

Applications for the LHC ALICE Experiment



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Overview

What is the GRID

The GRID

GRID implementation: the middleware

AliEn, the ALICE GRID

RMKI resources

A job's life

ROOT and AliROOT

GP-GPU Applications in Physics

GP-CPU

- EIC test cluster

Architecture

Summary

Comments / Questions

GRID

What is a GRID?

A distributed system, a group of interconnected computers that share a common interface to share resources.

Why would we need such a thing?

"Anything that can be calculated on paper has already been done." Great demand for computing power. Too expensive to do it

GRID, the CERN Way

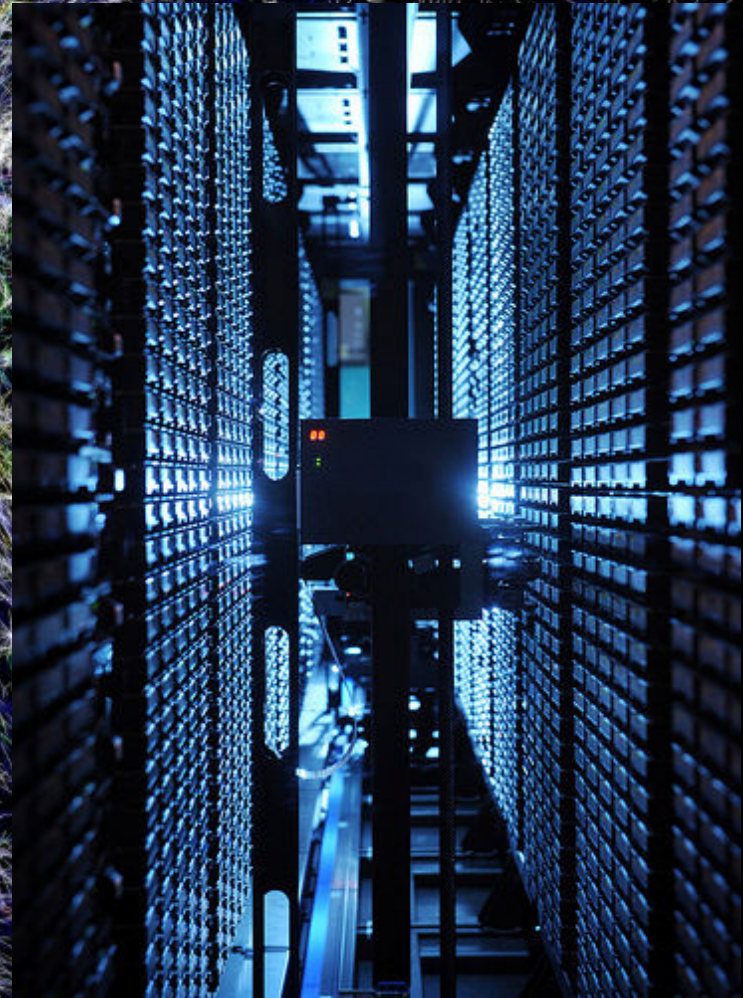
The solution?

Amidst the LCG-EGEE (LHC Computing Grid – Enabling GRIDs for E-Science)

program, the **gLite middleware** has been developed. (see 7th slide)

What's considered to be a
source?

10/10/00



Where is the middleware?

middleware

Operating system

Operating system

Operating system

hardware

hardware

hardware



The role of the middleware


It serves as the distributor of resources available to a machine.

Advertises these resources (free vs. used)

It schedules incoming jobs for execution reports their status.

It serves the jobs with whatever packages or any dependencies they might have.

