciana de la Innovación (Generalitat Valenciana)

Basics of GPU computing

Basic behavior of CUDA



Remark:
GPUs can only be used within the node they are attached to



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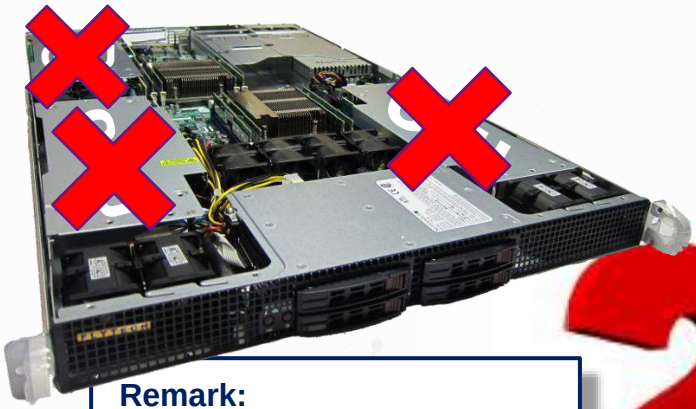

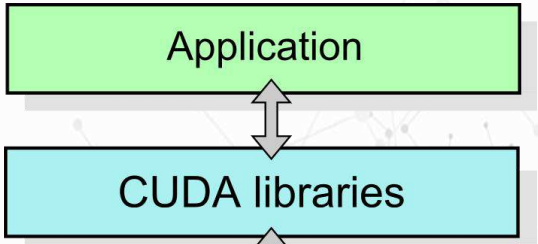

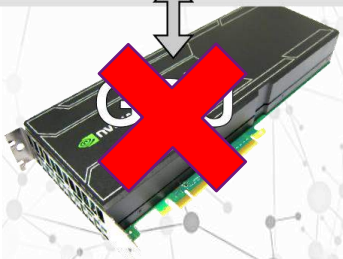

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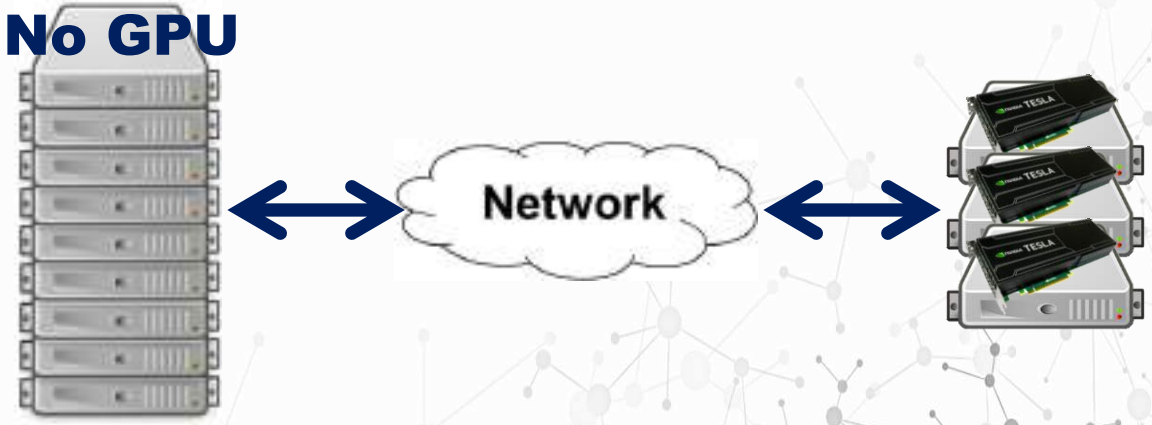
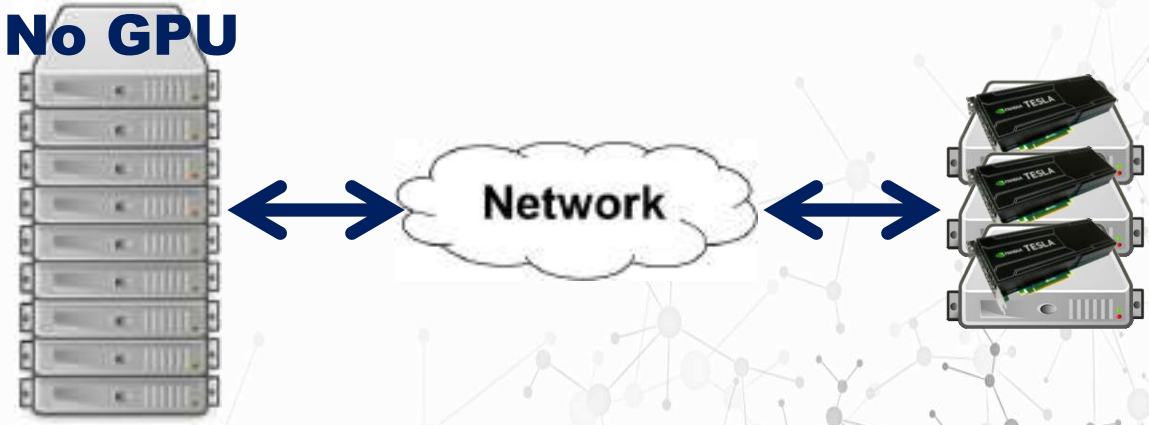
A different approach: remote GPU virtualization



