SMNanoS: Submitting and Monitoring Nanoelectronic Simulations in the MOSFET VO

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Outline

- Introduction.
- MOSFET VO Infrastructure.
- Description of the Job Submission and Monitoring Application, SMNanoS.
- Results: Testing the MOSFET VO Resource Centres.
- Conclusions and Future Work.

Introduction

End of Traditional Scaling Era

- "Challenges and Innovations in Nano-CMOS Transistor Scaling", Presentation by Intel Fellow Tahir Ghani.
- End of traditional scaling era 2003. Lasted $\sim$ 40 years.

Introduction

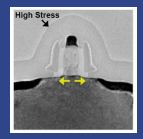
End of Traditional Scaling Era

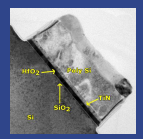
Challenges

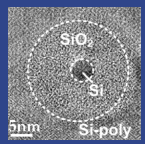
- High Speed. 

- Integration. 
- Power Save. 

How can Moore's Law continue?

- Strained Silicon. 

- Hi-K. 

- Mutigate Devices. 

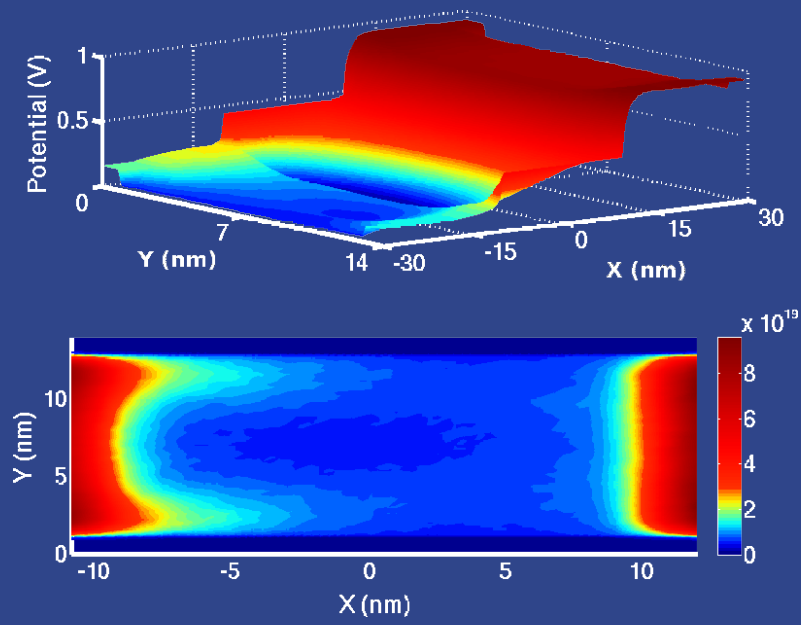
- SOI Devices. 

Introduction

- The next creation of the EGI based on NGIs is giving a boost to the NGI development.
- The grid infrastructure of each country will be run by National Grid Initiatives.
- The Spanish NGI (es-NGI) is supported by the Spanish Network for e-Science.

Introduction

- MOSFET VO belongs to Application Area of es-NGI.
- It was created in 2009 to perform semiconductor device simulations using the grid infrastructure of the es-NGI.
- Nowadays, this VO is adapting the nanoelectronic devices simulators to grid infrastructure.
- Also, it is trying to make a job submission and monitoring system based on GLite easier.



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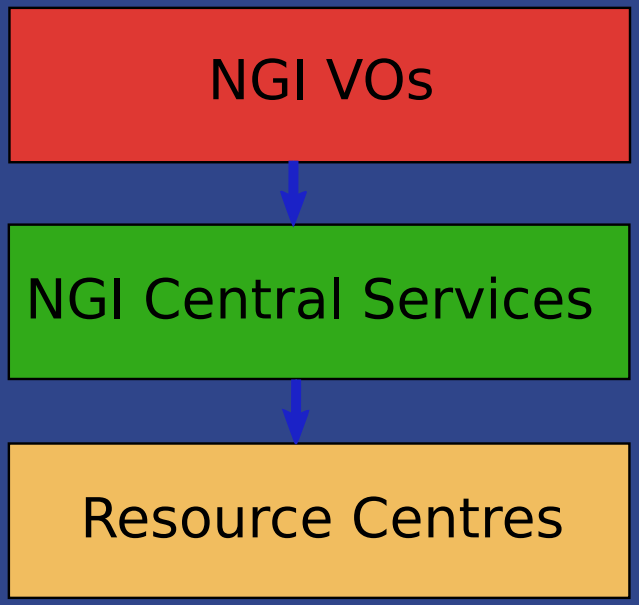
MOSFET VO Infrastructure

