E-SCIENCE EFFORTS IN TURKEY

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TURKEY OVERVIEW

Population: 77.6 M (18th in the world)
Most Populous City: Istanbul (14 M, )
Capital City: Ankara

Istanbul Area
HIGHER EDUCATION in TURKEY

• In Turkey, Universities are of two types:
  - State
  - Foundation (private)
• Turkey has 185 universities (109 state, 76 foundation)
• Istanbul has 52 universities (11 state, 41 foundation)
• Higher Education Council (YÖK) is responsible for the supervision of universities

• Universities offering graduate degrees in Computational Science and Engineering
  - Bogazici University
  - Istanbul Technical University
  - Koc University

• Rankings of Turkish Universities in THEWUR (2014-15)
• https://www.timeshighereducation.co.uk/world-university-rankings
  - Rank 85 : Middle East Technical University
  - Rank 139 : Bogazici University
  - Rank 165 : Istanbul Technical University
  - Rank 182 : Sabancı University
  - Rank 201-225: Bilkent University
  - Rank 301-350: Koc University
HIGHER EDUCATION in TURKEY

- Recently university engineering programs are increasingly seeking accreditation evaluations from organizations like ABET (USA) and MUDEK (Turkey), EUR-ACE.
- Higher Education Council (YÖK) is also in the process of making accreditation evaluations mandatory.
- Criteria: (e.g. from ABET)

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**Criterion 3. Student Outcomes**

The program must have documented student outcomes that prepare graduates to attain the program educational objectives.

Student outcomes are outcomes (a) through (k) plus any additional outcomes that may be articulated by the program.

- (a) an ability to apply knowledge of mathematics, science, and engineering
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data
- (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- (d) an ability to function on multidisciplinary teams
- (e) an ability to identify, formulate, and solve engineering problems
- (f) an understanding of professional and ethical responsibility
- (g) an ability to communicate effectively
- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- (i) a recognition of the need for, and an ability to engage in life-long learning
- (j) a knowledge of contemporary issues
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

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- E-Science courses and projects which involve substantial multi-disciplinary material can help satisfy criteria on multi-disciplinary work skills.
MAIN E-INFRASTRUCTURE PROVIDERS

TUBITAK-ULAKBIM (Turkish Academic Network and Information Center)
• Main e-Science resource provider
• **TRUBA (Turkish National e-Science e-Infrastructure)**: offers research network, high performance computing, grid, cloud, data-intensive scientific computing and data warehousing services
• **Contacts**: Onur Temizsoylu, Feyza Eryol
• http://www.truba.gov.tr/eng/

UHEM (National High Performance Computing Center)
• Supercomputing resource provider
• Managed by ITU (Istanbul Technical University)
• **Contacts**: Ertuğrul Karaçuha, Enver Özdemir
• http://www.uhem.itu.edu.tr/
• In 2003, TUBITAK-ULAKBIM started to operate the high performance computing center
• Between 2006-2008, infrastructure is significantly expanded with the TUGA (Turkish National Grid Infrastructure/TR-Grid). TR-Grid National Grid Initiative members were: Tubitak-Ulakbim (coordinator), Bilkent, Bogazici, Cukurova, Erciyes, Istanbul Technical, Middle East Technical, Pamukkale Universities and Turkish Atomic Energy Authority
• In 2009, "TR-Grid e-Infrastructure Strengthening Research" project is presented to State Planning Organisation Research Infrastructure Call. This project, formerly called the TR-Grid to TRUBA until the end of 2011
• From 2012, on the continuation of the previous project "Strengthening the Turkish National e-Science e-Infrastructure" project is supported by the Ministry of Development
• During 2008-2010, TUBITAK-ULAKBIM, Bogazici University and Middle East Technical University participated in the major regional SEE-GRID-SCI e-Science project.
SOME TRUBA STATISTICS

- Registered users: 1130
- Universities served: 106
- Supported ARDEB projects: 31
- No. of publications: 570
- Used core-hours in 2014: 50M
- High performance storage: 2 Pbyte
- Available no. of cores: 10,000
- Total EU framework programme support: 2 M€
- National e-infrastructure projects: 3
- EU framework projects: 12
TRUBA PROJECTS
FP7 SEE-GRID-SCI: Development of virtual organizations, applications and services for earth science on grid e-Infrastructures for South Eastern Europe

SEE-GRID-SCI was coordinated by GRNET/Greece 2008-2010
FP7 SEE-GRID-SCI Seismology VO

Applications

Programming Tool (Data Iterators)