A different approach: remote GPU virtualization

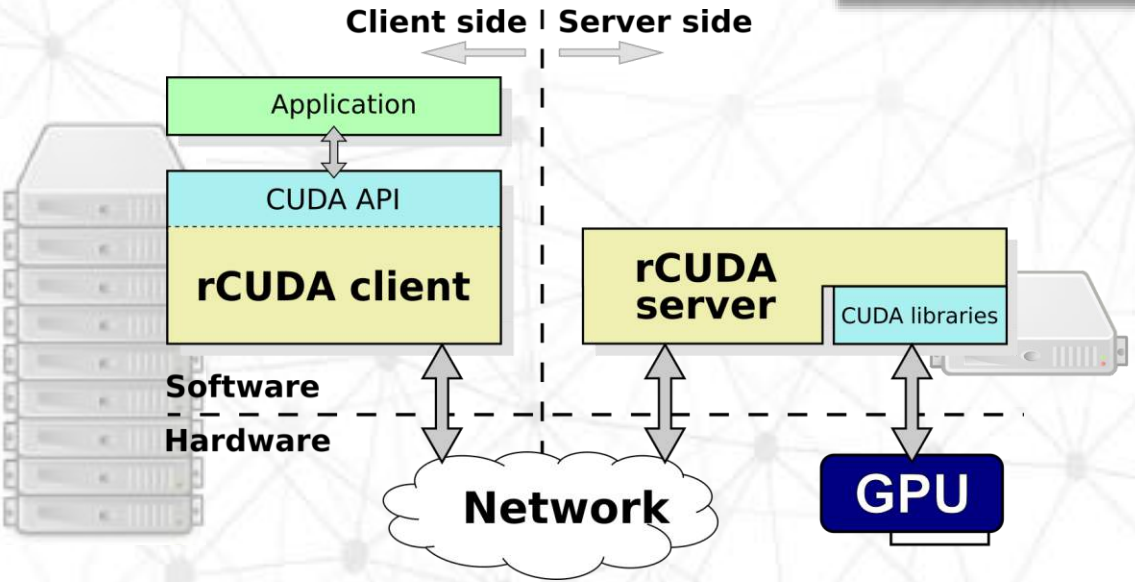
A software technology that enables a more flexible use of GPUs in computing facilities



rCUDA … remote CUDA

Basics or rCUDA

Access to remote GPU is transparent to applications: no source code modification is needed



Basics or rCUDA

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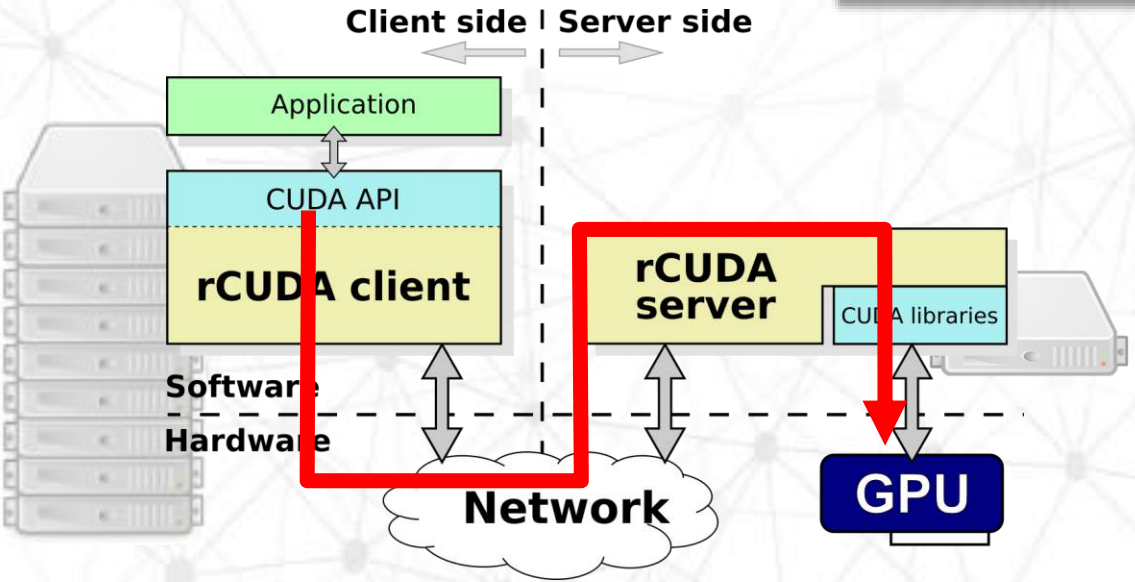

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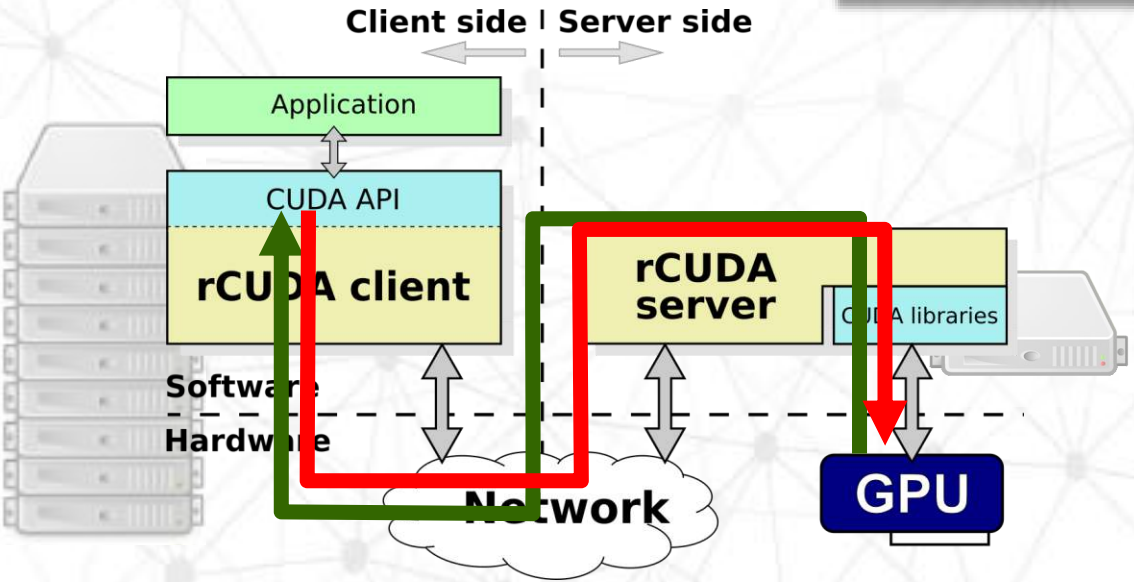
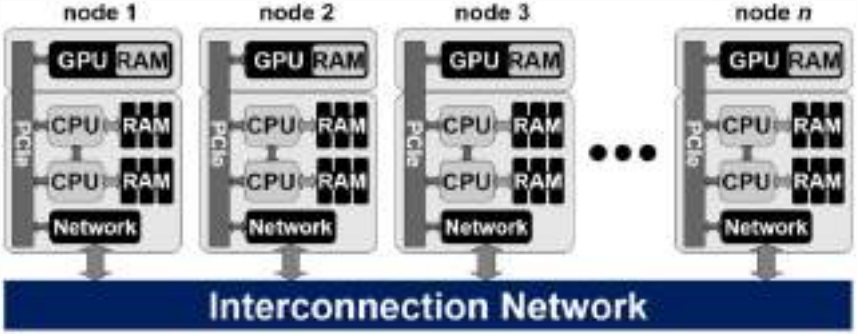