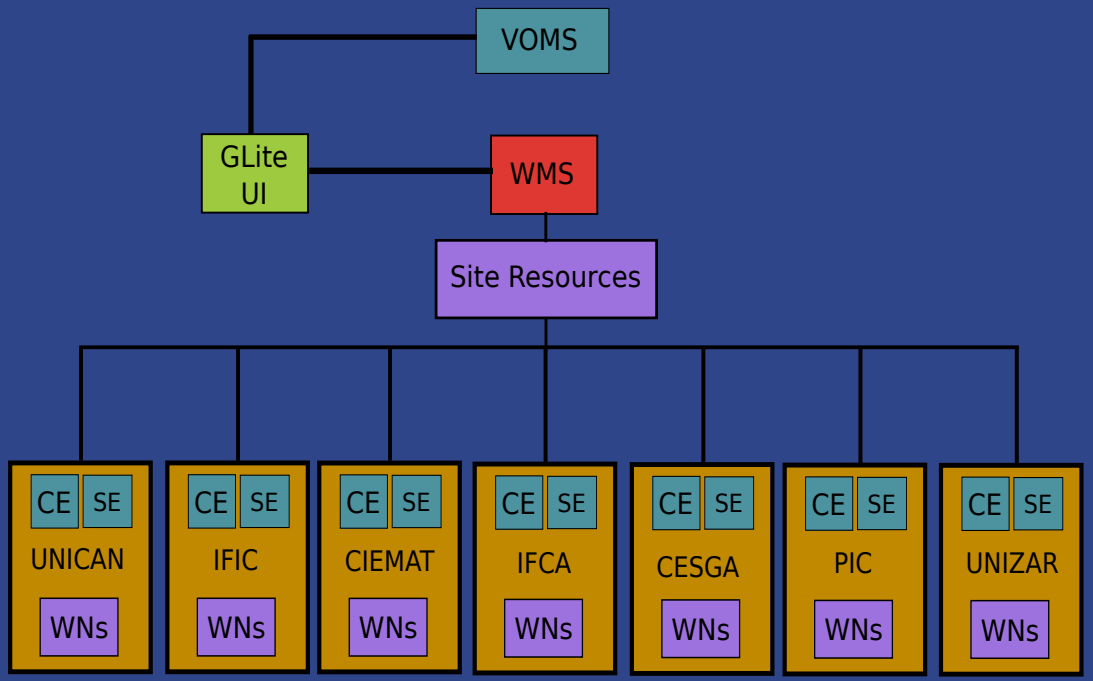
Based on es-NGI central services:

- **Information Service**: provides the state of the resources to the resource broker.
- **Resource Broker**: submits jobs to the resource centres.
- **VOMS**: stores the information about VOs belonging to es-NGI.
- **Storage**: Distributed between the resource centres and available for all VO.
- **File Catalogue**: Localises the stored files.



Moreover, this infrastructure relies on monitoring and accounting services.

