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
**AVITOHL 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

**HPCG cluster at IICT-BAS**
- 36 blades BL 280G(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 S110P 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

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

**TOTAL PERFORMANCE:**
- **Rpeak**: 27.85 TFlop/s
- **Rmax**: 23.45 TFlop/s

**PHYSION at Sofia University**
- 53 Intel Xeon x86_64 processors
- 524GBs 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
### 150 HP Cluster Platform SL250S GEN8 servers with 2 Intel Xeon E 2650 v2 CPUs and 2 Intel Xeon Phi 7120P coprocessors

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site</td>
<td>IICT-BAS/Avitohol</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>Hewlett-Packard</td>
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<tr>
<td>Cores</td>
<td>20700</td>
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<tr>
<td>Interconnection</td>
<td>FDR InfiniBand</td>
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<tr>
<td>Theoretical Peak Performance</td>
<td>412.3 Tflop/s</td>
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<tr>
<td>RMAX Performance</td>
<td>264.0 Tflop/s</td>
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<tr>
<td>Memory</td>
<td>9600 GB</td>
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<tr>
<td>Operation System</td>
<td>Red Hat Enterprise Linux for HPC</td>
</tr>
<tr>
<td>Storage capacity</td>
<td>96 TB SAN</td>
</tr>
</tbody>
</table>

**Top500 List on 389 place (Nov 2015)**

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

**Scientific disciplines:** HPC, Grid and Cloud applications

- **Life Sciences**
- **Computational Chemistry**
- **Environmental Sciences** (Climate change, Environmental Protection)
- **Computational Physics** (fluid dynamics, semiconductor modelling)
- **Culture Heritage**

**National Centre for HPC and Distributed computing**

**Users workstations**
CoE on Supercomputing Applications: SuperCA++, Bulgarian NSF

- 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
IICT-BAS in H2020 Related Projects

- 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-INFRASUPP-2016-1
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.
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!