
Tarmo Uustalu, Institute of Cybernetics at TUT

EXCS kickoff, TUT, 18 September 2008
EXCS in one slide

- A national centre of excellence in research 2008-2015
- dedicated to the study of computer science and computational sciences,
- funded within the Measure for the development of CoEs of the Operational programme for the development of the economic environment of the Estonian system for the implementation of the EU Structural Funds 2007-2013,
- composed of researchers at the Institute of Cybernetics at TUT (IoC), Cybernetica AS (CybAS) and the University of Tartu (UT),
- coordinated by IoC, project leader Tarmo Uustalu.
- http://cs.ioc.ee/excs/
- One of the 7 CoEs funded within this measure (across all disciplines), selected from 24 proposals in spring-summer 2008.
Financing

- Budgeted eligible cost for the structural funds during the 7-year duration is 69.9 MEEK.
- **Structural assistance** comes from the European Regional Development Fund, ERDF, and amounts to 95 pct, i.e., 66.4 MEEK (ca 4.25 MEUR).

![EU and Estonian flags]

- The Estonian state contributes an **additional support** of 3.8 MEEK (ca 0.25 MEUR)
- and **compensates** for the non-eligible VAT.
- The measure is administered by the Ministry of Education and Research and the Archimedes Foundation.
Institutions and people (1)

- Institutions and people determined by four HTM target-financed themes (those of Tarmo Uustalu, Ahto Buldas, Jaak Vilo, Mare Koit).

- Three institutions:
  - Institute of Cybernetics at TUT
  - Cybernetica AS (via its non-profit making Information Security Institute)
  - University of Tartu (through its Dept. of Computer Science)
Institutions and people (2)

(As of 2 March 2008) 43 senior staff:
3 DScs (Ülo Jaaksoo, Enn Tõugu, Haldur Õim, all members of the Estonian Academy of Sciences), 34 PhDs and CScs, 6 MScs

Ca 50 PhD/MSc students

The core is a young generation of research leaders:
Ahto Buldas, Peeter Laud, Helger Lipmaa, Kaili Müürisepp, Tarmo Uustalu, Eero Vainikko, Varmo Vene, Jaak Vilo, Jan Willemsen
+ Marlon Dumas, the Hansapank professor of software engineering at UT.
Objectives

- General objective: to consolidate and advance the Estonian computer science in six areas of recognized strength.

- Specific objectives: to boost the research potential of the groups involved by facilitating collaboration and safeguarding their sustainability and growth, to increase the impact of their research results in academia, industry and society as well as to popularize them.

- To be achieved by: carefully planned coordination and joint actions, targeted at creating a thriving, highly reputed research environment, attractive for young researchers, in particular from abroad.
The activities to achieve the objectives fall into two groups:

- **coordinated research:**
  regular research activity, aiming at the highest quality and emphasizing, in particular, collaboration across institutions and topic areas

- **coordinated support actions:**
  specific actions targeted at developing the research potential of the groups involved and increasing the impact
Working groups (WGs)

- The research activities of EXCS are centered around 6 thematic working groups (WGs) (for the 6 areas of strength):
  - programming languages and systems (PLS),
  - information security and cryptology (Sec),
  - software engineering (SE),
  - scientific and engineering computing (Comp),
  - bioinformatics (BI),
  - human language technology (LT)

These cross the TFT and institution boundaries wherever appropriate.
WG research areas (1)

- **Programming languages and systems**
  design of type-theoretical programming languages; program logics/type systems for to certify code in mainstream languages; static analysis of multithreaded code; algebraic and categorical automata theory and theory of context-dependent computing
  T Uustalu, A Saabas, H Tamm, H Nestra, J Penjam, V Vene (IoC + UT)

- **Information security and cryptology**
  secure communication protocols for oblivious transfer, e-voting, privacy-preserving information retrieval, secure function evaluation in general, time-stamping etc; security assessment of information systems
  A Buldas, P Laud, S Laur, H Lipmaa, M Saarepera, J Willemsen (CybAS + UT)
WG research areas (2)

- **Software engineering**
  service-oriented architectures, rapid aggregation of services, incl ontology induction, data mining to assess of architectural quality service-oriented systems
  M Dumas, H-M Haav, A Kalja (UT + IoC)

- **Scientific and engineering computing**
  parallel algorithms for solving large computational problems, system DOUG for solving large systems of linear equations; middleware for GRID and P2P computing, friend-to-friend (F2F) computing; knowledge-based tools for engineering computations, modelling and simulation
  E Vainikko, U Norbisrath, M Harf, E Tõugu (UT + IoC)
WG research areas (3)

- **Bioinformatics**
  interpretation of biological data through novel advanced algorithmic designs using machine learning and data mining, visualization, techniques for hypothesis prioritization; dissection of gene regulation mechanisms, reconstruction and analysis of genetic networks, gene expression data mining
  J Vilo, P Agius (UT)

- **Human language technology**
  linguistic changes of Estonian for computer processing of written Estonian; sentence and discourse modelling, dialogue modelling for written Estonian; models for Estonian speech recognition, coping with signal variability, spontaneous and emotional speech
  M Koit, K Müürisep, H-J Kaalep, K Jokinen, K Kaljurand, K Muischnek, H Õim, T Alumäe, E Meister (UT + IoC)
Research activities

- The research activities comprise:
  - research within the WGs,
  - cross-WG research efforts,
  - dissemination,
    via high-level scientific publications, tutorials, intensive courses, seminar talks at foreign universities, the centre’s web portal
- The MC will continuously monitor the quality of the centre’s publications and other dissemination.
Support actions

- Support actions go into strengthening the centre and increasing its impact.