MOSFET VO Infrastructure



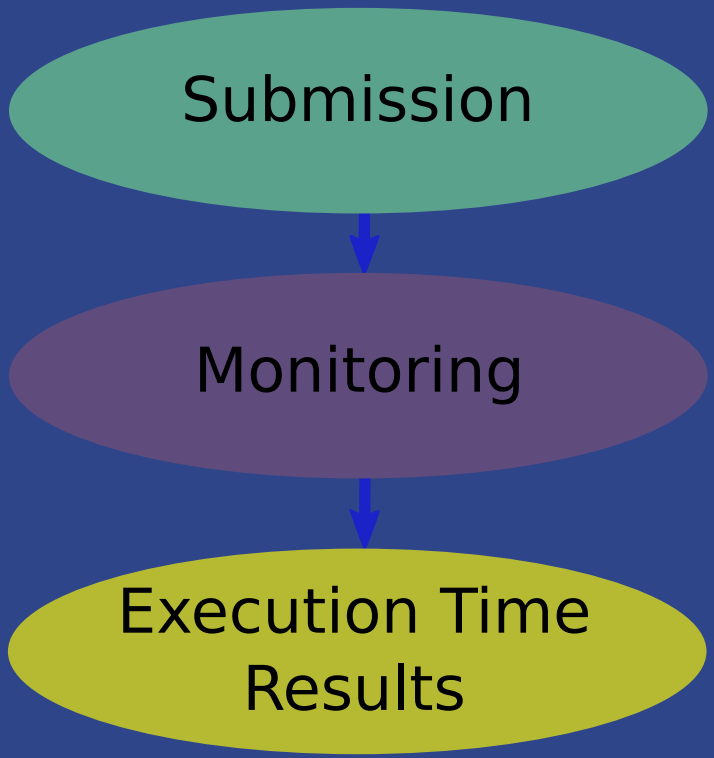
- Based on GLite middleware.
- Compatible with other grid initiatives such as EGEE or EELA.

Information obtained from *lcg-infosites* command.

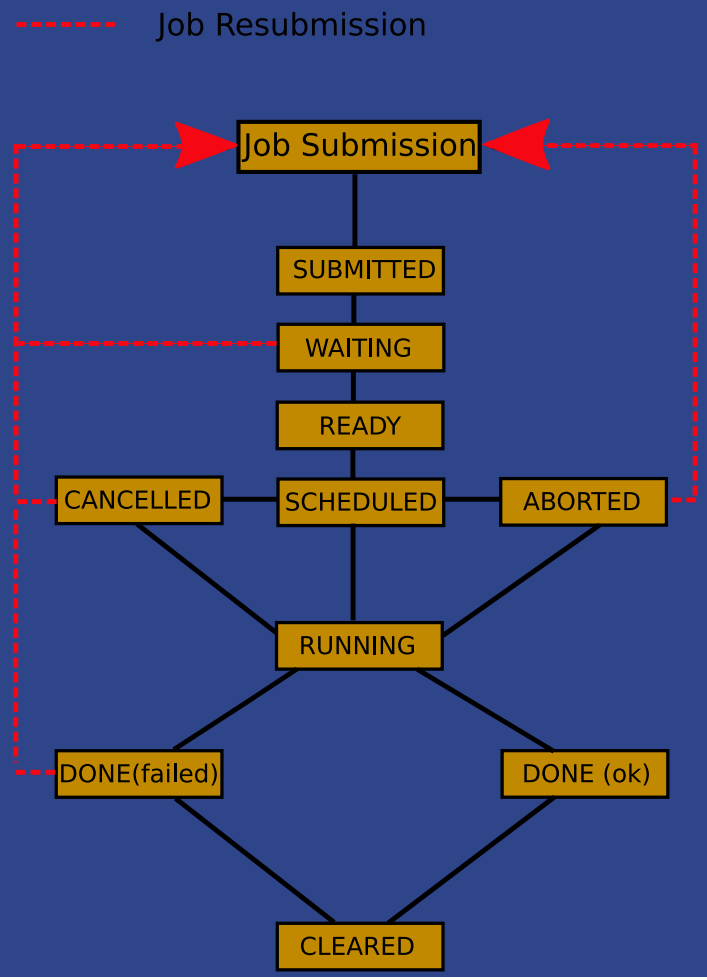
# Cores	Res. Centre
1378	PIC
1616	IFCA
848	IFIC
284	CIEMAT
340	CESGA
148	UNICAN
22	UNIZAR
Total #Cores	4636

SMNanoS Description.

Command line user interface may be a problem for MOSFET VO users. A Python application has been developed to submit and monitor jobs.



Functionality levels.