Distributed storage and indexing of data on grid using AMGA

Earthquake and seismic waveform data

SEE Country 1

Earthquake and seismic waveform data

SEE Country 2

... Earthquake and seismic waveform data

SEE Country n

NERIES / ORFEUS Datacenter

European Countries

EMSC Datacenter
FP7 SEE-GRID-SCI Seismology VO Achievements

- Massive regional seismic data collected and made available to VO users
- Diverse set of seismology applications deployed:
  - Seismic Data Server SDS (service)
  - Seismic Risk Assessment – SRA
  - Earthquake Location Finding – ELF
  - Massive Digital Seismological Signal Processing with the Wavelet Analysis-MDSSP-WA
  - Fault Plane Solution – FPS
  - Numerical Modeling of Mantle Convection – NMMC3D
- Special care was taken to develop high level tools that are easy to use by seismologists
- Successful collaboration and use of JRA1 applications services (SDSAS, AWT, PGRADE)
- Extensive use of grid services mainly for storage (AMGA, LFC)
- Successful international collaborations (e.g. with ORFEUS/NERIES)
METU SCIENCE GATEWAY (SCI-BUS) WORK

- **Contact:** Cevat Şener, Dept. of Computer Eng., Middle East Tech. University
- SCI BUS FP7 Project (2011-2014): SClence gateway Based User Support Provides WS-PGRADE/gUSE gateway framework and science gateway building technology
- Statistical Seismology Science Gateway: Provides seven statistical seismology functions to international seismology community
- METUWIND Gateway: Science gateway of METU Center for Wind Energy
- SimBusPro Gateway: simulation based optimization by utilizing SCI-BUS
CONFERENCE ACTIVITIES

• E-Science work carried out nationally are usually presented in the BASARIM conferences:
• Conference language is Turkish.
Bogazici University
TETAM: Telecommunications and Informatics Technologies Research Center

- Contact: Cem Ersoy, Dept. of Computer Eng., Boğaziçi University
- Members from many disciplines: Computer Eng. Electrical and Electronics Eng., Industrial Eng., Mechanical Eng., Earthquake Eng., Civil Eng., Geophysics
- Web: http://tetam.boun.edu.tr
- FP7 Firensense Project (http://www.firesense.eu/)

Goals:
- Create a national platform for inter-disciplinary research and applications in all areas related to telecommunications and informatics technologies,
- Build national and international collaboration including the industry in all areas related to telecommunications and informatics technologies,
- Organize research and education activities in all areas related to telecommunications and informatics technologies.
Bogazici University
Observatory and Earthquake Research Institute

- **Contact**: Mustafa Erdik
- Collect seismology data from all over Turkey
- Extensive international collaboration (ORFEUS, NERIES etc).
- [http://www.koeri.boun.edu.tr/](http://www.koeri.boun.edu.tr/)
Bogazici University
Center for Climate Change and Policy Studies

• **Contact:** Levent Kurnaz
• Leader of Region 8 Central Asia domain of WCRP-CORDEX
• [http://climatechange.boun.edu.tr/](http://climatechange.boun.edu.tr/)
• Uses RegCM application and data to do regional climate modeling.
SOME RESEARCH WORKS
PARALLEL UNSTRUCTURED MESH
GENERATION/REFINEMENT

• **Contact:** Can Özturan, Dept. of Computer Eng., Boğaziçi University
• FP7 PRACE Project Work: Generation of multi-billion element meshes on
distributed supercomputers ([https://code.google.com/p/pmsh/](https://code.google.com/p/pmsh/))
• Adaptive triangular mesh refinement on GPUs

- B. Hatipoglu, C. Özturan, Parallel Triangular Mesh Refinement by Longest Edge Bisection ,
(To appear in SIAM Journal on Scientific Computing.)
- S. Soner, C. Özturan, Generating Multi-billion Element Unstructured Meshes on
Distributed Memory Parallel Machines , Scientific Programming, Vol. 2015, Article id
437480, 20015.
- Y. Yılmaz, C. Özturan, Using sequential NETGEN as a component for a parallel mesh
generator , Advances in Engineering Software, Vol. 84, p. 3-12, 20015.
JOB SCHEDULING for HETEROGENEOUS SUPERCOMPUTERS

- **Contact:** Can Özturan, Dept. of Computer Eng., Boğaziçi University
- Auction and integer programming based SLURM scheduler for heterogeneous supercomputers with generic resources (e.g. GPUs)
- FP7 PRACE Project work: https://code.google.com/p/slurm-ipsched/

TEXT ANALYTICS

- **Contact:** Arzucan Ozgur, Dept. of Computer Eng., Boğaziçi University
- Contextual Text Mining from the Biomedical Scientific Literature
- Analyze drug-target interactions
- FP7 Marie Curie Grant


EMBEDDED SYSTEMS, HARDWARE ACCELERATION, CO-DESIGN

• Contact: Arda Yurdakul, Dept. of Computer Eng., Boğaziçi University
• Acceleration of in-memory database analytics in order to have faster query processing capabilities has gained significant attention. Designed hardware accelerators using Vivado HLS that accelerate complete queries
• Customization of VLIW processors
• On chip architectures

BIG DATA ANALYTICS

- **Contact:** Taylan Cemgil, Dept. of Computer Eng., Boğaziçi University
  - Machine Learning, Big Data analysis

- **Contact:** Cevdet Aykanat, Dept. of Computer Eng., Bilkent University
  - Graph Partitioning, Big Data Analysis, Sparse-Matrix Vector Multiply