Middleware – a la ALICE

- **gLite**. The background service. All higher layers give commands to this layer.
- **AliEn** (AliceEnvironment) a module extending the regular gLite services. (faster, stronger, better and nonetheless: userfriendly) 
- **VOBOX**. (Virtual Organisation) It is a general purpose element in the middleware.
 - It is mandatory to install a vobox onto a site.
 - Experiments use it to different ends.
 - In the case of AliEn commands are given from the vobox as a result downloading the

Storage – à la ALICE

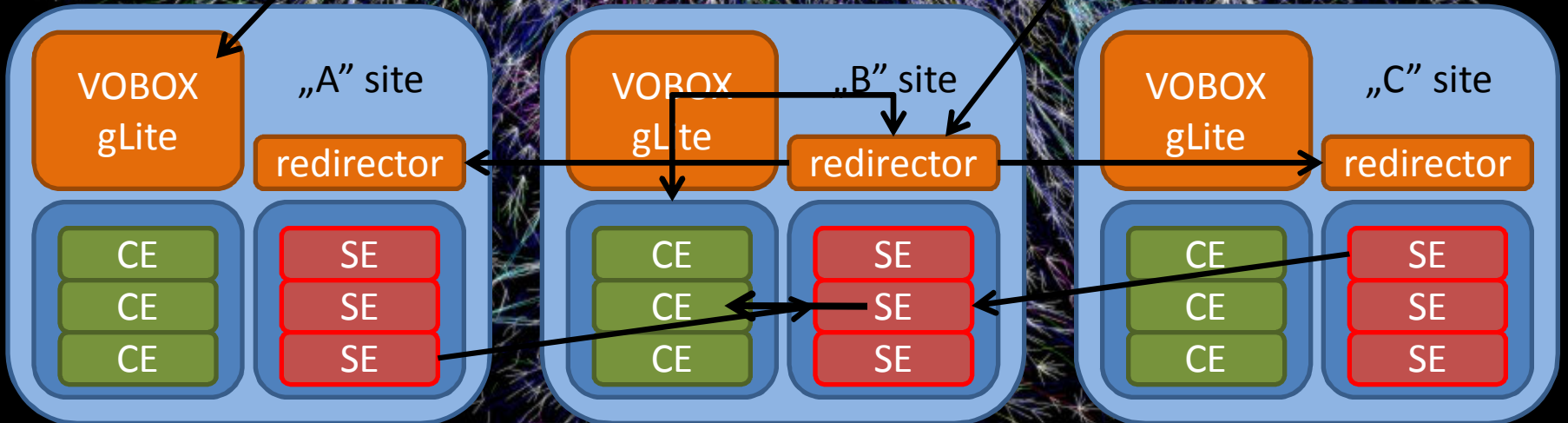
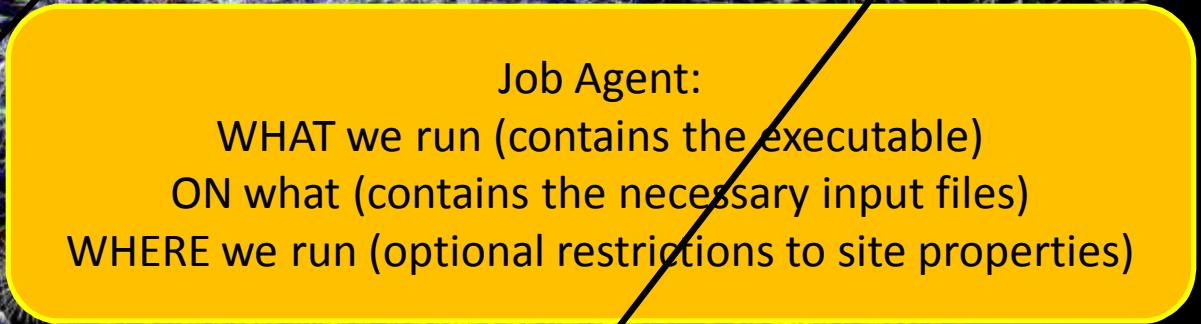
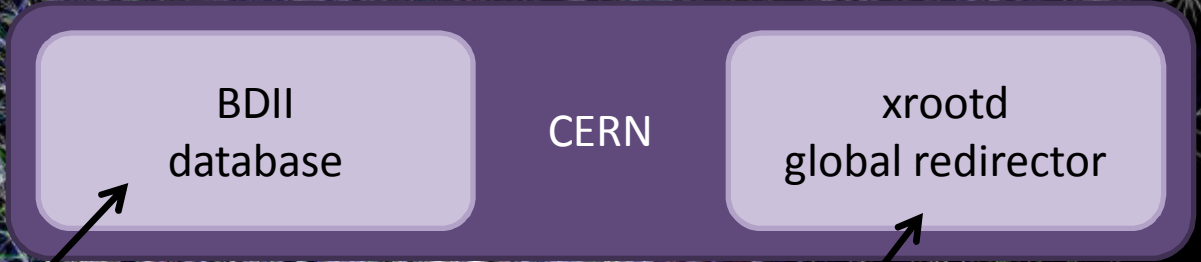
The handling of **storage** does not go according to standard procedure; gLite supports many storage types and topologies, but not the ALICE standard xrootd.