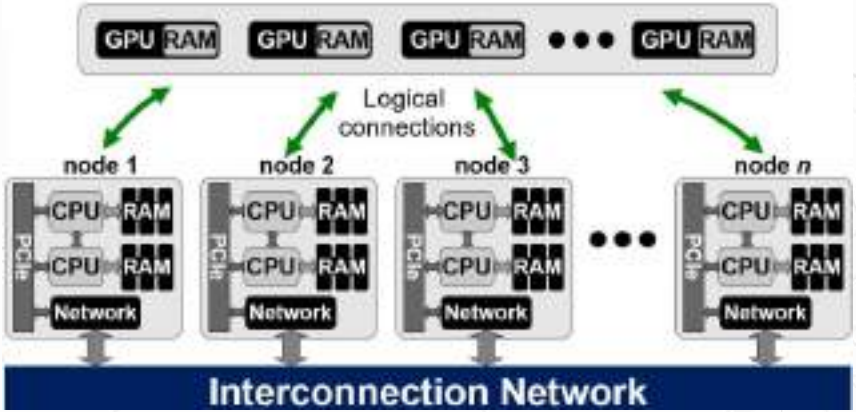
rCUDA envision

- **rCUDA allows a new vision** of a GPU deployment, moving from the usual cluster configuration …



Physical configuration

… to the following one:



Logical configuration

Perfomance of rCUDA?

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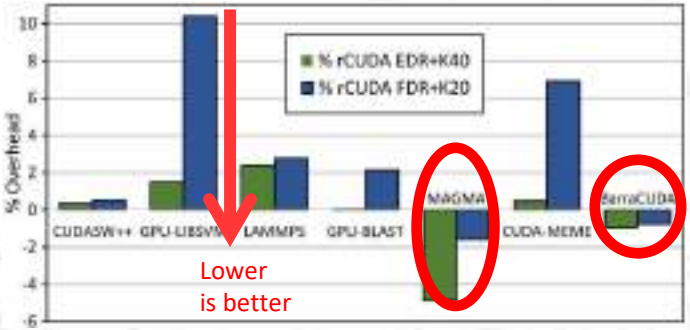
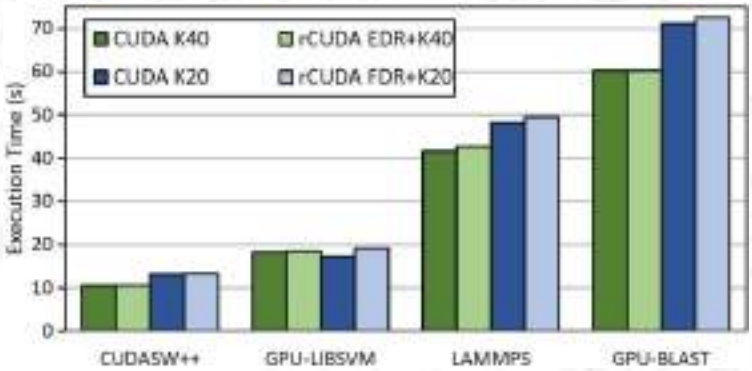
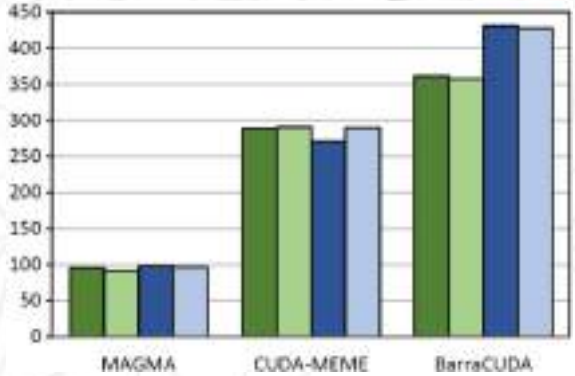
Performance of rCUDA

