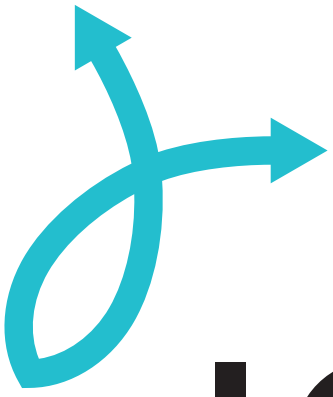
Annual Report 2013



ICE-TCS

Icelandic Centre of Excellence
in Theoretical Computer Science

Contents

1 Introduction

The Icelandic Centre of Excellence in Theoretical Computer Science (ICE-TCS) celebrated its eight birthday on 29 April 2013. This eight annual report is meant to give the (Theoretical) Computer Science community in Iceland and elsewhere, our sponsors and funding agencies, and our scientific advisory board an overview of the activities of the centre in 2013. It will also allow us to evaluate our achievements vis-a-vis our original aims in setting up this centre, and to set ourselves goals for the future.

For the sake of completeness, we remind our readers that the aim of the centre is to establish in Iceland important areas of basic research in the mathematical foundations of Computer Science, notably Algorithmic Program Verification, Mathematical Logic in Computer Science, Models and Logics for Reactive Systems, Semantics of Computation and Systems Biology, alongside existing activities in Algorithmics, Bioinformatics, Applied and Discrete Mathematics and Machine Learning.

ICE-TCS aims at exploiting the available scientific strength in order to

- focus the research efforts, and establish synergies amongst the active researchers in Iceland,
- attract outstanding researchers in Theoretical Computer Science to Iceland for short- or long-term visits leading to collaborations with local researchers and to improvements in the Icelandic research environment,
- organize international conferences and workshops in Theoretical Computer Science in Iceland to put the country firmly on the map as a recognized conference location for high quality events in the field, and
- attract young, outstanding students from Iceland to this research area.

The research centre initially started as a collaboration between the Department of Computer Science, Faculty of Engineering, University of Iceland, and the School of Computer Science, Reykjavik University. From 2011 to 2013, the centre was based solely at Reykjavik University. In November 2013, Páll Melsted (University of Iceland and Decode Genetics) joined the centre, thereby restoring some of the original links with the University of Iceland. Moreover, ICE-TCS still has some affiliated members from the University of Iceland. However, it is fair to say that all the activities of the centre take place at Reykjavik University.

Further information is available from the centre's web page at:

http://www.icetcs.ru.is.

2 Executive Summary and Highlights for the Reporting Period

The calendar year 2013 has been a very active one for ICE-TCS, both nationally and internationally. The following subsections survey briefly what the centre has achieved in the reporting period.

Research Highlights

At the end of 2013, ICE-TCS members had a total of 403 publications since the establishment of the centre: two books, 21 edited volumes, six book chapters, 203 journal papers, 164 conference and workshop papers and seven abstracts in peer-reviewed ISI-indexed journals. By way of comparison, the overall number of publications was 297 at the time of writing our annual

report for 2010, 339 for 2011 and 360 for 2012. The centre has thus reached two publication milestones of 400 publications overall and 200 journal papers. (The latter milestone was explicitly mentioned as a specific goal for 2013 in our previous annual report.) As far as the number of publications is concerned, the year 2013 has been the most productive for ICE-TCS since 2010.

The centre still has substantially more journal publications than conference publications. However, the difference between the two figures has been slowly decreasing in the last few years: it is now 39, and was 43 in our report for 2012 and 45 in 2011. We expect that this trend will continue in the coming years, but we will strive to continue publishing in journals a substantial percentage of our scientific work.

ICE-TCS still contributes four out of the five Icelandic entries to the list of DBLP most prolific authors.

Below, we limit ourselves to pointing out a few research-related highlights in the reporting period.

- The work of the algorithms group on algorithms for wireless networks has appeared in top class conferences such as PODC 2013 and SODA 2013. As a sign of recognition of the quality and impact of the work carried out within that group, Magnús M. Halldórsson has been invited speaker at
  - ALGOSENSORS 2013, the 9th International Symposium on Algorithms and Experiments for Sensor Systems, Wireless Networks and Distributed Robotics,
  - MAPSP '13 (11th Workshop on Models and Algorithms for Planning and Scheduling Problems) and
  - the 6th Annual Meeting of the AAAC in Matsushima, Japan.
- CADIAPlayer, the general-game-playing agent developed by Yngvi Björnsson and his research group, came second in the 2013 International General Game Playing Competition. CADIAPlayer is the most successful game-playing agent in the history of the competition.
- The work by Ýmir Vigfússon and his group on scalable data caching received unexpected attention for a poster on *Dynamically Profiling Memory Caches* that resulted in talks and follow-up collaborations with places such as Facebook, Twitter and CloudPhysics (startup from VMware) in Silicon Valley.

- Anna Ingólfsdóttir received the Reykjavik University Research Award 2013. ICE-TCS researchers have received three of the four university research awards given so far.

