

# Centre of Excellence in Computer Science, EXCS (2008–2015): Proposal and Plans

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).



- 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 Müürisep,  
Tarmo Uustalu, Eero Vainikko, Varmo Vene, Jaak Vilo,  
Jan Willemson  
+ 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.

# Activities

- 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  
Willemson (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 Norbistrath, 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,

EXCS = CDC

– computer engineering

+ bioinformatics

+ 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)
- 1st **Training School** of COST **Action IC0701**, Viinistu, 25–29 Jan 2009  
(R Hähnle, E B Johnsen, J Kiniry, C Marché, A Poetzsch-Heffter)
- 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