Therefore file operations cannot be invoked via the underlying gLite middleware, it has to be maintained by the **VOBOX** (Where for security generality comes in handy)

Storage and Computing elements at RIM

- **SE** (Storage Element) Two machines with 20TB disk space each.
 - 1 machine: 4X RAID 5+1, all 1TB HDD
- **CE** (Computing Element) Vastly Intel Xeon processors with the standard 2GB RAM/core.
 - 13 Dual Core és 100 Quad Core machines are brought to work.
 - They are used in time division with the storage element.

A job's life



ROOT and AIRROOT

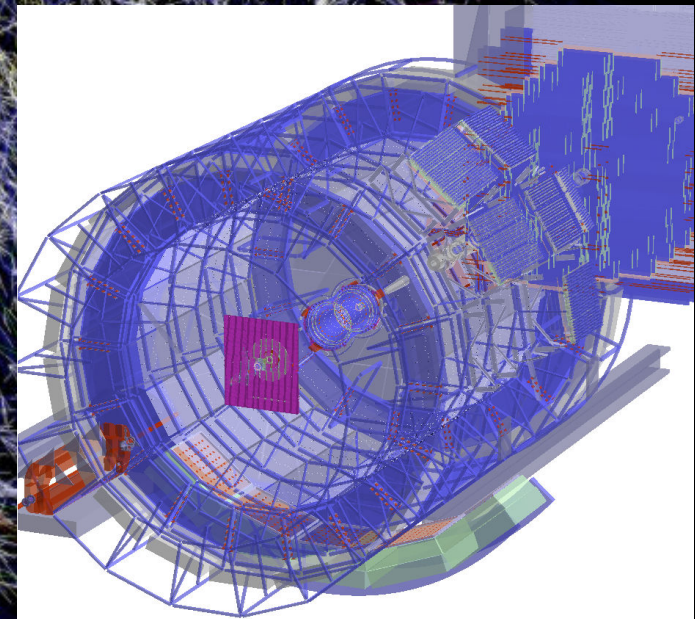
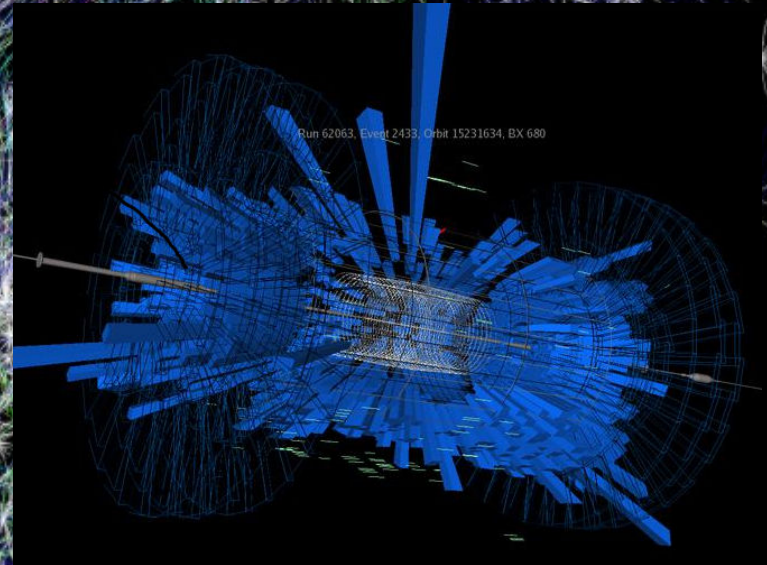
ROOT: C++ based framework

• Mean for 3 dimensional designing with capable mathematical support.