- K20 GPU and FDR InfiniBand
- K40 GPU and EDR InfiniBand

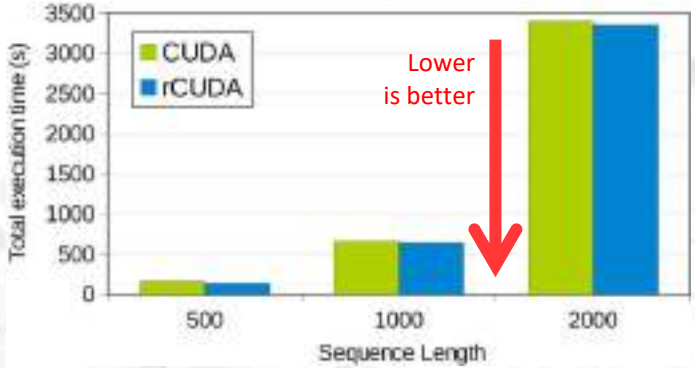






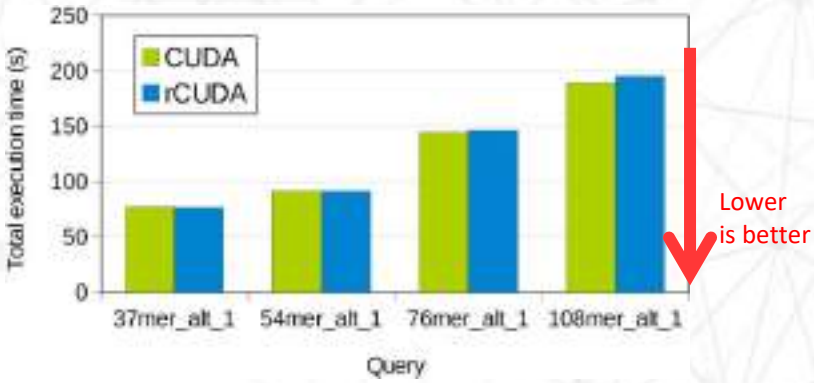
Performance of rCUDA

P100 GPU and EDR InfiniBand

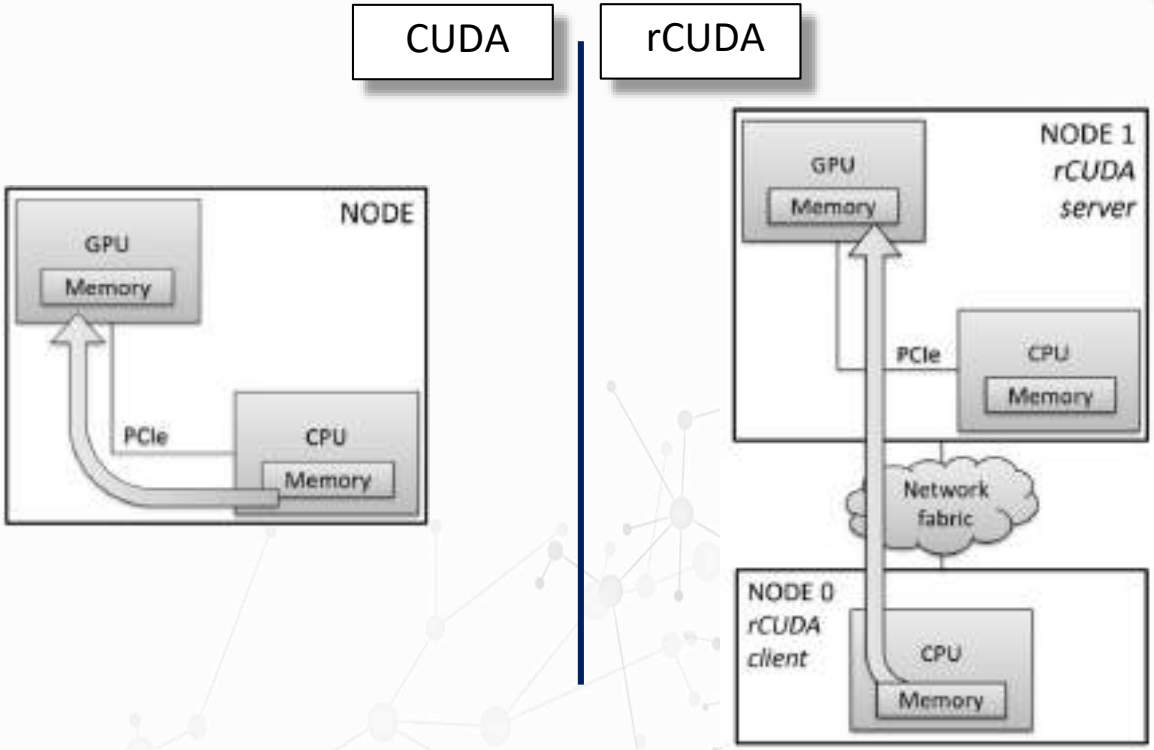


CUDA-MEME

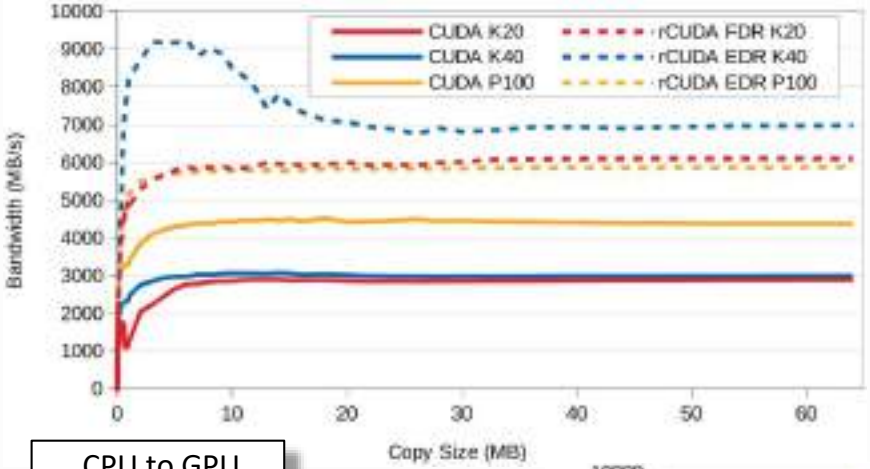
BarraCUDA



Performance of data movements to/from GPUs

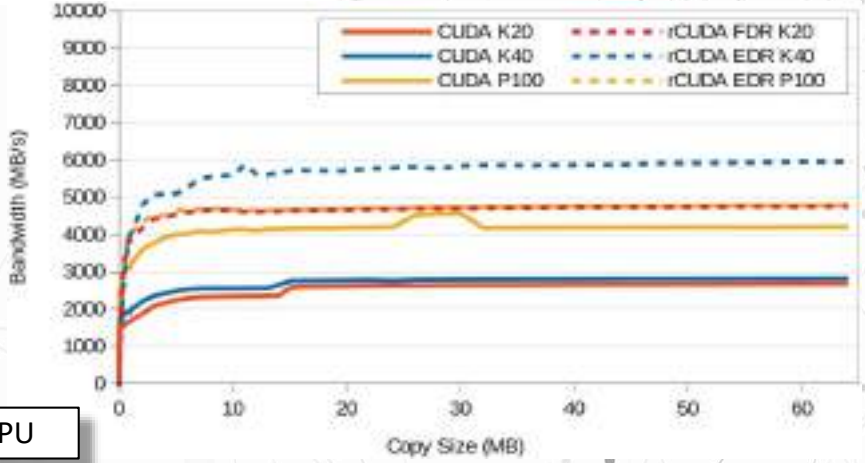


