Overview of Centre of Dependable Computing 2002–2007

Jaan Penjam & Tarmo Uustalu
Institute of Cybernetics

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What is (was!) CDC?

- A centre of excellence in research (project, really) in the programme of national CoEs 2002-07 of the Estonian Ministry of Education and Research (HTM), financed by the Estonian state.
- There were 10 centres altogether across all disciplines, awarded as a result of two calls in 2001 (6 centres) and 2002 (4 centres). CDC was approved in 2002.
- CoEs originally devised to last 2002-06, then extended until end of 2007.
- Now a new programme in the making, financed by the EU structural funds (programming period 2007-13 of their implementation)
- Largely, the new programme is based on completely different principles; in particular, it is not seen as continuation of the previous one.

Estonian centres of excellence in research 2002-07

1. CoE for Gene and Environmental Technologies (Univ of Tartu)
2. CoE for Basic and Applied Ecology (Univ of Tartu, Estonian Agricultural University)
3. Estonian Centre of Behavioral and Health Sciences (Univ of Tartu, Estonian-Swedish Inst of Suicidology, National Inst of Health Development)
4. Institute of Physics, Univ of Tartu
5. Centre of Molecular and Clinical Medicine (Univ of Tartu)
6. CoE for Chemical and Materials Science (Univ of Tartu, Tallinn Univ of Techn)
7. CoE of Analytical Spectrometry (National Inst of Chemical and Biophysics)
8. Centre of Cultural History and Folkloristics in Estonia (Estonian Literary Museum)
9. Centre for Nonlinear Studies (Inst of Cybernetics, Univ of Tartu, Tallinn Univ of Techn)
10. Centre for Dependable Computing (Inst of Cybernetics, Univ of Tartu, Tallinn Univ of Techn, Cybernetica AS)