- Marjan Sirjani was promoted to a full professorship in June 2013. It is worth noting that all the four full professors at the School of Computer Science, Reykjavik University, are affiliated with ICE-TCS.

- Dario Della Monica, a postdoctoral researcher within ICE-TCS, received one of the GULP Distinguished Dissertation Prizes in the area of Computational Logic for 2010–2011. Dario's thesis dealt with decidability and expressiveness issues for interval temporal logics.

- As two signs of recognition of the research work carried out within the field of bioinformatics, we limit ourselves to mentioning that Bjarni V. Halldórsson delivered an invited talk entitled *Applications of optimization in DNA sequence analysis and disease association studies* at SINTEF, Oslo, Norway, 8 November 2013. Moreover, he supervised Gudný Anna Árnadóttir's summer project that was selected as a finalist for the president's research award.

- The concurrency group within ICE-TCS has developed an algorithm that uses algebraic laws to enhance the automatic generation of axiomatizations from operational language specifications (presented in a paper at CALCO 2013), and has completed the classification of the expressiveness of Halpern-Shoham logic over dense linear orders (presented in a paper at TIME 2013).

Events

During 2013, ICE-TCS members organized a large number of scientific events, both in Iceland and abroad.

Nationally, ICE-TCS started the Pearls of Computation seminar series in January 2013. To connect the seminar series with the Turing Year events of 2012, the talks in the Pearls of Computation series mostly focus on presenting the life and work of some of the recipients of the ACM Turing Award or some other major award related to computer science in an accessible way. The Pearls of Computation talks at Reykjavik University are organized in collaboration with the School of Computer Science at Reykjavik University, CADIA (Center for Analysis and Design of Intelligent Agents), CRESS

(Center on Research in Engineering Software Systems), the Icelandic Mathematical Society, IIIM (Icelandic Institute for Intelligent Machines) and the Mathematics Group at Reykjavik University.

Moreover, ICE-TCS celebrated the centenary of the birth of Paul Erdös with a talk delivered by Magnús M. Halldórsson entitled *Paul Erdös Centennial: The master collaborator*. The presentation was organized jointly with the Icelandic Mathematical Society.

On Friday, 22 March 2013, ICE-TCS held the ninth edition of its annual Theory Day, which featured invited presentations by Pierluigi Crescenzi (University of Florence, Italy), Pierre Fraigniaud (CNRS and University Paris Diderot, France) and Stephan Holzer (ETH Zurich, Switzerland), as well as talks by ICE-TCS doctoral student Marijke Bodlaender and ICE-TCS postdoctoral researcher Dario Della Monica.

In the period 6–12 June 2013, ICE-TCS hosted Ice Break 2013, a six-day PhD course with emphasis on symmetric cryptography and with world-class lecturers.

ICE-TCS members served as PC chairs or PC members for at least 14 international conferences. (See Section 5.2 for details.)

Below we list the main events in reverse chronological order. See

http://www.icetcs.ru.is/events.html

for more details.

- 16 December 2013: Georgiana Caltais defended her PhD thesis entitled Coalgebraic Tools for Bisimilarity and Decorated Trace Semantics. The thesis defence took place at Radboud University Nijmegen as part of a double degree agreement. Georgiana's official supervisor at Reykjavik University was Anna Ingólfsdóttir.

- 5 December 2013: Magnus M. Halldorsson, the director of ICE-TCS, was the Program Chair for Track C (Foundations of Networked Computation) of the scientific program of ICALP 2013, which was held in Kyoto in co-location with LICS.

- 26 November 2013: Páll Melsted (Faculty of Industrial Engineering, Mechanical Engineering and Computer Science, University of Iceland, and Decode Genetics) joined ICE-TCS. Páll will contribute to the centre with his work in algorithmics and bioinformatics.

- 26 September 2013: Dario Della Monica received one of the GULP Distinguished Dissertation Prizes in the area of Computational Logic

for 2010-2011. The prizes were presented during the CILC conference 2013.

- 5-6 September 2013: Magnús Halldórsson was an invited speaker at ALGOSENSORS 2013, the 9th International Symposium on Algorithms and Experiments for Sensor Systems, Wireless Networks and Distributed Robotics, September 5-6, 2013 Sophia Antipolis, France. The event was co-located with ALGO 2013.

- 22 August 2013: Eugen-Ioan Goriac defended his PhD thesis at Reykjavik University. The examination committee for the thesis consisted of Jos Baeten (Director of CWI Amsterdam, NL), MohammadReza Mousavi (Halmstad University, Sweden) as well as ICE-TCS members Luca Aceto and Anna Ingolfsdottir, who supervised the thesis.

- 22-24 July 2013: Magnús M. Halldórsson was the treasurer of PODC 2013.

- 21 July 2013: Magnús M. Halldórsson organized the Fourth Workshop on Realistic models for Algorithms in Wireless Networks (WRAWN) in Montreal, Canada, in co-location with PODC 2013.

- 23-28 June 2013: Magnús Halldórsson was an invited speaker at MAPSP '13 (11th Workshop on Models and Algorithms for Planning and Scheduling Problems).