Performance of data movements to/from GPUs



Higher is better

CPU to GPU

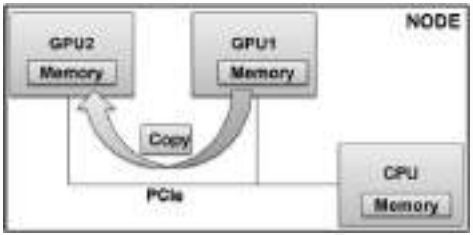


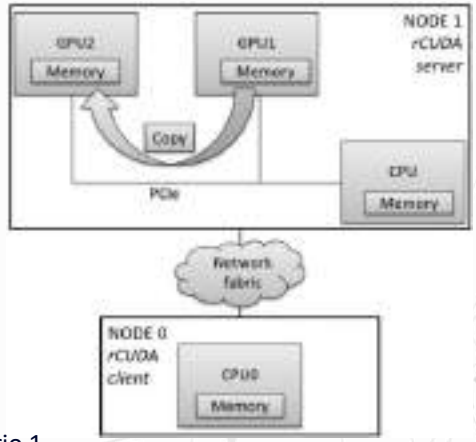
GPU to CPU

Performance of data movements among GPUs

CUDA

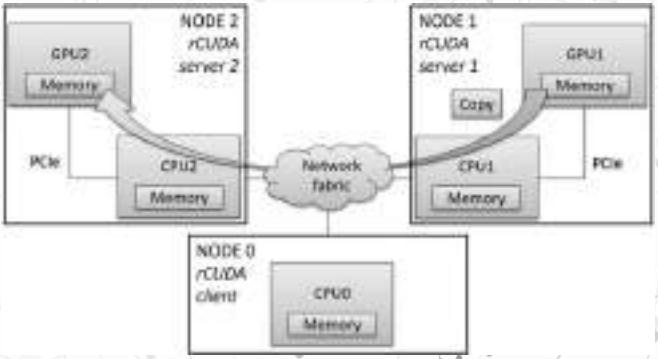
rCUDA



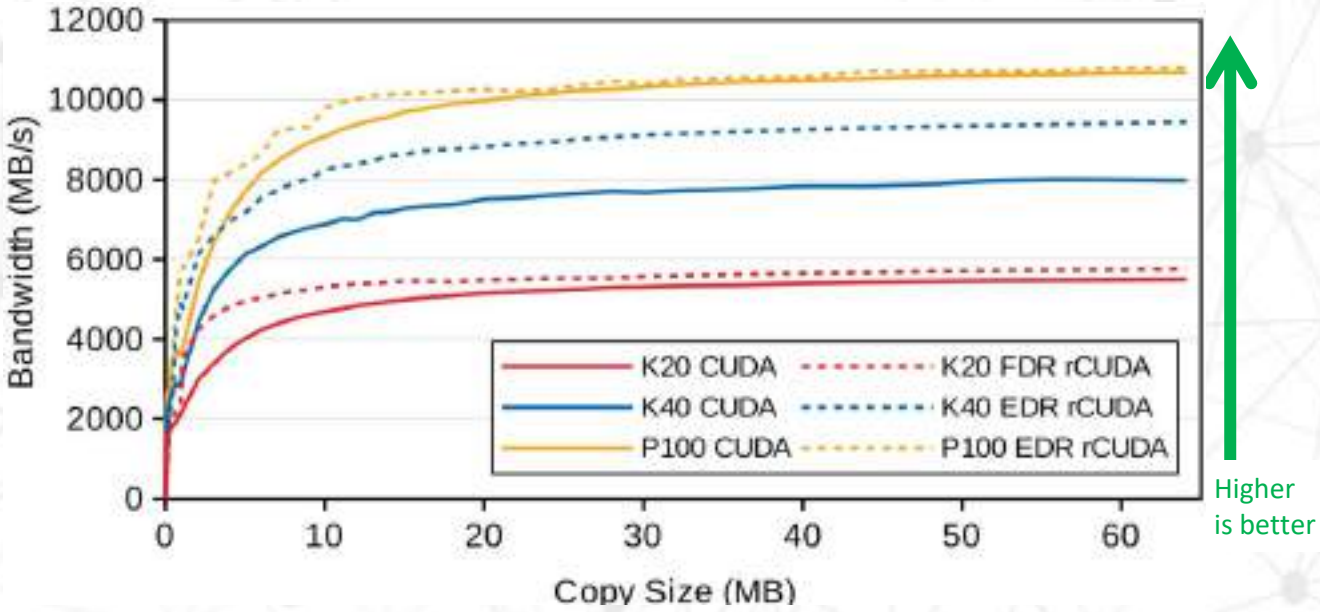


rCUDA scenario 1

rCUDA scenario 2



Performance of data movements among GPUs



Benefits of rCUDA?

