



INSTITUTE OF INFORMATION AND
COMMUNICATION TECHNOLOGIES
BULGARIAN ACADEMY OF SCIENCE

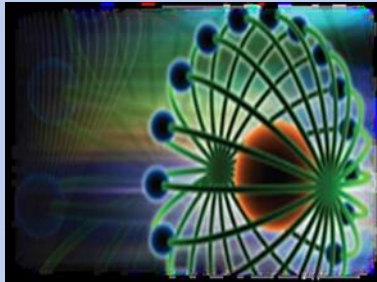


E-Infrastructures Development

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National Roadmap for Research Infrastructures 2017-2023



National Center for High Performance and Distributed Computing (NC HP&DC)

➤ Coordinator

Institute of Information and Communication Technologies

➤ Location

Institute of Information and Communication Technologies

➤ Financial coordinator

Ministry of Education and Science

➤ Participation in European Infrastructures

EGI and PRACE

AVITOHOL at IICT-BAS

150x HP ProLiant SL250s Gen8 each with
 2x Intel Xeon E5-2650 v2 (8C/16T),
 64 GB DDR3-1866 RAM and
 2x Intel Xeon Phi 7120P
 6x HP ProLiant DL380p Gen8 nodes with
 2x Intel Xeon E5-2650v2 (8C/16T),
 64 GB DDR3-1866 RAM
 Infiniband 56 Gb/s FDR
 Storage system with 96 TB



Total Performance:
 RPeak: 412.3 TFlop/s
 RMax: 264.2 TFlop/s
 Top 500 position: 389

HPCG cluster at IICT-BAS

36 blades BL 280c(2x Intel X5560(4C/8T); 24GB DDR3);
 8 management nodes HP DL 380 G6(2x Intel
 X5560(4C/8T); 32GB DDR3);
 2 HP ProLiant SL390s G7(2x Intel E5649(6C/12T); 96GB
 DDR3)
 8x nVidia TESLA M2090 per server;
 2 HP SL270s Gen8 (2x Intel Xeon E5-2650 v2(8C/16T);
 128GB DDR3)
 Total number of Xeon Phi 5110P coprocessors: 9
 Total 132TBs of system storage



TOTAL PERFORMANCE:
 RPEAK: 22.94 TFlop/s

NCSA IBM Blue Gene/P

8192 PowerPC 450 processors
 4TBs of system memory
 12TBs of system storage
 IBM proprietary interconnect with
 2.5 µs latency and 10GBps bandwidth

TOTAL PERFORMANCE:
 RPEAK: 27.85 TFlop/s
 RMAX: 23.45 TFlop/s



PHYSON at Sofia University

53 Intel Xeon x86_64 processors
 524Gibs of system memory
 6.5TBs of system storage
 2x nVidia Tesla M2090 graphics processors



TOTAL PERFORMANCE:
 RPEAK: 3.57 TFlop/s
 RMAX: 3.22 TFlop/s

MADARA at IOCCP-BAS

54 Primergy RX200 S5 servers with
 2 Intel Xeon E5520(4C/8T) each
 and a total of 800GB DDR3 1066MHz
 20Gb/s DDR Infiniband
 108TB System Storage by Fujitsu FibreCat SX100