- 6-12 June 2013: ICE-TCS hosted Ice Break 2013, a six-day (PhD) course with emphasis on symmetric cryptography and with world-class lecturers.

- 24 May 2013: Magnús M. Halldórsson delivered a talk to celebrate the centenary of the birth of Paul Erdös. The presentation, which was organized jointly with the Icelandic Mathematical Society, was entitled Paul Erdös Centennial: The master collaborator.

- 19-21 April 2013: Magnús M. Halldórsson was one of the invited speakers at the 6th Annual Meeting of the AAAC in Matsushima, Japan.

- 5 March 2013: Dario Della Monica received the Young researcher award for 2011 of the University of Udine (Italy).

- 3-8 March 2013: Magnús Már Halldórsson delivered the doctoral course Approximation Algorithms for Unweighted Graph Problems at the

18th Estonian Winter School in Computer Science, EWSCS '13, Palmse, Estonia.

- 1 February: The start of the Pearls of Computation seminar series organized by ICE-TCS and the School of Computer Science.

The ICE-TCS Pearls of Computation events are listed below, in reverse chronological order.

- 18 October 2013: Yngvi Björnsson delivered a talk on John McCarthy. The talk was entitled *John McCarty: A Pioneer of Artificial Intelligence.*
- 17 May 2013: Björn Thór Jónsson (School of Computer Science, Reykjavik University) delivered a talk on E.F. Codd and the relation model. The talk was entitled *Codd and the mathematical model that turned into a multi-billion dollar industry.*
- 3 May 2013: Henning Úlfarsson (School of Computer Science, Reykjavik University) delivered a talk on the work of Donald E. Knuth. The talk was entitled *Donald Knuth: The great inventor.*
- 5 April 2013: Kristinn R. Thorisson (School of Computer Science, Reykjavik University) delivered a talk on the work of Marvin Minsky. The talk was entitled *Marvin Minsky: Pioneer, Critic, Optimist.*
- 15 February 2013: Eyjólfur Ingi Ásgeirsson (School of Science and Engineering, Reykjavik University) delivered a talk on E.W. Dijkstra. The talk was entitled *The shortest path to beautiful code (- DEATH TO GOTO -).*
- 1 February 2013: Luca Aceto (School of Computer Science, Reykjavik University) delivered a talk on R. Milner and his work. The talk was entitled *The work of Robin Milner: Proof, language and interaction.*

The posters for the talks and further information, as well as audio of most of the talks in .avi format, are available here

http://www.icetcs.ru.is/poco.html

The talks are also accessible from the YouTube channel of the School of Computer Science at Reykjavik University and have been viewed about 500 times overall.

As in previous years, 'regular' events, such as talks in our seminar series, have been advertised locally and on our ever-increasing mailing lists, which include well over 100 individuals at the time of writing. Events that are appealing to a general audience have also been advertised in the local newspapers, and on the mailing lists of Reykjavik University as a whole, of the mathematics society and of the computer science society. In all cases, ICE-TCS events have been a large fraction (if not the majority) of advertised events. In fact, it is fair to say that the ICE-TCS Research Seminar series continues to be the only regular seminar series in Computer Science in Iceland, and one of the very few seminar series in the country that have more than a handful of talks each year. During the reporting period, the ICE-TCS Research Seminar series hosted 27 seminars, not counting the talks delivered as part of the above-mentioned events.

Networking

During the reporting period, ICE-TCS has strengthened its ties with IMT Lucca, Italy, where Luca Aceto and Anna Ingólfsdóttir were visiting professors in September and October 2013. During his stay at IMT, Luca Aceto delivered PhD courses on *Modelling and Verification of Reactive Systems* (20 hours), *An Introduction to Timed Automata* (6 hours) and *An Introduction to Research Ethics* (4 hours).

In the period 13–26 November 2013, Luca Aceto and Anna Ingólfsdóttir were visiting professors at the State Key Laboratory for Computer Science, Institute of Software, Chinese Academy of Sciences, Beijing, China, supported by an "IOS Distinguished Scholarship". Their stay in Beijing was a first step towards building joint research projects and graduate student/teacher exchange agreements between ICE-TCS and the State Key Laboratory for Computer Science of the Chinese Academy of Sciences.

Two PhD students from ICE-TCS graduated in 2013 under double-degree agreements with KTH Stockholm and Radboud University Nijmegen.

Outreach

One of the goals of the centre is to foster an appreciation of discrete mathematics and theoretical computer science within a general scientifically-minded public and to attract students to these fields. As part of this effort, ICE-TCS is organizing joint events, including many of the talks in the ICE-TCS Pearls of Computation series—which is our flagship series of public

talks at the moment—, with several sister organizations and centres, such as the Icelandic Mathematical Society and CRESS (Center for Research into Engineering Software Systems).