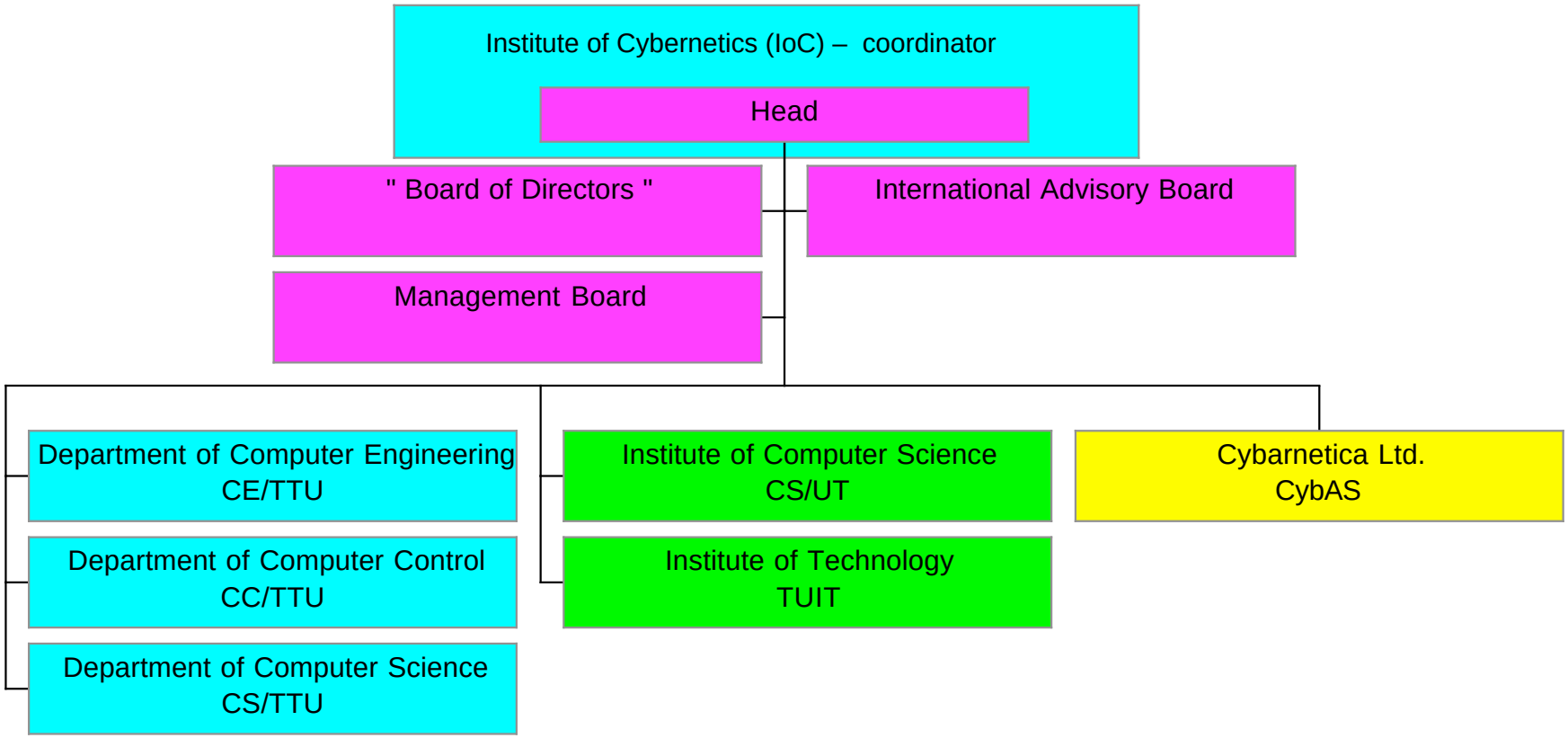
CDC

- Essentially a network of researchers working on topics related to correctness/safety and security in software and hardware.
- Formalized a longstanding informal cooperation between individual researchers of a number of institutions.
- Coordinated by Institute of Cybernetics.
- Project leader: Jaan Penjam.
- Scientific advisory board:
  Reino Kurki-Suonio (Tampere UT), Kim G Larsen (Aarhus),
  José Nuno Oliveira (Minho), Reinhard Wilhelm (U Saarlandes)
- cdc.ioc.ee
- Nov 2002-Sept 2005, CDC was tightly related to
  WP2 (software technology and trust & confidence)
  + WP4 (digital systems design & test)
  of EU FP5 IST accompanying measures project eVikings II,
  ev2.ioc.ee

Institutions

- A network-type centre built on a consortium of different institutions:
  - Institute of Cybernetics (IoC) (J Penjam)
  - Tallinn University of Technology (TUT)
    - Dept of Computer Science (CS) (J Vain)
    - Dept of Computer Engineering (CE) (R Ubar)
    - Dept of Computer Control (CC) (L Mõtus)
  - University of Tartu (UT)
    - Dept of Computer Science (CS) (V Vene)
    - Institute of Technology (TUIT) (M Meriste)
  - Cybernetica AS (CybAS) (A Buldas)

Structure of CDC



Financing

- Financing from Ministry of Education and Research (5 years):
  2003: 1350 kEEK
  2004: 1368 kEEK
  2005: 504+685 = 1189 kEEK
  2006: 1466 kEEK
  2007: 1466 kEEK

  Total: 6839 kEEK (437 kEUR)
- Additional financing for infrastructure from EU structural funds: 3440 kEEK.
- Cf. eVikings II (2 years 11 months) EU community contribution was 890 kEUR

Research groups and people

- Four research groups, formed of researchers from different institutions:
  - mathematical foundations and programming languages:
    T Uustalu, V Vene, (J Pöial, M Tombak,) H Tamm, (A Eppendahl, O Shkaravska,) P Laud
  - formal methods in systems development:
    J Penjam, E Tõugu, M Harf, J Vain, T Tammet, L Mõtus, M Meriste, E Vainikko, ...
  - cryptology and information security:
    A Buldas, P Laud, J Willemson, (H Lipmaa)
  - digital systems design and test:
    R Ubar, P Ellervee, G Jervan, J Raik, M Kruus, A Sudnitsõn, K Tammemäe ...

Research topics

- mathematical foundations and programming languages:
  program logics and program transformations, functional programming, categorical semantics, automata theory
- formal methods in systems development:
  automated theorem proving and program synthesis (software composition), verification of timed/hybrid systems by model-checking, interactive computing, scientific computing, parallel computing
- cryptology and information security:
  design and analysis of cryptoprotocols, digital time-stamping, e-voting, practical information security
- digital systems design and test:
  design and test of SoCs and NoCs, self-test, fault-tolerance

Activities

- (main:) business as usual, i.e., research
- coordinated joint activities targeted at
  - internationalization
    (European projects,
    international conferences in Estonia,
    in- and outbound research mobility)
  - attraction of young people to CS&E
    (winter/summer schools, theory days, courses etc)
- eVikings II core WPs 2..4 had the same activities