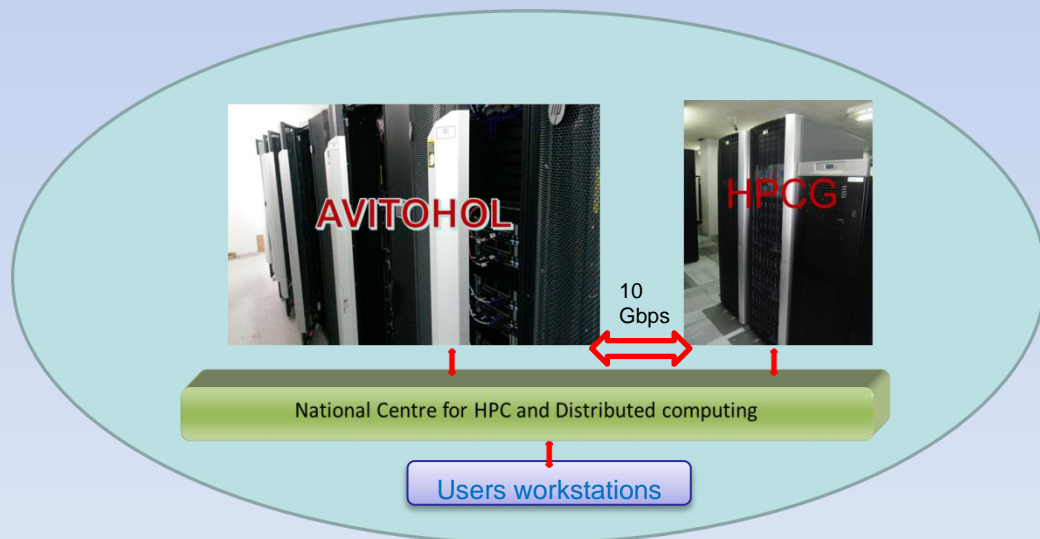
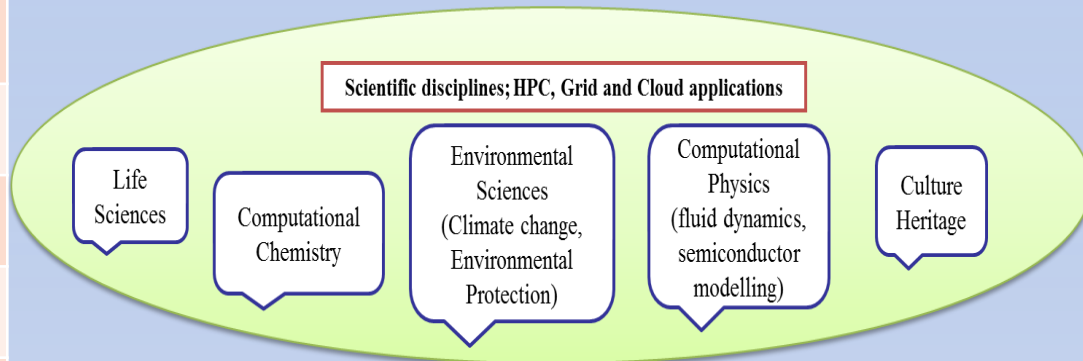


**150 HP Cluster Platform SL250S GEN8 servers
with 2 Intel Xeon E 2650 v2 CPUs and 2 Intel Xeon
Phi 7120P coprocessors**

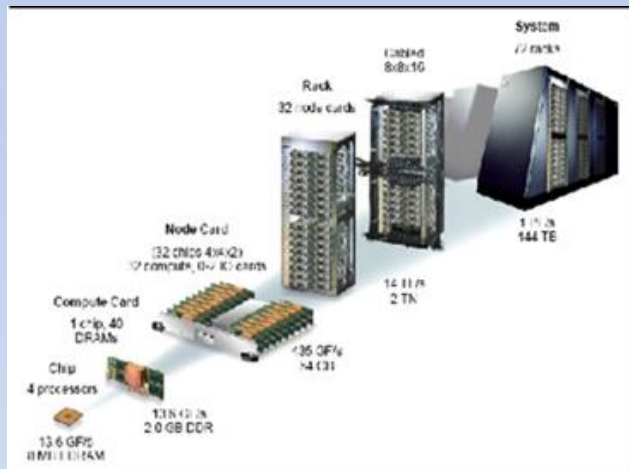
Site	IICT-BAS/Avitohol
Manufacturer	Hewlett-Packard
Cores	20700
Interconnection	FDR InfiniBand
Theoretical Peak Performance	412.3 Tflop/s
RMAX Performance	264.0 Tflop/s
Memory	9600 GB
Operation System	Red Hat Enterprise Linux for HPC
Storage capacity	96 TB SAN