Some educational initiatives during the reporting period were aimed at BSc. and MSc. students. Of particular note is the development of the Bachelor program in Discrete Mathematics and Computer Science at Reykjavik University. The prime movers behind this study program are Anna Ingólfsdóttir and Henning Úlfarsson. The program started without formal advertisement in Fall 2011 and, with 33 enrolled students at the time of writing, is still small, but it has been highly successful in attracting talented and motivated students. By way of example, a team comprising three students in that program was in 9th–15th place at the North-Western European Regional Programming Contest of the ACM Programming Competition. This is the best result ever by an Icelandic team in that competition.

As an alternative way of attracting more theoretically-minded students to discrete mathematics and theoretical computer science, we have also continue to offer an 'emphasis line' in theoretical computer science as part of the BSc. degree in computer science at Reykjavik University. However, it is fair to say that this line of specialization is not very attractive for students.

Moreover, ICE-TCS members continue to play a leading role in the design and running of novel courses such as *Problem Solving* for first-year students in Computer Science, *Effective Programming and Problem Solving* for BSc. students, *Combinatorial Game Theory* for BSc. students, *The Structure of Social and Information Networks* (intensive summer course for BSc. students) and *Logic in Computer Science* for third-year BSc. students and MSc. students.

ICE-TCS events have managed to attract a sizable attendance. Beyond members of the centre, nearly every meeting is attended by some researcher from fields with areas of contact with theoretical computer science. We also continue to host a small number of talks by researchers from sister fields like mathematics and physics, with the aim to explore possible synergies between their work and the research carried out within the centre. As mentioned above, ICE-TCS has strengthened its connections with the Icelandic Mathematical Society and other research centres in Computer Science at Reykjavik University.

3 Current Members and Their Research Areas

ICE-TCS has currently ten permanent members (nine at Reykjavik University and one at the University of Iceland) and four affiliated members (two at the University of Iceland, one at the University of Strathclyde and one at Université de Lyon 1). The present members of the centre are: Luca Aceto (Scientific Co-director), Eyjólfur Ingi Ásgeirsson, Yngvi Björnsson, Bjarni V. Halldórsson, Magnús M. Halldórsson (Scientific Director), Anna Ingólfsdóttir (Scientific Co-director), Páll Melsted, Marjan Sirjani, Henning Úlfarsson and Ýmir Vigfússon.

In addition, at the time of writing, the centre hosts three postdoctoral researchers: Dario Della Monica (temporal logics, mentored by Luca Aceto and Anna Ingólfsdóttir), Christian Konrad (design and the analysis of algorithms, mentored by Magnús M. Halldórsson) and Koosha Paridel (distributed systems, mentored by Ýmir Vigfússon). During 2013, ICE-TCS member Yngvi Björnsson mentored two postdoctoral researchers, Hilmar Finnsson and Stephan Schiffel, who are formally affiliated with the Center for Analysis and Design of Intelligent Agents.

During 2013, the centre had five PhD. students (four in Computer Science and one in Bioinformatics). Three of those students are from outside Iceland. In addition, in the reporting period ICE-TCS members supervised four doctoral students whose primary affiliation is with centres and institutions other than ICE-TCS. Three of the five PhD students affiliated with ICE-TCS graduated in 2013. K.V. Jónsson has taken up a position in industry in Iceland, E. Goriac is working at the Icelandic Heart Association and G. Caltais has a postdoctoral appointment at ETH Zürich in Bertrand Meyer's group.

So far, five of the seven students who have graduated from the doctoral program in computer science at Reykjavik University were affiliated with ICE-TCS. However, in the light of the current lack of funding for PhD positions, it is unclear whether ICE-TCS will be training new doctoral students in the near future.

At present, the members of ICE-TCS carry out research in the following main areas of Theoretical Computer Science and Discrete Mathematics: Algorithms and Complexity, Bioinformatics, Combinatorics, Computer-aided Verification, Concurrency Theory, Formal Methods in Software Engineering, Machine Learning, Search Methods in Artificial Intelligence and Structural Operational Semantics. With the recent addition of Páll Melsted, ICE-TCS has further strengthened its research profile in algorithmics and bioinformatics.

Algorithms group The majority of recent efforts of the algorithms group has been within a subgroup on wireless networking. That subgroup has included Magnús M. Halldórsson, Pradipta Mitra, Eyjólfur I. Ásgeirsson, Henning Úlfarsson, Ýmir Vigfússon, Christian Konrad, Koosha Paridel, Marijke Bodlaender and several master students. Additionally, Sverrir Ólafsson (from RU School of Science and Engineering and Business) has collaborated with the group. The main research effort has been on giving efficient and effective algorithms for link scheduling and capacity in generic wireless networks. More recently, studies have included connectivity and aggregation capacity, as well as connections with game theory and stability of networks. With the expansion of the efforts in 2013, the group additionally explored spectrum auctions, test-bed operation and higher-level distributed computing problems.

Other efforts on algorithms included streaming algorithms and online algorithms motivated by distributed computing.

Bioinformatics group The bioinformatics group developed discrete optimization algorithms, algorithms for DNA sequence variant detection and classification algorithms for clinical decision support systems for osteoporosis and autoimmune diseases. The group further contributed to the analysis of human and zebrafish genetics datasets.

