

MOS

Research Center of
Modelling, Optimization, and Simulation

HPC- UBB infrastructure

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Faculty of Mathematics and Computer Science

- Mathematics
 - *Academic Ranking of World Universities in Mathematics* – Babeş-Bolyai Univ. -> in top 200 Shanghai.
- Computer Science
 - An important interest and orientation on:
 - Model of computations
 - Parallel and distributed computing
 - Cloud and cluster computing;
 - GPGPU programming
 - ...
- New courses on these directions
- New Master Program:
High Performance Computing and Big Data Analytics

High Performance Computing demand

- 2013
 - a complex analysis of the computation requirements
 - analysis done at the university level
 - initiated by the Department of Computer Science
- The demand for an infrastructure of High Performance Computing comes from many research centers of UBB
 - Environment Science
 - Physics
 - Chemistry
 - Mathematics and Computer Science
 - Biology

MADECIP – "Dezvoltarea infrastructurii de cercetare pentru managementul dezastrelor bazat pe calcul de înaltă performanță "
(Project POSCEE no. ID 1862)

- UBB research infrastructure => modernization
 - innovator character
 - multi-disciplinary research

Main Goal

Developing

UBB Research Infrastructure

- Research centers and laboratories

Computational Infrastructure

- High Performance Computing

High Performance Computing Infrastructure

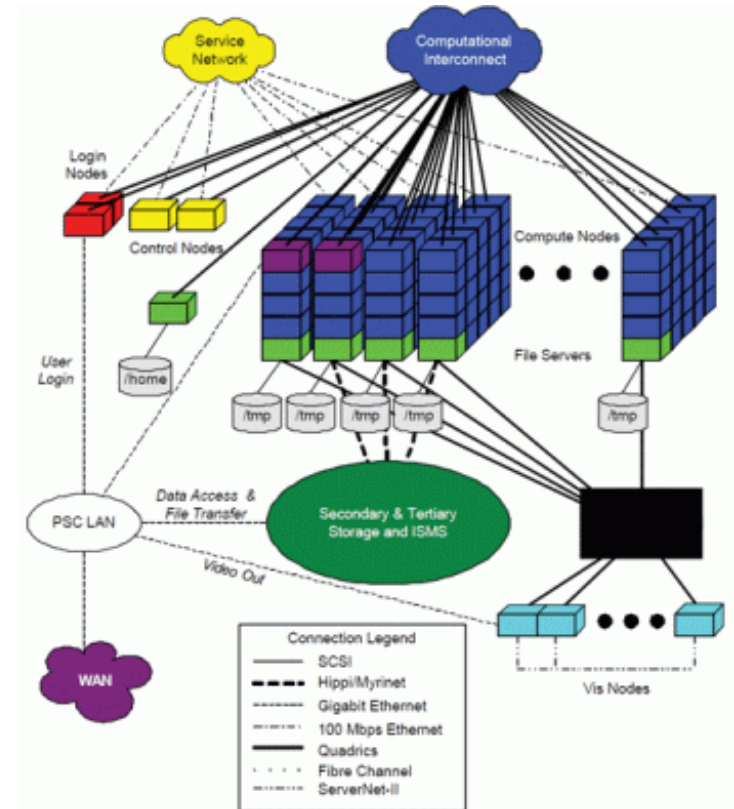
- The system would be used for different jobs types:
 - *computation intensive,*
 - *data intensive.*

=> The solution is based on hybrid architecture:

- *High Performance Computing system*
- *private cloud system*
- Two interaction platforms for easy satisfying:
 - the computation jobs,
 - storage requirements and
 - interaction.

High Performance Computing system Cluster structure

- Computation power:
 - Performance:
 - 60Tflops (Rpeak) and
 - 40Tflops (sustained performance).
- **HPC :**
 - Computation nodes ~50 (each with 2 proc. X 10 cores);
 - Computation nodes ~12 (each with 2 proc. X 10 cores + GPU);
 - Computation nodes ~12 (each with 2 proc. X 10 cores + Xeon Phi coprocessor)
 - Management nodes: 4
 - Connectivity: InfiniBand FDR (54Gbps)
- Private cloud system
 - Computation nodes ~10 (each with 2 processors X 10 cores);
 - Connectivity: Ethernet
 - Management nodes: 2
- Common storage component: 72TB raw
- Tape System.
- UPS



Typical Architecture for a cluster system
source: www.engisoft.net/activities/hpc2.html

MOS – Modeling, Optimization and Simulation

Research Center

<http://cs.ubbcluj.ro/MOS>

MOS – Modeling, Optimization and Simulation

Research activity :

- Mathematical modeling for various phenomena and processes.
- Numerical and statistical simulations
- Simulation of natural phenomena.
- Visualization and Image processing
- Models for parallel and distributed computing
- Domain Specific Languages
- Optimization →
 - Mathematical models
 - Software implementation
 - performance;
 - productivity

Applicative Research – (not restrictive view)