Top500 List on 389 place (Nov 2015)

<http://www.top500.org/system/178609>

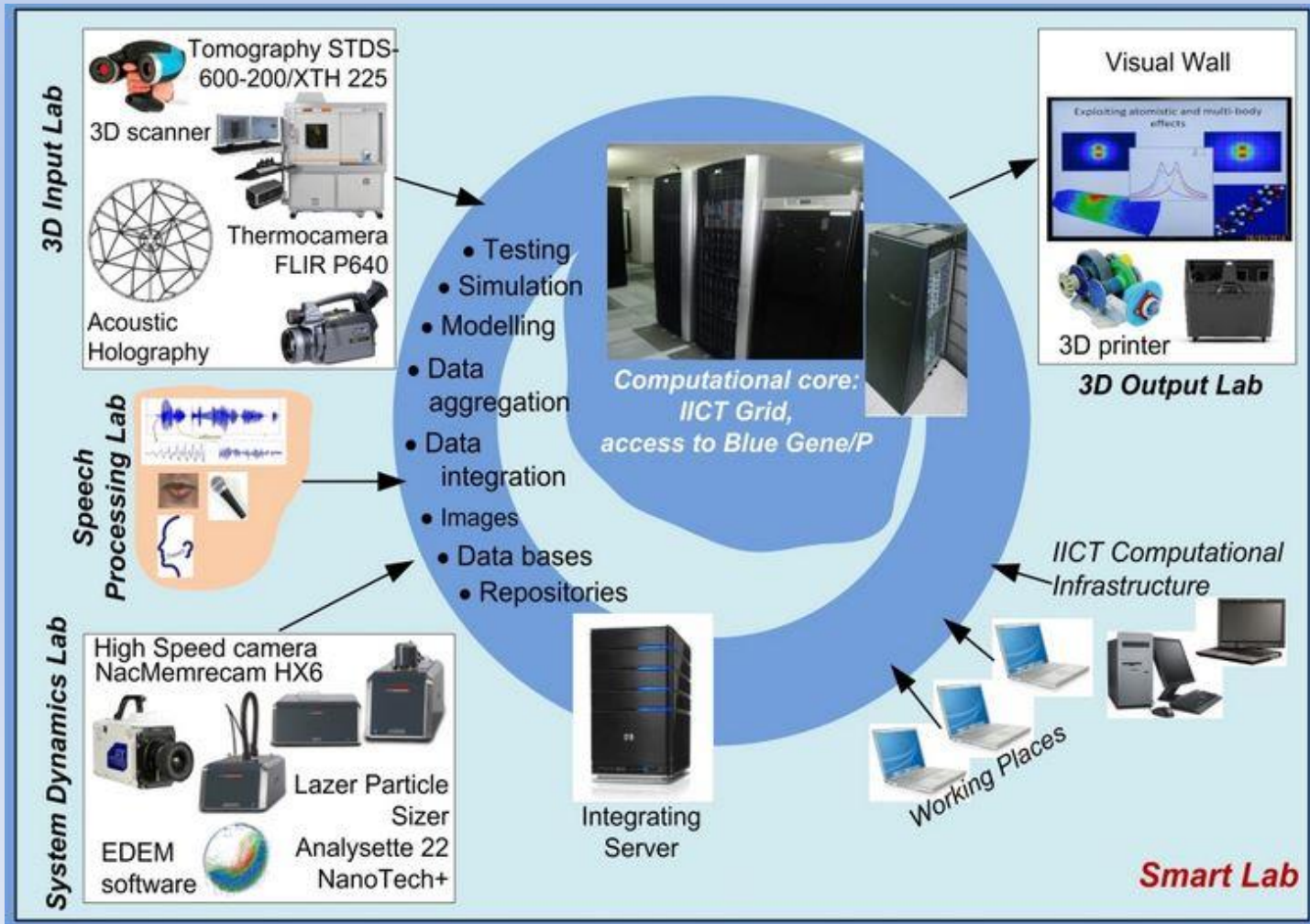


- Consortium: IICT – BAS (coordinator), SU, TU – Sofia, MU – Sofia, IM – BAS, NIGGG - BAS
- Infrastructure: supercomputer IBM Blue Gene/P at NSCC, HPC Cluster at IICT – BAS