Concurrency theory group The research efforts within the concurrency theory group have mainly focused on negative and positive results in the equational logic of process algebras, on the meta-theory of structural operational semantics, with emphasis on rule formats for guaranteeing the validity of certain algebraic properties of processes, and on modal characterizations of process semantics. Moreover, the group has joined an ongoing research effort aimed at obtaining a complete classification of the expressiveness of fragments of Halpern-Shoham logic over various classes of linear orders.

General game playing group The focal point of this research group continues to be on general game playing, that is, in building intelligent game-playing agents capable of autonomously learning to play a wide variety of games at an expert level. The work over the past year focussed mostly on developing efficient algorithms for online learning of search-control for simulation-based search.

Software engineering group The software engineering group has focused on the further development of the theory and applications of the actor-based language Timed Rebeca, and of its associated tool suite. In particular, the group worked on a variety of case studies related to the modelling and analysis of timed asynchronous systems using Timed Rebeca.

Systems group The core of the research within the systems group is on the scalability, consistency and security of data replication. A SOCC paper came out on the consistency front in October, but the main thrust is on scalable data caching. In a collaboration between the CRESS Systems Lab and ICE-TCS, the group has also been working on uniting the theory of ad-hoc wireless network connectivity with practice.

4 Funding

ICE-TCS researchers continue to be fairly successful in obtaining grants from the Icelandic Research Fund. In the rounds of applications for projects starting in 2013, ICE-TCS researchers received funding from several sources.

- Yngvi Björnsson obtained a three-year project grant from the Icelandic Research Fund for the project *Simulation- and Heuristic-Based Search in General Game Playing and Beyond* of total amount of 20 million ISK (about 126,350 euros).
- Bjarni V. Halldórsson was awarded 1 million ISK (about 6,324 euros) by the Nýskpunarsjódur Námsmanna fund to support two students.

In addition, the following project grants were still ongoing during the reporting period:

- *Design of Ad-Hoc Wireless Networks* (Excellence grant; PI: Magnús M. Halldórsson).
- *General Intelligence Problem-Solving Agents* (PI: Yngvi Björnsson),
- *Processes and Modal Logics* (PI: Anna Ingólfsdóttir).

On the 18th of December 2013, the Technical Development Fund of the Icelandic Research Fund funded a project led by Vignir Örn Gudmundsson at Radiant Games for 12 million ISK a year for the next three years. Vignir is an MSc student affiliated with ICE-TCS. This is a remarkable achievement for a master student.

Bengt Aspvall (Blekinge Tekniska Högskola, Sweden). Period: 21-22 October 2013.
Benny Chor (School of Computer Science, Tel-Aviv University, Israel). Period: 22 August 2013.
MohammadReza Mousavi (Halmstad University, Sweden). Period: 21-23 August 2013.
Jos Baeten (Director of CWI Amsterdam, NL). Period: 21-23 August 2013.
Raymond Yeung (Department of Information Engineering, The Chinese University of Hong Kong). Period: 30 May-5 June 2013.
Stephan Holzer (ETH Zurich, Switzerland). Period: Late March 2013.
Pierre Fraigniaud (LIAFA, Universite Paris Diderot - Paris 7, France). Period: 4-29 March 2013.
Pierluigi Crescenzi (University of Florence, Italy). Period: 4-29 March 2013.

Table 1: ICE-TCS Guests in 2013

We remark that these grants, however, can only be used to support project specific activities, and *not* for activities related to the centre as such. Whatever success ICE-TCS might have had so far has therefore been achieved with minimal financial support for centre-building. We believe that the quantity and quality of the centre's activities, and its impact on research and education in computer science in Iceland, could be increased substantially if ICE-TCS had more funding.

Finally, Luca Aceto and Anna Ingólfsdóttir received two "IOS Distinguished Scholarships" from the Institute of Software of the Chinese Academy of Sciences (18,000 yuan, approximately 2,186 euros, each).

5 Activities in 2013

5.1 Guests

During the reporting period, we received 8 guests from foreign institutions for short stays. These are listed in Table 1 in reverse chronological order. All the guests delivered seminars and/or contributed (mini-)courses organized by the centre.

5.2 Organization of Conferences, Symposia and Workshops

Members of the centre have served as organizers and PC members for at least the following events.