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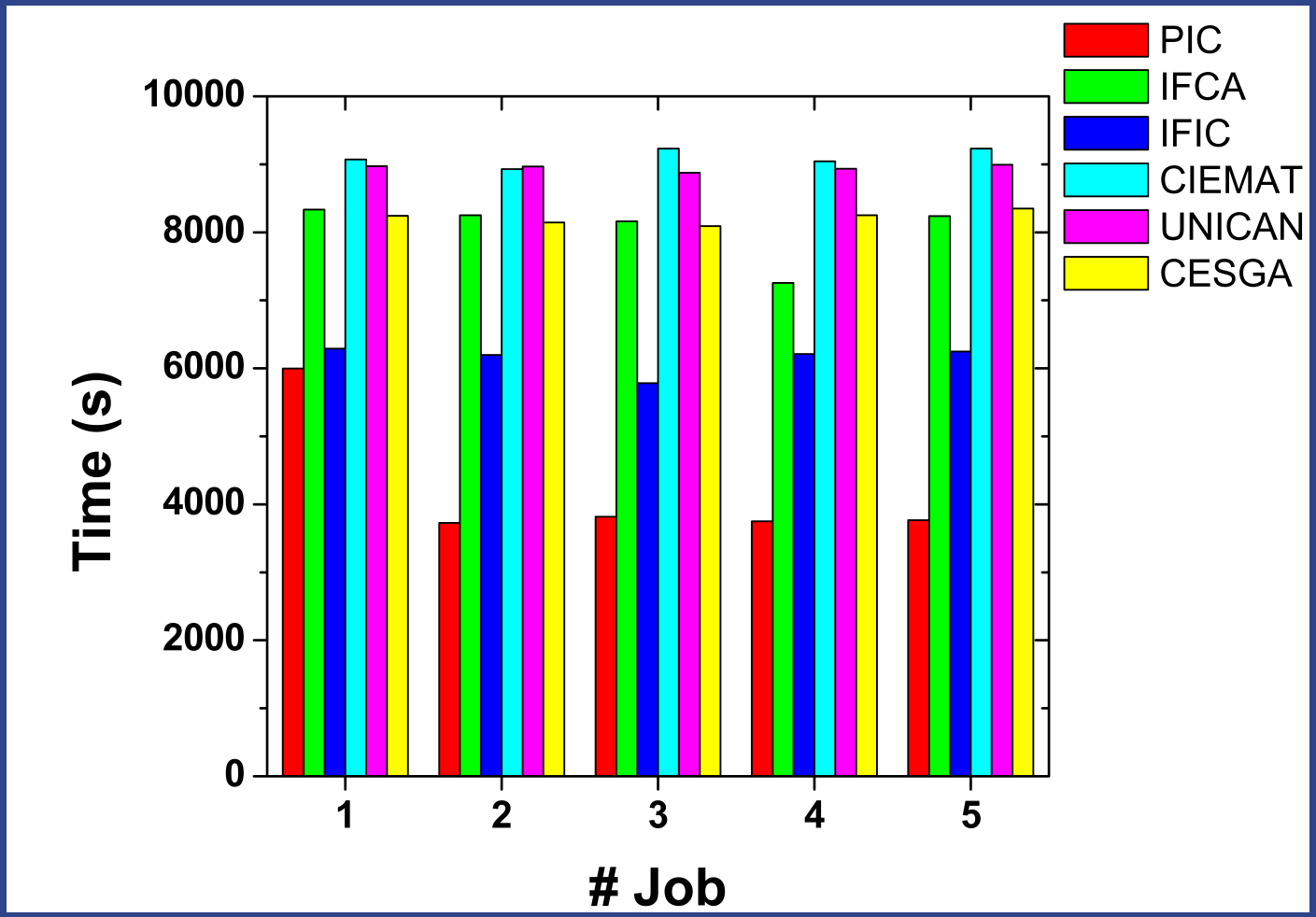
Results: Testing the MOSFET VO Resource Centres.

Test Simulation

- We have simulated a job collection with 5 jobs for testing the resource centres.
- Each job simulates a 2 ps length stationary state of a 2D DGSOI MOSFET.
- The execution script of each job saves the execution time, cpuinfo and kernel characteristics of the WN in the SE.
- These simulations were submitted to the resource centres that support the MOSFET VO except for Unizar.
- Simulation results enable us to evaluate the influence of the resource centres heterogeneity on the execution time.

Results: Testing the MOSFET VO Resource Centres

Simulation Results



Execution time of each job of each resource centre.