AIRROOT:

• Every version contains the up-to-date schematics of the ALICE detector.

• The physical behavior of particles are simulated by





PART II.

GP-GPU applications in the
CERN GRID

GP4GPU

version

General Purpose-Graphics Processing Unit

Advantages:

- 10-100X speed increase is achievable
- Better performance vs cost, wattage ratios

Backdraws:

- Longer development time.

- Not all problems can be parallelized.

Recent events

- OpenCL (Open Computing Language)

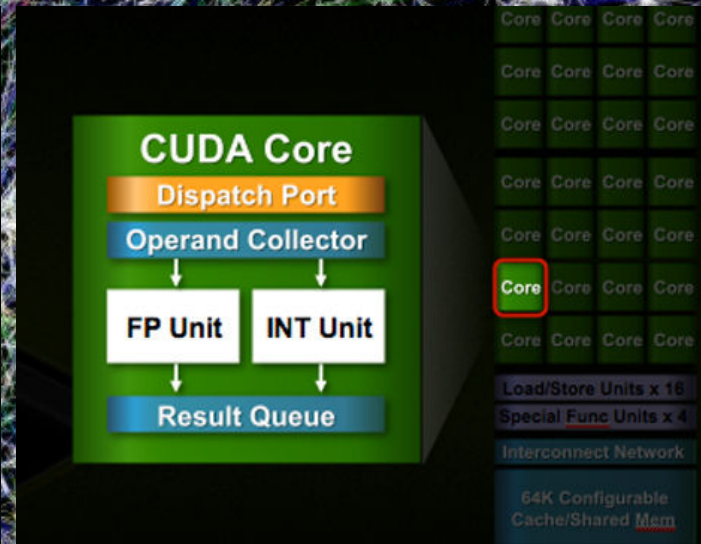
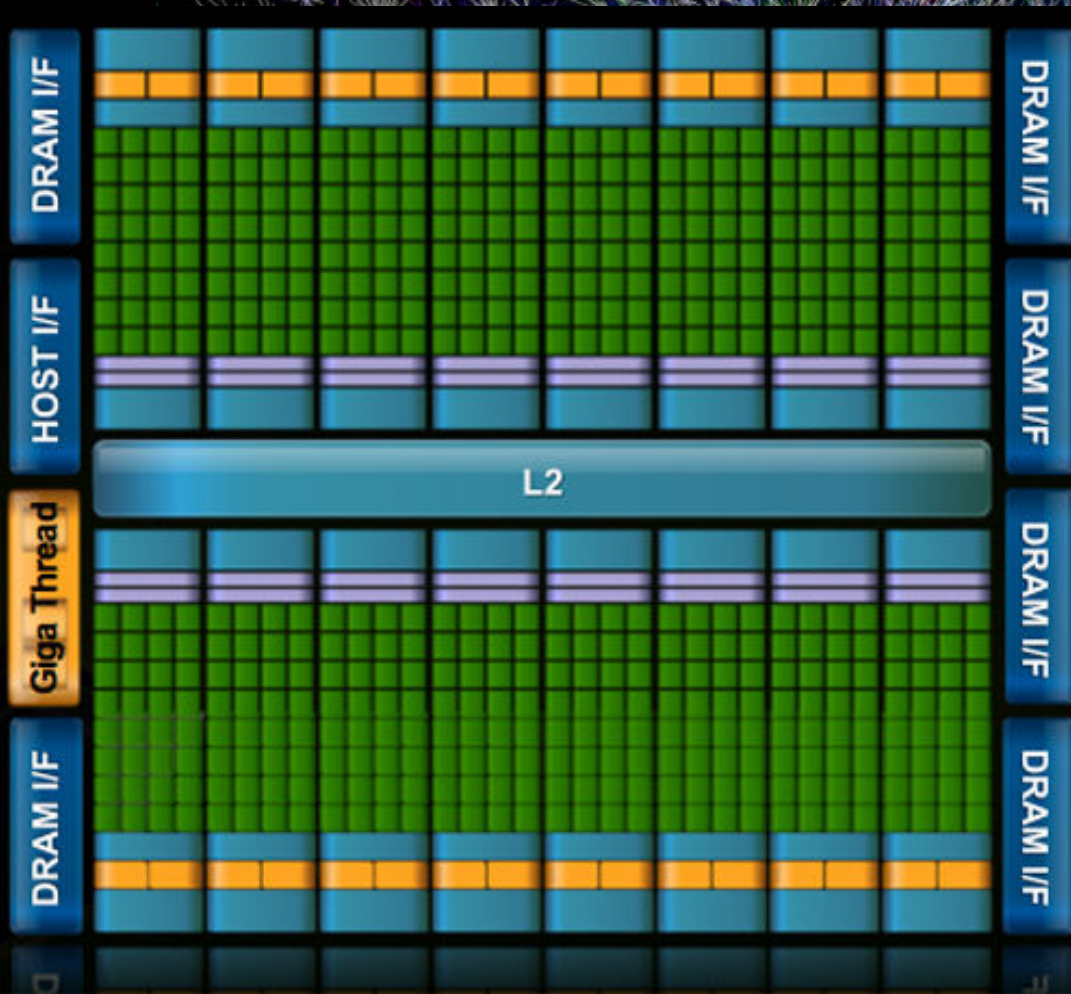
- DirectX 11 Compute Shader 5.0