- Target: to create a critical mass of highly qualified scientists
- Core team: more than 80 participants, 56% of them - PhD students and young researchers

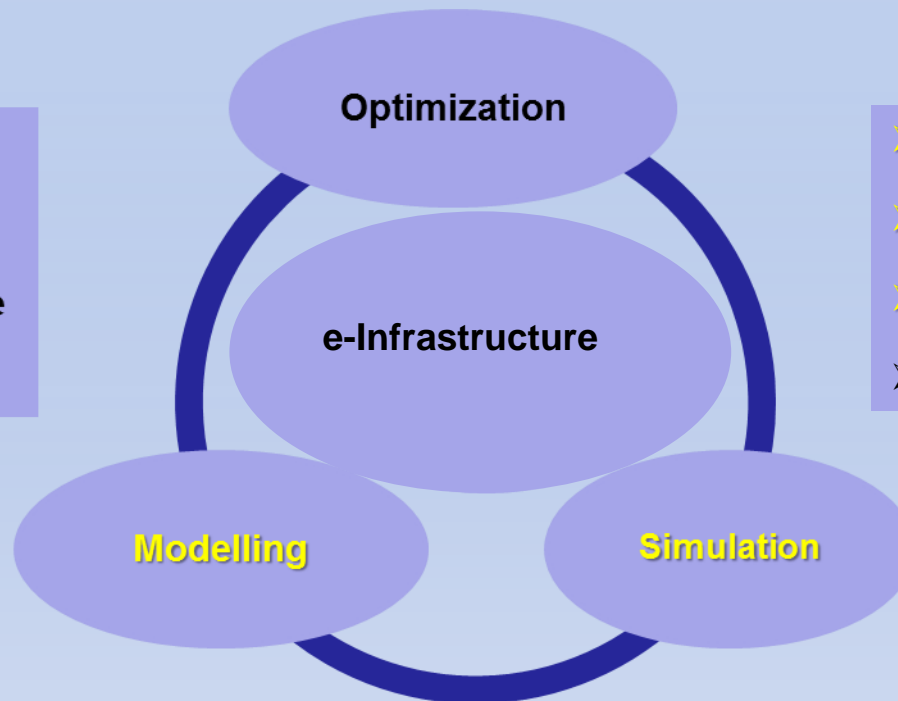
The synergy between advanced digitalization tools and advanced computing is among the Industry 4.0 challenges.



- South-Eastern European GRid-enabled eInfrastructure Development (SEE-GRID), Coordinator - GRNET, Greece, 10 partners, FP6-RI-002356
- South-Eastern European GRid-enabled eInfrastructure Development-2 (SEE-GRID-2), Coordinator - GRNET, Greece, 10 partners, FP6-RI-031775
- SEE-GRID eInfrastructure for regional eScience (SEE-GRID-SCI), Coordinator - GRNET, Greece, 45 participants, FP7-INFRA-211338
- South East European Research Area for e-Infrastructures (SEERA-EI), Coordinator - GRNET, Greece, 18 participants, FP7-INFRA-228052
- High-Performance Computing Infrastructure for South East Europe's Research Communities (HP-SEE), Coordinator - GRNET, Greece, 15 participants, FP7-INFRA-261499
- Virtual Research Environment for Regional Interdisciplinary Collaboration in Southeast Europe and Eastern Mediterranean (VI-SEEM), Coordinator - GRNET, Greece, 15 partners, H2020-EINFRA-2015-1