European projects

- Institutions of CDC partook in a number of European projects:
- 5th Framework Programme:
  - IST accompanying measures project Establishment of the Virtual Center of Excellence for IST RTD in Estonia, eVikings II (Nov 2002-Sept 2005, IoC coordinator)
  - IST thematic network Network of Excellence in Computational Logic, CoLogNet (Jan 2002-June 2005, IoC partner)
  - IST thematic network Applied Semantics II, APPSEM II (Jan 2003-June 2006, IoC partner)
  - IST thematic network European Robotics Research Network, EURON (Dec 2000-Apr 2004, CS/TUT partner)
  - IST accompanying measures project Research and Training Action for System-on-Chip Design, REASON (Jan 2002-June 2005, CE/TUT partner)
  - IST accompanying measures project An Open Source Technology for Data Certification in Value-Added Services, OpenEvidence (Apr 2002-Sept 2003, CybAS partner)
  - IST them network Roadmaps for Europ Research on Smartcard Technologies, RESET (Sept 2002-May 2003, CybAS partner)

- 6th Framework Programme:
  - IST coordination action Types for Proofs and Programs, TYPES (Sept 2004-Apr 2008, IoC partner)
  - IST integrated project Mobility, Ubiquity, Security for Small Devices, MOBIUS (Sept 2005-Aug 2009, IoC partner)
  - IST network of excellence European Robotics Network, EURON II (May 2004-Apr 2008, CS/TUT partner)
  - IST STREP Knowledge Environment for Interacting Robot Swarms, ROBOSWARM (Nov 2006-Apr 2009, CS/TUT coordinator)
  - IST STREP Verification and Validation of Embedded System Design Workbench, VERTIGO (June 2006-Nov 2008, CE/TUT partner)
  - IST integrated project Algorithmic Principles for Building Efficient Overlay Computers, AEOLUS (Sept 2005-Aug 2009, CybAS partner)
  - IST STREP Reinforcing eGovernment services in Baltic States through legal and accountable digital time stamp, BALTICTIME (Jan 2006-Dec 2008, CybAS partner)

- COST:
  - Action 295 Dynamic Communications Networks: Foundations and Algorithms, DYNAMO (Jan 2005-Jan 2009, CC/TUT in MC)
  - Action IC0701 Formal Verification of Object-Oriented Software (Dec 2007-June 2012, IoC in MC)
- various bilateral projects under different schemes

International conferences

- A number of internat conferences were organized in Estonia, these:
  - 14th Nordic Wksh on Programming Theory, NWPT '02, Tallinn, Nov 2002
  - 2nd Annual Meeting of APPSEM II, APPSEM '04, Apr 2004
  - 5th Int Summer School on Advanced Functional Programming, AFP '04, Tartu, Aug 2004
  - 9th Biennial Baltic Electronics Conf, BEC '04, Tallinn, Oct 2004
  - 10th European Test Symp, ETS '05, Tallinn, May 2005
  - 20th Int Conf on Automated Deduction, CADE-20, Tallinn, July 2005
  - 9th Symp. on Programming Languages and Software Tools, SPLST '05, Tartu, Aug 2005
  - 9th East-European Conf on Advances in Databases and Information Systems, ADBIS 05, Tallinn, Sept 2005

- . . . as well as these:
  - 6th Int Symp on Trends in Functional Programming, TFP 2005 / 10th ACM SIGPLAN Int Conf on Functional Programming, ICFP 2005 / 4th Int Conf on Generative Programming and Component Engineering, GPCE 2005, Tallinn, Sept/Oct 2005
  - IFIP WG 2.8 Meeting #22, Kalvi manor, Oct 2005
  - 10th Nordic Wksh on Secure IT Systems, NordSec 2005, Tartu, Oct 2005
  - 8th Int Conf on Mathematics of Program Construction, MPC '06 / 11th Int Conf on Algebraic Methodology and Software Technology, AMAST '06, Kuressaare, July 2006
  - 7th Joint Conf on Knowledge-Based Software Engineering, JCKBSE '06, Tallinn, Aug 2006
  - Joint 19th IFIP Int Conf on Testing Communicating Systems and 7th Int Wksh on Formal Approaches to Testing of Software, TestCom-FATES 2007 / 27th IFIP WG 6.1 Int Conf on Formal Methods for Networked and Distributed Systems, FORTE 2007, Tallinn, June 2007
  - TYPES Wksh on Effects and Type Theory, EffTT, Tallinn, Dec 2007

Winter schools

- EWSCS: a series of regional-scope internat winter schools in theoretical CS, organized annually by IoC. All schools but the first one in 1996 have taken place at Palmse (Lahemaa National Park).
- Emphasis on Theory A & B (as at ICALP or in TCS).
- 4..5 courses of 6 hrs from renowned scientists + a student session (short oral and poster presentations).
- Typical attendance: 50, whereof 4..5 lecturers and ∼20 students are from abroad.
- Some lecturers from over the years: S Artemov, Arvind, G Barthe, J Bergstra, G Chaitin, P Cousot, I Damgård, O Danvy, W P de Roever, N Halbwachs, J Håstad, A Ingólfsdóttir, A Jung, K G Larsen, H Mannila, J Massey, Yu Matiasevich, K Mehlhorn, P B Miltersen, G Morrisett, M Naor, J N Oliveira, G Păun, J Reynolds, Ph Rogaway, C Schnorr, H Schwichtenberg, H Seidl, M Sudan, R Wilhelm, W Yi, M Yung