- **Strengthening the centre**: making it a sustainable thriving research environment capable of attracting and keeping talent.

  - **Human resources**:
    - positions for postdocs PhD students, technical personnel, training.

  Personnel development will be done in adherence to the European charter for researchers and code of conduct for the recruitment of researchers.

- **Equipment**.

Most of the centre’s funds will be put here.
Increasing the impact: enhancing the centre’s visibility, i.e., raising the awareness of the target groups of the centre’s research results.

- **International cooperation:**
  - organization of high-level scientific events,
  - international cooperation projects.

- **Technology transfer:**
  - contact days for industry,
  - industrial cooperation projects.

- **Contribution to policy-making:**
  - contributions to shaping of policies in R&D, higher education and IT related areas, technology roadmapping and foresighting, standardization etc

- **Popularization:**
  - media coverage,
  - popular books,
  - open-door events for the general public
Management

- **Management committee (MC):**
  operative management, consists of the leaders of the 4 TFTs and the leaders of the WGs

- **General assembly (GA):**
  institutional strategy, consists of institution administration representatives (one from each) + the leaders of the 4 TFTs

- **International advisory board (IAB):**
  scientific advice, consists of internationally renowned researchers from abroad
  - Ivan Damgård (U. of Aarhus),
  - Reino Kurki-Suonio (Tampere U. of Techn.),
  - Kim G. Larsen (Aalborg U.),
  - Heikki Mannila (Helsinki Inst. of IT),
  - José Nuno Oliveira (U. do Minho),
  - Martin Volk (U. Zürich),
  - Reinhard Wilhelm (U. des Saarlandes).
Track record

- Long-standing successful cooperation between the consortium partners, formalized in particular in the EU FP5 project eVikings II (2002-2005) and the Estonian CoE CDC (2002-2007).
- Main players on the Estonian computer science scene.
- Esp during the last 5 years a very strong emphasis on internationalization:
  active involvement in FP5/6/7 and other int projects,
  active organizers of high-level int conferences in Estonia,
  highly reputed int winter schools in TCS since 1996,
  visiting researchers etc
- A young generation of research leaders, several from PhD degrees and/or postdoctoral research experience from abroad.
EXCS vs CDC

- **CDC** (the Centre for Dependable Computing) was one of Estonia’s 10 national CoEs 2002–2007 funded by the Estonian state.

- Roughly,

\[
\text{EXCS} = \text{CDC} - \text{computer engineering} + \text{bioinformatics} + \text{human language technology}
\]

- The computer engineering part, supplemented with electronics and biomedical engineering, spawned another successful CoE proposal in IT, viz. CEBE.

- So 1/10 became 2/7!
EXCS vs Estonian computer science

- At this moment, EXCS encompasses most of the computer science research done in Estonia, except
  - hybrid systems verification and testing research by J Vain at IoC and DCS/TUT (in the TFT of Ü Kotta),
  - automated theorem proving, semantic web by T Tammet at DCS/TUT,
  - proactive systems research by L Mõtus, M Meriste at DCC/TUT and TUIT (in the TFT of L Mõtus),
  - information systems and other research pursued at DInf/TUT,
  - robotics research (to the degree it belongs to artificial intelligence) by M Kruusmaa at the Centre for Biorobotics of TUT

- Major opportunities to overcome fragmentation and harvest synergy.
EXCS values

- High-quality research has priority over any other activity. Nonsense cannot be afforded.
- People matter most.
- Quality of research is defined by recognition by true experts (the international research community) rather than spreadsheet software.
- Indicators to assess research must be meaningful and fair.
Nearest events

- Computer Science **Theory Days** at Jõulumäe, 3–5 Oct 2008 (A Ambainis, K Cirulis, R Freivalds et al) (training)
- Symp on **Innovative Software Technology**, Tartu, 27–28 Oct 2008 (industry contact event)
- 20th Nordic Workshop on Programming Theory, **NWPT 2008**, Tallinn, 19–21 Nov 2008 (D Clarke, V Danos, M Fränzle, M Veanes) (int conference)
- 14th Estonian Winter School in Computer Science, **EWSCS 2009**, Palmse, 1-6 March 2009 (N T Courtois, P Dybjer, R Gennaro, P W Goldberg, M Müller-Olm)
Further nearest activity

- international postdoc recruitment campaign
- popularization actions: translation of *Computers Limited* by D Harel, *Computer Science Unplugged* courses etc
- first cross-WG research activities
- more...
Kickoff programme

- Industry session: computer science for industry and society
- Popular CS + PhDs from EXCS
- [Tomorrow:] Individual WG planning sessions