- Centre of Excellence for Mathematical Modeling and Advanced Computing (MMAC), Coordinator - IICT-BAS, Bulgaria, 3 partners, H2020-WIDESPREAD-2014-1
- Supercomputing Expertise for SmAll and Medium Enterprise Network (SESAME-NET), Coordinator - High Performance Computing Wales, UK; 10 partners, H2020-EINFRA-2014-2
- Engaging the EGI Community towards an Open Science Commons (EGI-Engage); Coordinator - EGI.eu, The Nederland; 43 partners, H2020-EINFRA-2014-2
- Virtual Research Environment for Regional Interdisciplinary Collaboration in Southeast Europe and Eastern Mediterranean (VI-SEEM), Coordinator – GRNET, Greece, 15 partners, H2020-EINFRA-2015-1
- e-Infrastructure Reflection Group Support Programme5 (e-IRGSP5), Coordinator: University of Hannover, Germany, 9 partners, H2020-INFRA-SUPP-2016-1

- Big Data
- **Deep Learning**
- Machine Learningce
- Internet of Things



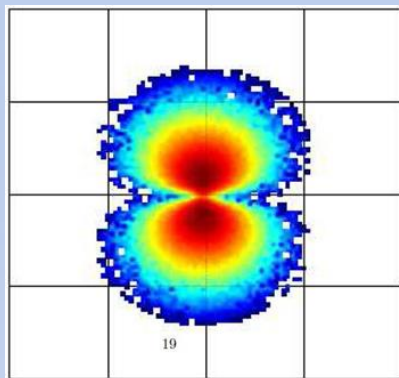
- **Supercomputing**
- **Cloud Computing**
- **Distributed Computing**
- **Sensor Networks**

- **3D Digitalization**
- **3D Visualization**
- **3D Prototyping**

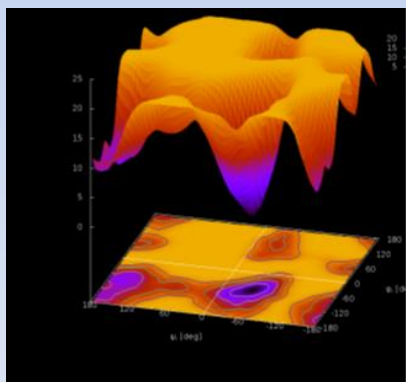
The important feature of MSODE is the novel vision to describe, to structure, to integrate and to interpret across disciplines in the rich data environment.

Our current HPC applications in **Computational Sciences** include activities in:

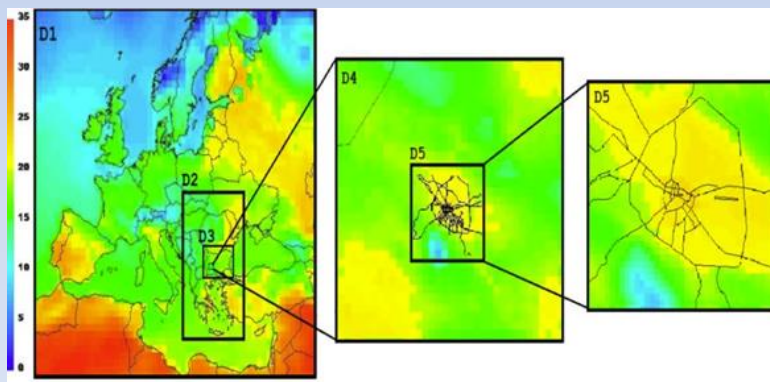
- Computational Mathematics;
- Computational Mechanics;
- Informatics;
- Computational Physics;
- Computational Chemistry;
- Computational Biology;
- Environmental Sciences.