- 22nd European Symposium on Programming (ESOP 2013), Rome, Italy. (Luca Aceto PC member)

- 5th Conference on Algebra and Coalgebra in Computer Science, CALCO 2013, Warsaw, 3–6 September 2013. (Luca Aceto PC member)
- GandALF 2013, Borca di Cadore, Dolomites, Italy, 29–31 August, 2013. (Luca Aceto PC member)
- EXPRESS/SOS 2013, joint workshop on Expressiveness in Concurrency and Structural Operational Semantics, Buenos Aires, Argentina, August 26, 2013. (Luca Aceto PC member)
- 25th Nordic Workshop on Programming Theory (NWPT'13), 20–22 November 2013, Tallinn University of Technology, Estonia. (Luca Aceto PC member)
- Twenty-Third International Joint Conference on Artificial Intelligence (IJCAI13), 3–5 August 2013, Beijing, China. (Yngvi Björnsson Senior PC member)
- 2013 IJCAI Workshop on Computer Games (PC), 3 August 2013, Beijing, China. (Yngvi Björnsson PC member)
- Workshop on General Intelligence in Game-Playing Agents 2013 (GIGA'13), 5 August 2013, Beijing, China. (Yngvi Björnsson Co-chair)
- Eight International Conference on Computers and Games (CG13), 13–15 August 2013, Keio University, Yokohama, Japan. (Yngvi Björnsson PC member)
- 25th Annual International Conference on Intelligent Systems for Molecular Biology, 21–23 July 2013. (Bjarni V. Halldórsson PC member)
- 18th Annual International Conference on Research in Computational Molecular Biology (RECOMB 2014), 2–5 April 2014, Pittsburgh, Pennsylvania, USA. (Bjarni V. Halldórsson PC member)
- LADIS 2013, Farmington, Pennsylvania, November 2–3 2013. (Ýmir Vigfússon general co-chair)
- Nordic Security Conference 2013, Reykjavik, Iceland, August 2013. (Ýmir Vigfússon co-organizer)
- IEEE P2P 2013, September 2013. (Ýmir Vigfússon PC member)
- EuroSys 2013, April 2013. (Ýmir Vigfússon PC member)

The list above is, however, most likely very incomplete, since we have not been very consistent in collecting relevant data.

5.3 Service and Honours

Members of ICE-TCS participate in the life of the international research community in Theoretical Computer Science at large. For instance, they hold positions in the steering committee of conferences and professional organizations, and act as (guest) editors of volumes and international journals. A sample of service activities contributed by members of the centre can be found in Tables 2 and 3. It is noteworthy that members of the centre play leadership roles in important international organizations. This is a sign of recognition of the centre's activities of which we are proud.

5.4 ICE-TCS Seminar Series

One of the main aims of ICE-TCS is to foster a broad appreciation of the field of Theoretical Computer Science in Iceland, and to help improve the Icelandic research environment in Computer Science at large. To this end, during 2013, the centre has organized the following seminar series:

- Research Seminar Series, and
- Reading groups.

These two seminar series are supposed to cater for different types of audiences and of presentations. As its name suggests, the *Research Seminars Series* is used for technical presentations reporting on research that has reached a fairly complete stage of development. Overall, there have been 27 seminars in this series during the reporting period. (See `http://www.icetcs.ru.is/rsem.html` for details on these talks.) This is similar to 2012 and 2010 when we had 28 and 26 seminars respectively. In 2011 the centre only organized 17 seminars due to the fact that during 2011 ICE-TCS organized a much greater number of conferences and workshops. Overall, we think that the centre's contribution to the research environment in computer science and related fields has been substantial during the reporting period.

Reading groups are used by ICE-TCS to learn about topics that have the potential of creating synergies amongst the members of the centre, or as fora for the discussion of research in one of the core areas of the centre. An example of the former use of a reading group is provided by the weekly concurrency lunch meetings. The weekly meeting of the wireless networking subgroup has included a reading group on game theory and auctions. Moreover, Marjan Sirjani holds weekly lunches with students working on formal methods in software engineering on Fridays.

Membership and Steering of Learned Bodies

- Luca Aceto is the president of the EATCS (July 2012–July 2014).
- Luca Aceto is a member of the advisory board of *Electronic Proceedings in Theoretic Computer Science (EPTCS)*.
- Luca Aceto is a member of the Organizing Committee for the ACM/IEEE Symposium on Logic in Computer Science (2012–2014).
- Luca Aceto is a member of the Board of the European Association for Computer Science Logic (EACSL).
- Luca Aceto is a member of the Board of the journal Logical Methods in Computer Science.
- Yngvi Björnsson is a member of the Education Committee of the Icelandic Association of Computer Scientists.
- Yngvi Björnsson is a member of the evaluation committee for the Research Infrastructure Fund of the Icelandic Research Fund.
- Bjarni V. Halldórsson is a committee member of the IFIP working group on computational biology.
- Bjarni V. Halldórsson is event organizer for the EURO working group on computational biology.
- Magnús M. Halldórsson is a member of the steering committee for the Scandinavian Workshop on Algorithm Theory series. He is chair of that committee since March 2007.
- Magnús M. Halldórsson is a member of the steering committee for the European Symposium on Algorithms.
- Anna Ingólfsdóttir is a member of the steering committee for the Workshop on Fixed Points in Computer Science (FICS).
- Anna Ingólfsdóttir is a member of the board of the Icelandic Mathematical Society.
- Marjan Sirjani is a member of the steering committee for DisCoTec (International Federated Conference on Distributed Computing Techniques).
- Henning Úlfarsson is the chairman of the Icelandic Mathematical Society.