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Benefits of rCUDA?

1. Many GPUs for an application
2. Increased cluster throughput

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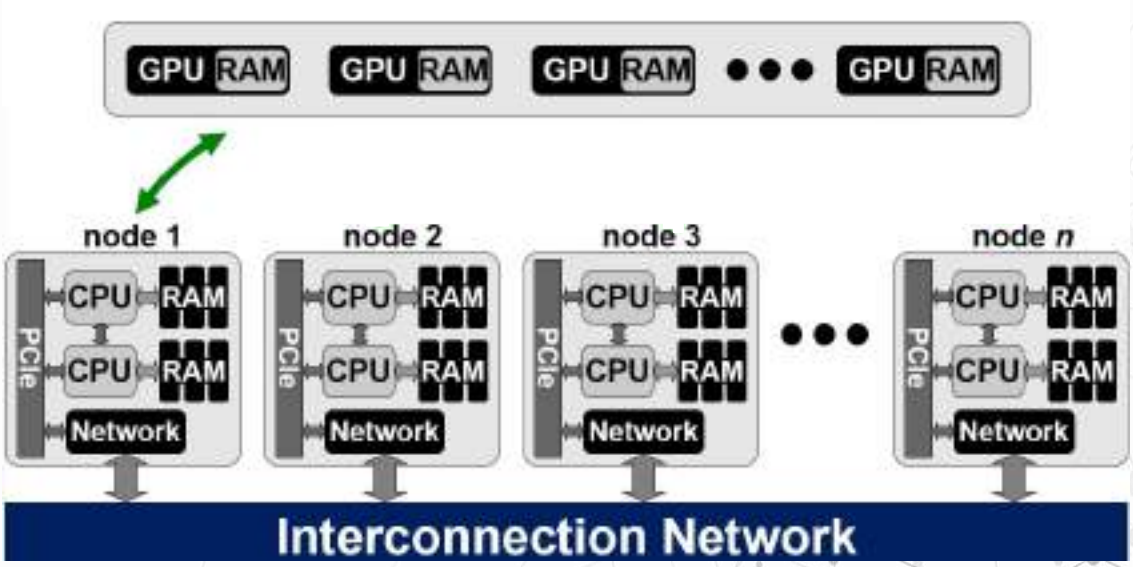
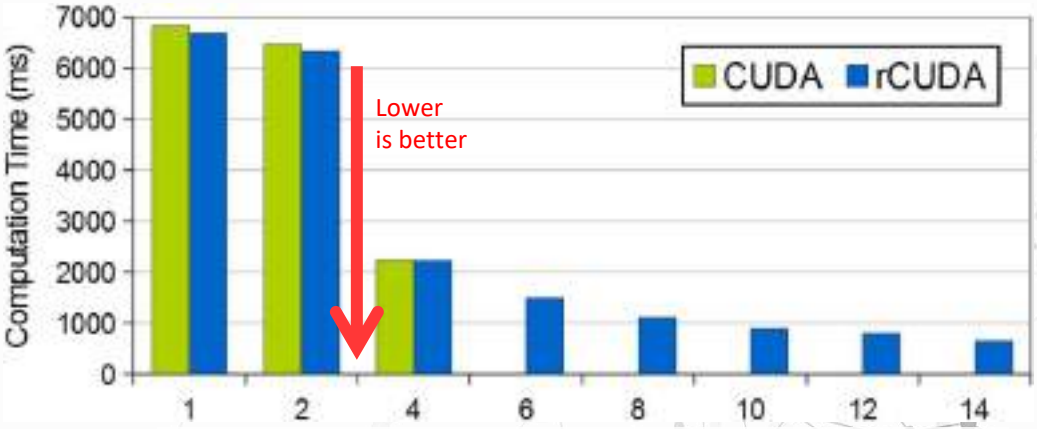
Providing many GPUs to an application with rCUDA