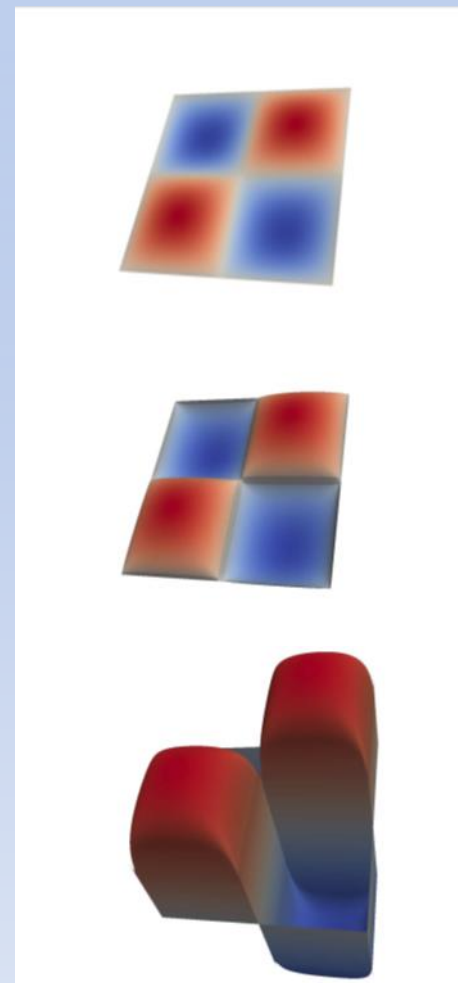
Quantum Computing



Molecular Dynamics



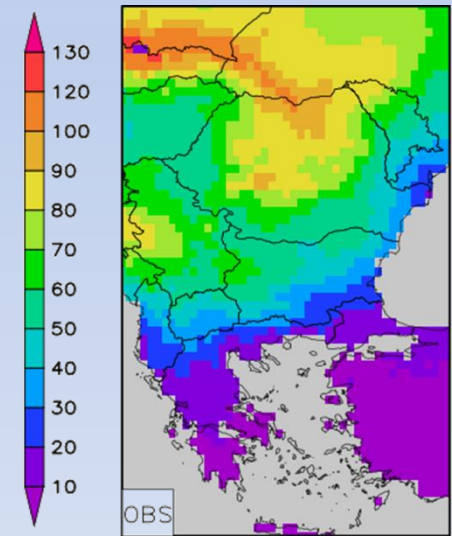
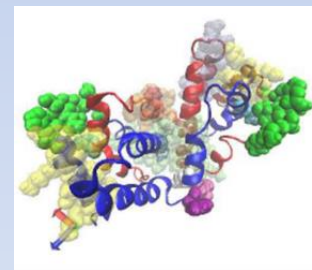
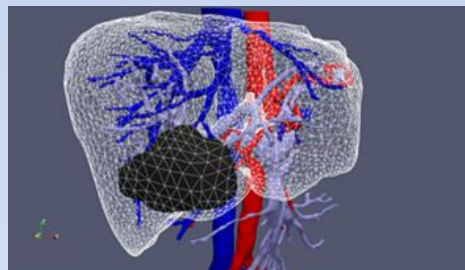
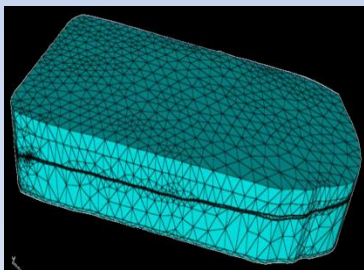
Zooming in Air Pollution Studies



Super Diffusion

Currently, our HPC experience is mostly related to topics of **technical computing**, including, e.g.,:

- Weather prediction and climate modelling;
- Simulation of natural hazards;
- Drug discovery;
- Industrial flows in porous media;
- Biomedical engineering;
- Advanced image processing of 3D voxel (CT) data;
- Complex financial modelling.



THANK YOU FOR YOUR ATTENTION !