- Coming up 2-7 March 2008: 13th EWSCS 2008,
  feat N Benton (Microsoft), D Harel (Weizmann),
  E Kushilevitz (Technion), J Meseguer (UIUC), G Persiano (U Salerno)

Summer schools

- The ESSCaSS annual summer schools are a younger sister of EWSCS.
- Emphasis more on systems engineering, software engineering, artificial intelligence.
- Format similar to that of EWSCS.
- Typical attendance: 30..40.
- Some of the lecturers: D Bjørner, B Fischer, R Dearden, J Hatcliff, J-M Jacquet, R Kurki-Suonio, A Møller, D Peled, A Ravn, M Veanes
- First school in 2002 at Kohala, organized by CC/TUT. Next schools 2003-2005 (Taagepera, 2 $\times$ Pedase) were organized by IoC.
- Schools of 2006-2007 (Pedase, Lepanina) were organized by CS/UT within the ICT doctoral school project.

Theory days

- Theory days are a genuine baby of CDC.
- A series of informal local Tallinn-Tartu meetings targeted primarily at doctoral and master students, with tutorials and technical presentations and "interactive seminars" from internat guests (1..2), researchers/teachers and students.
- 3-day getaways in different places held twice a year from autumn 2002, organized in alternation by IoC and CS/UT.
- Important ingredients: autumn resp winter sports, sauna.
- Highly popular, attendance 35..45.
- Coming up this weekend 25-27 Jan 2008: 12th Theory Days at Põlva, feat invited talks by V Capretta (U Nijmegen) and M Dumas. Supported now by Tiger University Plus.

Guest courses

- A number of short courses were taught by internat lecturers at IoC, TUT, UT:
  T Altenkirch (Nottingham), M Hansen (DTU), R Hartenstein (Kaiserslautern), L Barbosa (Minho), M Fränzle (DTU), T Vierhaus (TU Cottbus), M Bezem (U Bergen), D Borrione & P Amblard (U Grenoble I), E Elkind (U Warwick), M Backes (U Saarlandes), Yu Lifshits (POMI St Petersburg), G Pace (U Malta), D Foty (Gilgamesh), I Kotenko & A Ulanov (SPIIRAS), M Veanes (Microsoft), J van Lent (Bath), G Ganezis (Microsoft)
- Many of these were financed by the Tiger University/Tiger University Plus programmes or the doctoral school in ICT.

PhD education

- Defended PhDs were not many, just 12:
  H Tamm (Helsinki UT, 2004), H Nestra (UT, 2006)
  R Savimaa (TUT, 2005), U Norbisrath (RWTH Aachen, 2007), J Ernits (TUT 2007)
  K Heero (UT, 2006)
  M Brik (TUT, 2002), A Jutman (TUT, 2004),
  G Jervan (Linköpings Univ., 2005), J Fomina (TUT, 2005),
  E Ivask (TUT, 2006), E Orasson (TUT, 2007)
  (K Heero was an "industrial" PhD student at CybAS)
- At this moment, 38 PhD students are being supervised by senior staff of CDC.
- Sufficient inflow of motivated PhD students and timely graduation are still major problems...
- A major reason is the completely dysfunctional national PhD education system. In addition, CDC had no influence over the institutional side of doctoral education even in CS&E.

Repatriation / foreign researchers

- Some researchers from Estonia that had studied / worked abroad returned: H Tamm, G Jervan, H Lipmaa (Apr 2005-Aug 2006)
- Some researchers of Estonian origin worked here: A Löh, A Eppendahl
- Foreign researchers: O Shkaravska, U Norbisrath
- It is obvious we badly need postdocs from abroad...

Related projects

- A number of projects cofinanced the activities of CDC:
- infrastructure programme for CoEs of Enterprise Estonia:
  CDC received funds for infrastructure within the CDC-INFRA project
- centres of technological competence programme of Enterprise Estonia:
  CS/TUT, CE/TUT and CybAS participate in the ELIKO centre (electronics and information & communication technologies)
- doctoral schools of Measure 1.1 of the National Development Plan for the Implementation of EU Structural Funds 2004-06:
  national doctoral school in ICT (Sept 2005-June 2008)
- Tiger University and Tiger University Plus national programmes to support university education:
  all winter schools/summer schools of CDC benefited from this programme