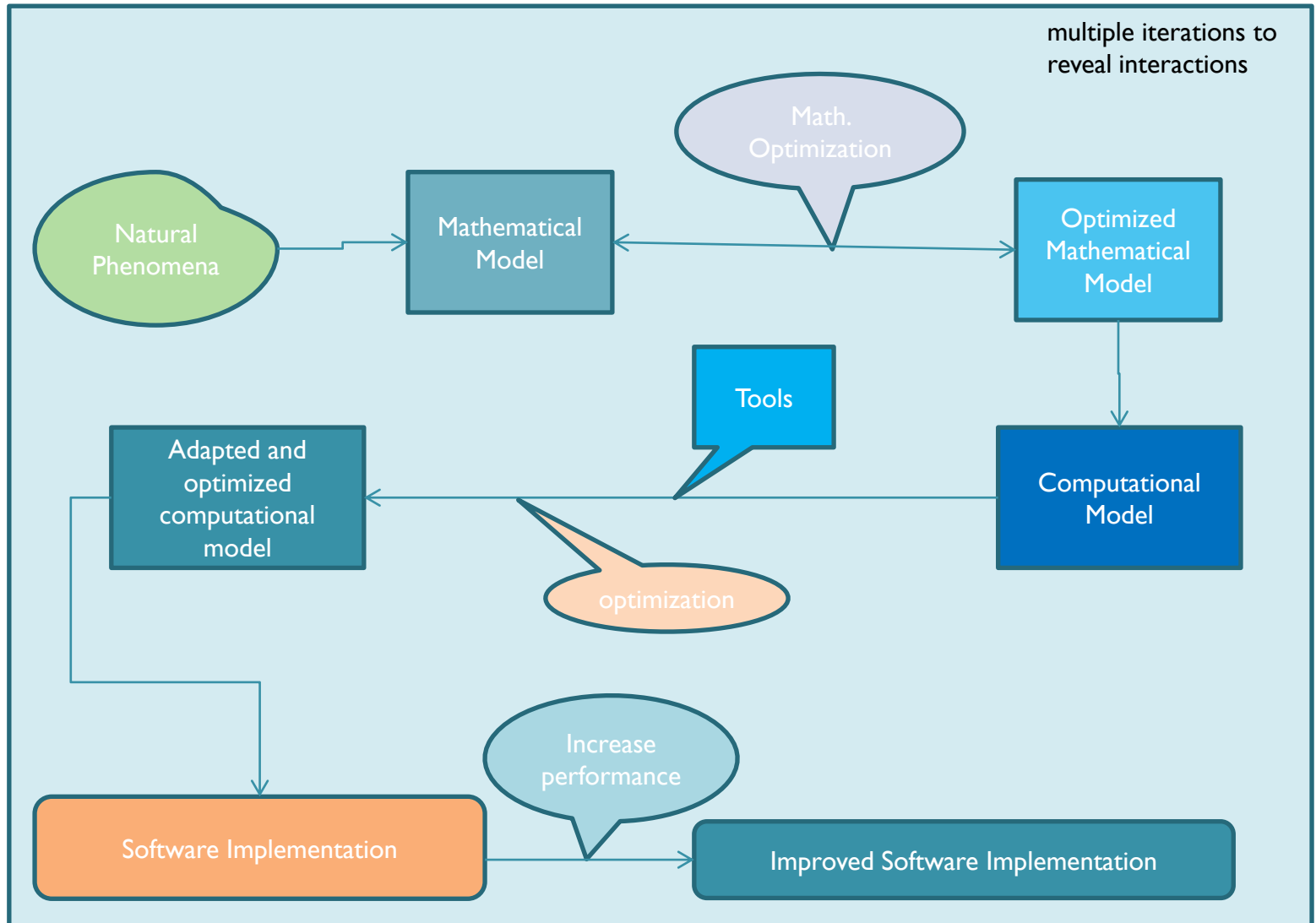
- Modelling and Simulation for:
 - tsunamis, analysis, floods, dangerous substances overflowing, barrage breakdown, dangerous substances dispersion in fluid or porous environments etc.
- Big Data Analytics – for specific data needed in disaster managements:
 - web interrogation
 - big databases management
- GIS maps
- Satellite image processing.
- Decision Support Tools – DDST
- Tools for communications, informing and alarming in disaster management domain.
- Simulation /Visualization of different scenarios
 - different disaster types.
- Frameworks and libraries development based on high performance computation.

Collaboration

- ***Faculty of Environment Science***
- ***Faculty of Economics***
- ***Faculty of Physics***
- ***Faculty of Chemistry***
- ***Faculty of Biology***

...through Models to Performance...

a simplified view...



MOS Intend

mathematics and computer science – as a glue -

- Projects
 - different research areas
- Collaborations
 - other similar national and international centers
- Development
 - increase the number of researchers
 - increase the number of involved master and PhD students
 - improvement of the infrastructure
- MOS – interconnection point between different disciplines