Table 2: Service and Honours by Members of ICE-TCS

Membership of Editorial Boards

- Information and Computation, Elsevier. (Luca Aceto guest editor of a special issue devoted to ICALP 2011)
- Logical Methods in Computer Science. (Luca Aceto guest editor of a special issue devoted to FOSSACS 2012)
- Journal of Logic and Algebraic Programming, Elsevier. (Luca Aceto editor and Anna Ingólfsdóttir guest editor)
- Acta Cybernetica (a scientific journal published by the Department of Informatics of the University of Szeged, Szeged, Hungary). (Luca Aceto editor)
- Electronic Proceedings in Theoretic Computer Science (EPTCS). (Luca Aceto editor)
- Frontiers in Statistical Genetics and Methodology. (Bjarni V. Halldórsson editor)
- Discrete Mathematics and Theoretical Computer Science. (Magnús M. Halldórsson managing editor)
- Soft Computing Journal (to be published by University of Kashan). (Marjan Sirjani Editor-in-Chief)

Table 3: Editorial Activities of Members of ICE-TCS

5.5 Courses and Students

As far as impact on the Icelandic Computer Science community is concerned, one of the main aims of ICE-TCS has always been to attract students to Theoretical Computer Science. Teaching, in the broad sense, plays a very important role in achieving this aim, and the members of ICE-TCS engage in course development and in student supervision. Apart from our dissemination activities related to the seminar series and the reading groups, ICE-TCS researchers have delivered classic courses on *Algorithmics* and *Theory of Computation*, at various levels, as well as more specialized courses on *Bioinformatics*, *Logic in Computer Science*, *Modelling and Verification*, *Problem Solving* and on *Semantics of Programming Languages* at Reykjavik University.

During 2013, members of the centre have supervised the following PhD students, five of which are affiliated with ICE-TCS.

- Marijke Bodlaender (Reykjavik University), PhD student working on her thesis supervised by Magnús M. Halldórsson.
- Georgiana Caltais (Reykjavik University), PhD student supervised by Luca Aceto and Anna Ingólfsdóttir. Georgiana Caltais defended her thesis in December 2013.
- Eugen-Ioan Goriac (Reykjavik University), PhD student supervised by Luca Aceto and Anna Ingólfsdóttir. Eugen-Ioan Goriac defended his thesis in August 2013.
- Stefán F. Gudmundsson (Reykjavik University), PhD student working on his thesis supervised by Yngvi Björnsson, formally affiliated with the Center for Analysis and Design of Intelligent Agents.
- Ali Jafari (Reykjavik University), PhD student supervised by Marjan Sirjani, formally affiliated with the Center on Research in Engineering Software Systems.
- Kristjan Valur Jonsson (PhD), PhD student supervised by Ýmir Vigfússon. Kristjan Valur Jonsson defended his thesis in March 2013 at KTH Stockholm.
- Ehsan Khamespanah (Reykjavik University), PhD student supervised by Marjan Sirjani, formally affiliated with the Center on Research in Engineering Software Systems.

- Alex Libov (Technion, PhD), PhD student supervised by Ýmir Vigfússon.
- Jón Ingi Sveinbjörnsson (Reykjavik University), PhD student working on his thesis supervised by Bjarni Halldórsson.

Members of the centre have also been involved in the supervision of several master students. Below we give a partial list of these supervision duties.

- Luca Aceto supervised one MSc student.
- Bjarni V. Halldórsson supervised two master students and one visiting master student from the Ecole Polytechnique Montpellier.
- Anna Ingólfsdóttir supervised one MSc student, who defended his thesis in August 2013.
- Henning Úlfarsson supervised two MSc students in computer science during 2013 (one graduated in the spring 2013 and one will graduate in the spring 2014).
- Ýmir Vigfússon supervised four MSc students at Reykjavik University and Eyal Enav (Technion, MSc).

6 Publications by Members of the Centre

We already mentioned some of the research highlights earlier in this report. Here we limit ourselves to mentioning that the work carried out by the members of our research groups in algorithmics and combinatorics has been presented at some of the premiere conferences in those areas such as APPROX-RANDOM, SODA and PODC and in some of the top journals, such as the Theoretical Computer Science and Theory of Computing Systems. Yngvi Björnsson's work on search-methods in artificial intelligence and on general game playing continues to have high visibility both nationally and internationally. Apart from being published in the top publication outlets in the area, some of that work has achieved wide recognition. Finally, ICE-TCS researchers published journal papers in outlets such as Mathematical Structures in Computer Science, Science of Computer Programming, Theoretical Computer Science and Information Processing Letters.

Since our last annual report, ICE-TCS researchers have published three edited volumes, 19 journal papers and 16 conference and workshop papers. By way of comparison, in the previous reporting period the corresponding figures were of 12 journal papers and 15 conference and workshop papers.

Full details on the publications by members of the centre since its inception may be found at

http://www.icetcs.ru.is/publications.pdf.

7 Forthcoming Activities

During 2014, we plan to continue our work with the aim of achieving the objectives stated in Section 1. Despite the available funding and staffing, the levels of ambition and activity remain high within ICE-TCS, and we hope that 2014 will be at least as successful as 2013 was.