New Cards Up the Sleeve

Two major GPU manufacturers introduced their new generation graphics cards that deliver massive computing power for parallelized algorithms.



Fermi (GT300) Architecture

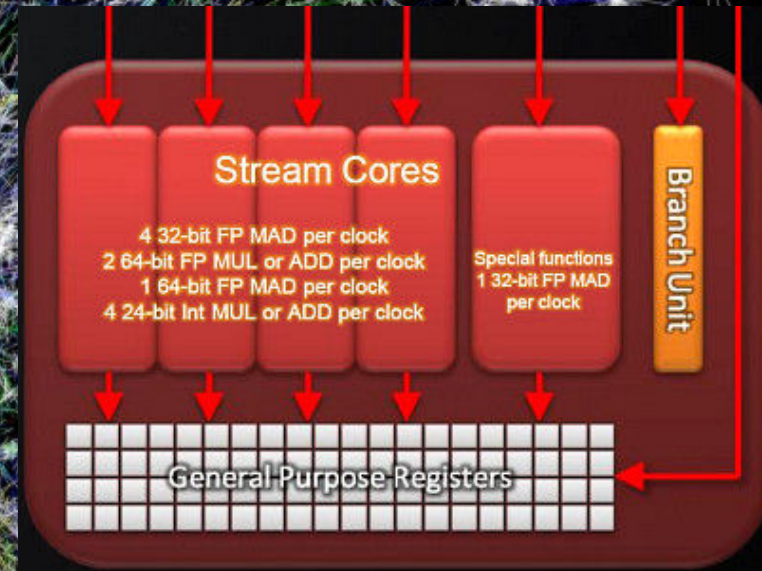
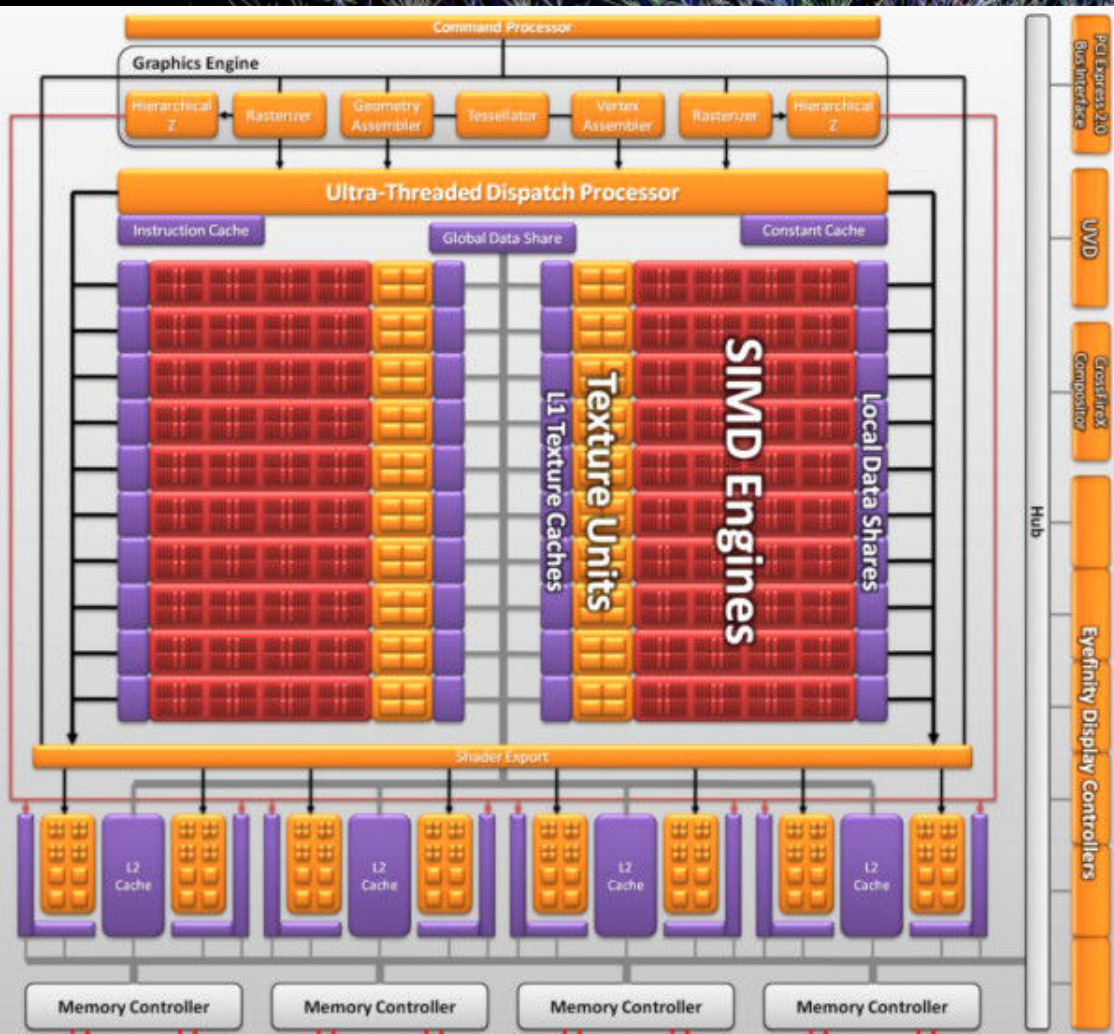


- The C2075 Tesla card will feature 512 CUDA cores, capable to run a single thread execution.
- Peak compute performance: 1600 GFLOPS

• 160 GFLOPS per Second

• 160 GFLOPS per Second (130 GFLOPS SP/DP)

Vyres (RV870) Architecture



- The AMD ATI Radeon R7 260 features 1600 stream processors, each able to execute 4 stream operations
- Peak performance of 2.700 GFLOPS

RIMKI GPU test cluster

- One machine with 3 GTX295 (dual core) GPUs
- Acquisition of 2 new high-end desktop configurations in rack mounts:
 - Intel Core-i7 quad-core 2.66 GHz processor
 - 12GB RAM
 - 3 high-speed (x16 PCI-E) slots
 - GPUs
- One machine will be equipped with AMD Radeon 5970 (dual core) GPUs for general computing in the near future. Several NVIDIA Tesla C2070 cards for GPU

Summary

The RMKI GRID has been functioning since 2003
ALICE computations running since 2006; from this
year at even larger scales.

The xrootd based ALICE dedicated storage has
been working since this year Q1.

Fully accomplishing the directives of a T2 site.

At the end of Scientific Linux 5 migration, one
step away from data taking (thx to Szabolcs Herceg)

Scientific activity; TDK work has just started

Animations

▶ [A simple 2D animation engine](#) (5B) (GitHub) (tutorial)
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