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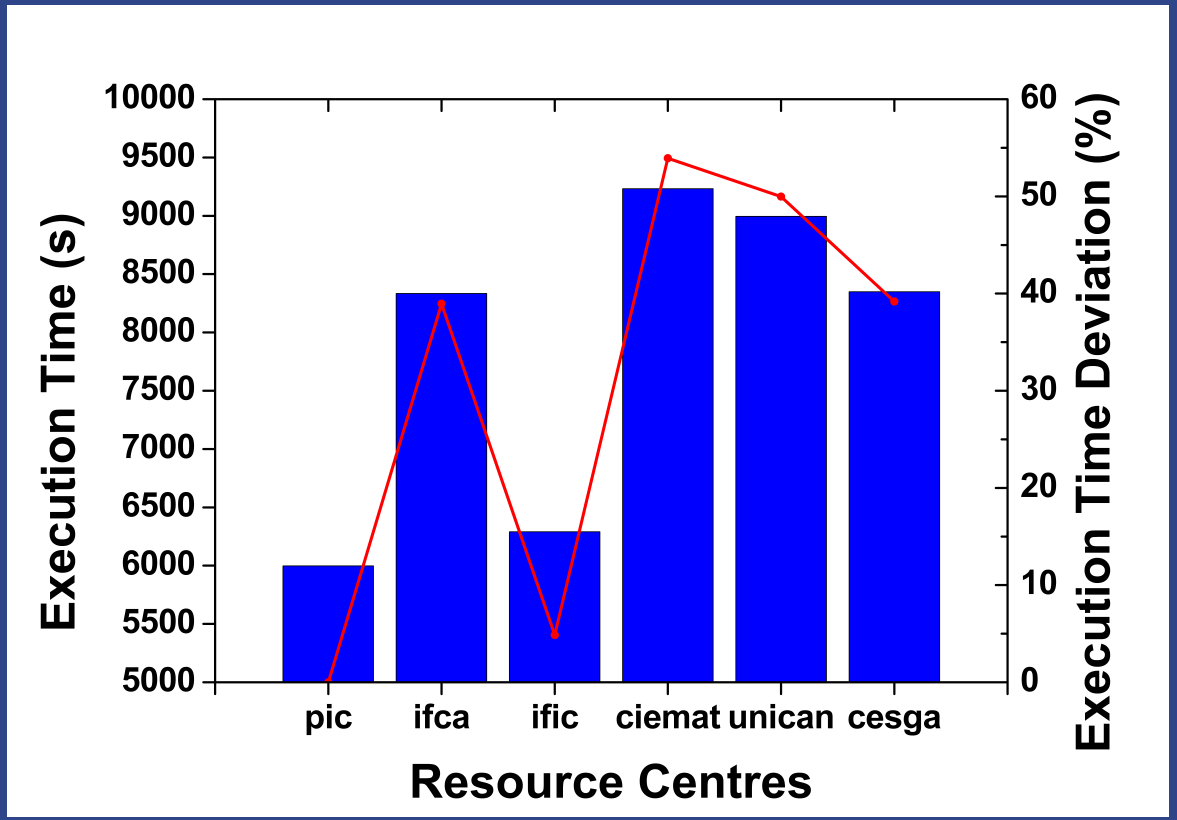
Results: Testing the MOSFET VO Resource Centres

Simulation Results



Execution time deviation between job collections. Execution time of a job collection = the slowest time of the jobs belonging to the collection.

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Results: Testing the MOSFET VO Resource Centres.

Simulation Results

# Res. Centre	CPU	Architecture
PIC	Xeon L5420 2.50 GHz	x86_64
	Xeon L5530 2.40 GHz	x86_64
IFCA	Xeon E5345 2.33 GHz	x86_64
IFIC	Xeon E5420 2.50 GHz	x86_64
CIEMAT	Opteron270 2.0 GHz	i686
UNICAN	PentiumD 3.0 GHz	x86_64
CESGA	Pentium4 3.20 GHz	i686

Processor models of the WNs for each resource centre.

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Conclusions

- The MOSFET VO was created in 2009 with in the framework of es-NGI and the EGI.
- The Main Objective is to develop the necessary tools which facilitate the use of the grid infrastructure for nanoelectronic simulations.
- Nowadays a job submission and monitoring system, based on GLite and independently of the command line UI, has been developed.
- The obtained results of the test simulations show execution time differences between resource centres up to 55%.
- However, thanks to the large amount of available resources this difference is not significant.
- The important challenge now is to adapt the execution time of our simulations to the batch system of the resource centres.
- In the future, we want to develop a web portal which allows the transparent use of the MOSFET VO.

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Thank you for your attention!

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