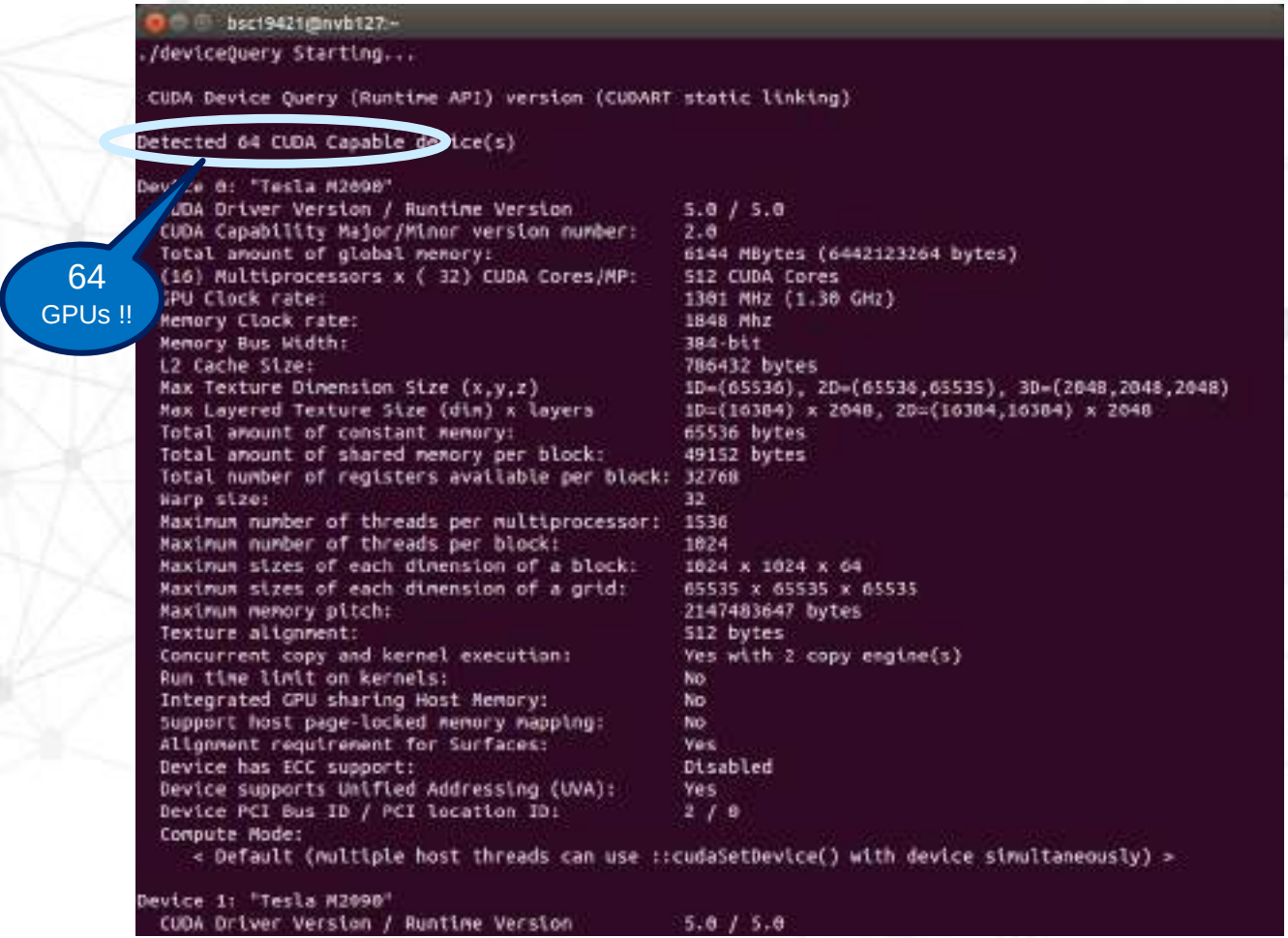
Providing many GPUs to an application with rCUDA