The calendar year 2014 will be rich of events that see major involvement from ICE-TCS members. The following events are confirmed at the time of writing.

- From January 2014, ICE-TCS will continue organizing the Pearls of Computation seminar series—see http://www.icetcs.ru.is/poco.html for details. The first two talks in the spring 2014 will be devoted to presentations of the work by Jon Kleinberg and Ed Clarke.

- In the period 14 January–30 April 2014, Magnús M. Halldórsson, Carsten Thomassen, Andrzej Rucinski and Klas Markstroem will organize a special half-year on *Graphs, Hypergraphs, and Computing* at Institut Mittag-Leffler in Stockholm.

- Guy Even, Magnús M. Halldórsson, Yvonne-Ann Pignolet and Christian Scheider are the organizers of a Dagstuhl workshop on *Algorithms for Wireless Communication*, which will be held in the period 27–31 January 2014.

- Adrian Francalanza (University of Malta) will visit ICE-TCS in the period 17–21 March 2014 and will deliver a mini-course on *Foundations of Monitoring and Run-time Verification*. Adrian Francalanza will then spend a sabbatical year at ICE-TCS starting from September 2014.

- We will hold the 10th ICE-TCS Theory Day on Friday, 22 August 2014. As a special guest, we will have Erik Demaine (MIT), who will deliver a public talk as well as a more technical talk during the Theory Day. We are also trying to arrange a public exhibition of some of Erik Demaine's artwork.

- In the autumn 2014, we will celebrate the centenary of George Dantzig's birth with a public seminar delivered by Eyjólfur I. Ásgeirsson.

8 Summary and Self-Evaluation

The reporting period has seen ICE-TCS continue to achieve a fair amount of visibility in the research community. The centre has been very active in organizing high-quality scientific events at Reykjavik University and some of its members have served on the PCs of conferences and workshops in theoretical computer science, and play leadership roles in steering committees and boards for conferences, journals and learned societies. In addition, Anna Ingólfsdóttir and Dario Della Monica have received awards for their research during the reporting period, and Magnús M. Halldórsson has been chosen as PC chair for Track C of ICALP 2014. These are all signs of recognition for the research work that has been carried out within the centre, and for the role that the centre as a whole has played in the theoretical-computer-science community since its inception. Moreover, since Ýmir Vigfússon joined the centre, ICE-TCS has begun to have some visibility also in the area of computer systems, broadly construed, and at the intersection of systems research and theoretical work.

Towards the end 2013, Páll Melsted joined ICE-TCS and we look forward to his contributions to the activities of the centre in the future. ICE-TCS now has ten permanent members and is slowly reaching again the size it had when it also hosted a sizable combinatorics group.

Scientifically, the centre has continued to play an important role in the computer-science and discrete mathematics communities in Iceland. As in previous years, the vast majority of the scientific events in those fields taking place in Iceland have been associated with the centre and, to the best of our knowledge, the ICE-TCS seminar series and guest program are pretty much unique in the country. Internationally, the centre has continued to contribute to the TCS community via its research output and its service activities. In particular, we are pleased to have met the goal of reaching the 200-journal-papers mark by the end of 2013 that we set ourselves at the end of 2012. During 2013, we have maintained a good rate of publication in journals and are slowly increasing the number of conference publications. We were also pleased to have reached the 400-publication mark by the end of 2013.

Overall, we feel that we can be proud of what has been achieved in 2013. However, a proper assessment of the quality and quantity of the research carried out within the centre must be done by others and we still have

an external evaluation of the centre's research activities on our wish list. Unfortunately, as long as specific funding is unavailable for this purpose, we will have to content ourselves with a sober self-evaluation of the centre's research output.

During the reporting period, the centre has further extended its network of research collaborators, and we feel that we have taken good advantage of all the ad hoc funding opportunities that we have had available. We will continue to try and attract research visitors to ICE-TCS using every avenue at our disposal. In particular, we remark that in 2014 a foreign academic will, for the first time, spend his sabbatical at ICE-TCS.

ICE-TCS members will also continue applying for visiting professorships abroad. (For instance, Luca Aceto will be a visiting professor at the Gran Sasso Science Institute in May 2014 and at IMT Lucca in June 2014.)

Overall, we feel that we can be pleased with the quality and the quantity of the research work carried out by our members, and with the ensuing publications. In keeping with the centre's ambitions, it will be a useful exercise for us to find ways to increase the influence and activities of ICE-TCS even further. However, growth in the centre's research activities will strongly depend on increasing the number of its permanent members, and on the number and quality of the PhD students and postdoctoral researchers that we will manage to attract. The main obstacles to attracting PhD. students and postdoctoral researchers is the lack of funding, and we will have to do our best to be successful in grant-winning. In particular, since most of the first batch of PhD students have graduated, we are now facing a dearth of doctoral students. In the coming year, we will have to work hard in order to secure funding for hiring PhD students and to sustain our research agenda with a very small number of graduate students.

We look forward to meeting the challenges ahead and to offering our contribution to the theoretical computer science community.