K20 GPUs and FDR InfiniBand

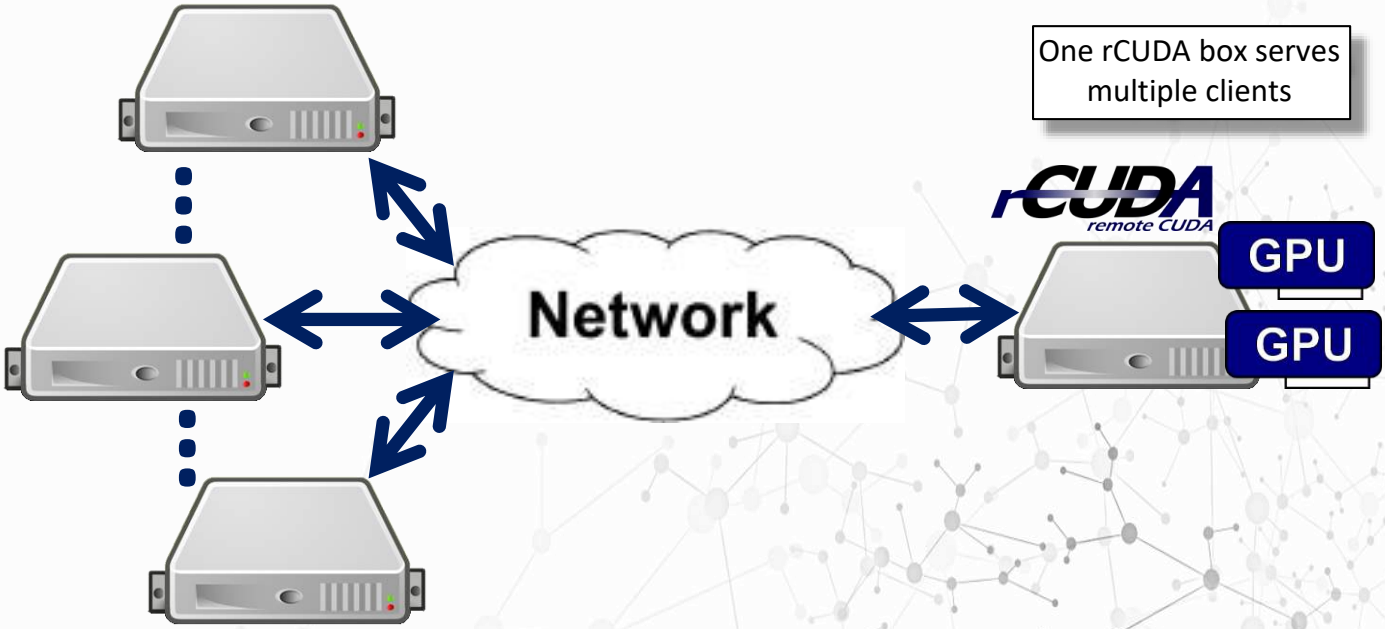


MonteCarlo multi-GPU program running in 14 NVIDIA Tesla K20 GPUs

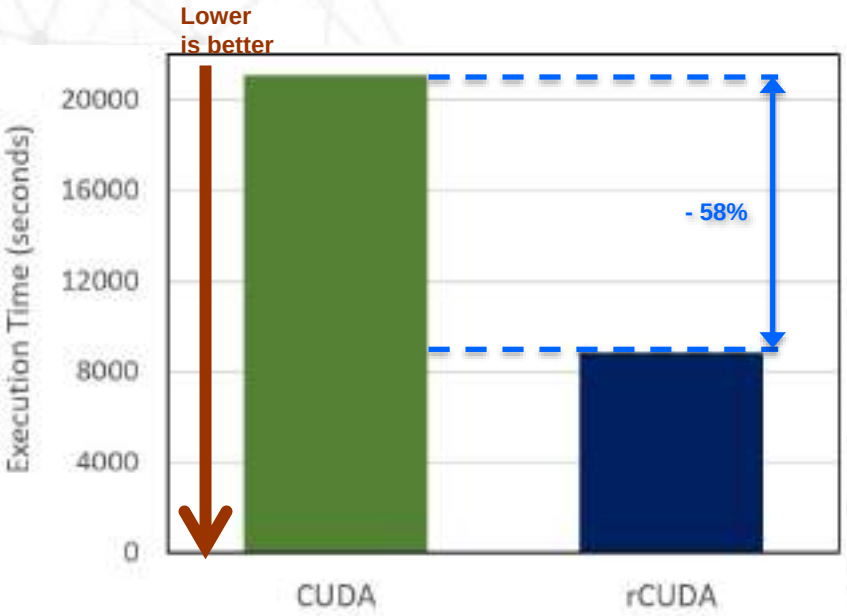
Providing many GPUs to an application with rCUDA



Increased cluster throughput

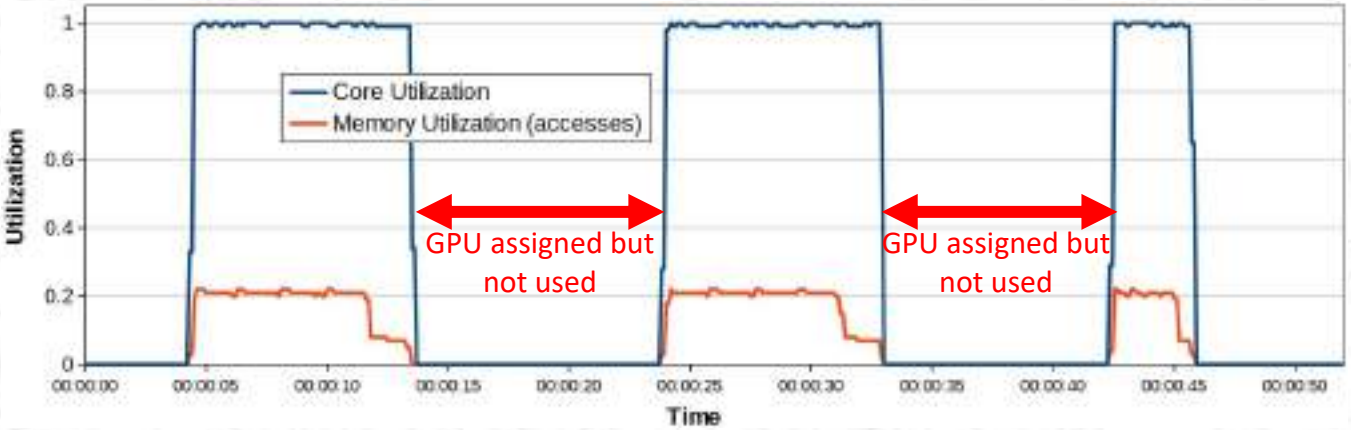


Increased cluster throughput



1. BarraCUDA
2. CUDA-MEME
3. CUDASW++
4. GPU-Blast
5. Gromacs
6. Magma

Increased cluster throughput



Slurm and rCUDA

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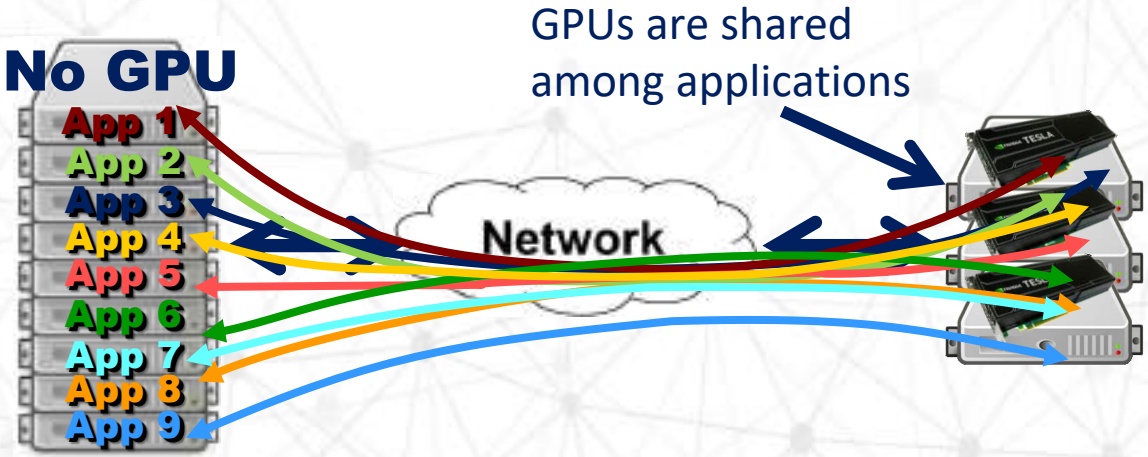
Need of a resource scheduler



Which is the limit of GPU sharing?

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