

# TC1 “Foundations of Computer Science” Activity Report

*Luís Soares Barbosa, TC1 chair*

## 1 Introduction

Established as Special Group (SG14) in 1989 and approved as a Technical Committee in 1996, TC1 aims at supporting the development of Theoretical Computer Science as a fundamental science, and its engineering, as well as the design of bridges with other sciences and their applications.

This annual activity report, covering essentially the period from 1 July 2022 – 30 June 2023, will be presented to the IFIP General Assembly, to take place in Bratislava, from 19 to 20 September, 2023.

## 2 TC1 Activities

One Business Meeting took place virtually in this period:

- *29 June 2023*. The main discussion topics were i) WG activities and planning ii) the support to the new Working Group on Quantum Computation (1.11 / 2.17), and iii) TC1 possible joint activities.

A second Business Meeting in 2023 is scheduled for the end of September.

Along this period, TC1 went on providing support the creation and dynamics of the new Working Group on Quantum Computation (1.11 / 2.17). TC1 Chair (together with TC2 Chair) assumed the WG coordination *ad interim*, until a proper governing structure was approved during the first in-person WG meeting, held in Paris, at INRIA, last 24-25 July.

This report includes for the first time a specific report on TC 1.11 (see Appendix).

TC1 also participated actively in the *IFIP Digital Education Task Force*, created in the last GA, developing the joint report component on *computational thinking and teaching Computer Science as a science*. A preliminary report was presented during a specific workshop at WSIS Forum 2023, in Geneva, 13-19 March.

Two joint initiatives of TC1 were pursued:

- The organization of a book on the role of foundations in building trustworthy information infrastructures, targeting publication in September 2024.
- The organization of a web-based repository of *success stories* on the practical/industrial use of formal methods and foundational approaches in software engineering practice, to be launched in 2024.

On the other hand, the possibility of promoting a TC1 joint event (e.g. conference or Summer School) did not progress and still needs to be consolidated.

### 3 Working Group administration, membership and dynamics

The scientific activity of TC1 takes places in its Working Groups. All of them have either their own flagship conferences and/or are deeply involved in the organisation of conferences with which they collocate their own workshops and business meetings.

The WG activity reports, collected in Appendix A to this document, and their web pages, give a good account of both their internal dynamics, and the scientific subjects that their communities are currently tackling.

The following changes in the WG coordination took place:

- *Martin Kutrib* stepped down as chair of WG 1.02. *Ricardo Reis*, from Sciences Faculty, University of Porto, Portugal, was elected as new chair. His mandate will start on 1st October 2023.

*Heribert Vollmer*, from Hannover University ( [www.thi.uni-hannover.de/en/vollmer/](http://www.thi.uni-hannover.de/en/vollmer/)), joined TC1 as the Germany national representative, replacing *Volker Diekert*.

The list of Working Groups of TC1, with their chairs, vice-chairs and secretaries, whenever applicable, as of the date of writing, is thus established as follows.

WG		Chair	Secretary
1.02	Descriptional Complexity	Martin Kutrib Rogério Reis (Vice)	Andreas Malcher
1.03	Foundations of System Specification	Fabio Gadducci Corina Cîrstea (Vice)	Holger Schlingloff
1.05	Cellular Automata and Discrete Complex Systems	Nazim Fates Henryk Fukō (Vice)	Luca Mariot
1.06	Rewriting	Cynthia Kop Carsten Fuhs (vice)	Carsten Fuhs
1.07	Theoretical Foundations of Security Analysis and Design	Sebastian Mödersheim Véronique Cortier (Vice)	Luca Viganò
1.08	Concurrency Theory	Pedro R. D’Argenio	Ana Sokolova
1.09	Verified Software	Jim Woodcock	Natarajan Shankar
1.10	String Algorithmics & Applications	Jan Holub	
1.11	Foundations of Quantum Computation	Ina Schaefer	Tobias Osborne

The up-to-date member lists for each WG are available the corresponding web pages (accessible from the TC1 web page at [ifip-tc1.org](http://ifip-tc1.org)). IFIP web page: [www.ifip.org/bulletin/bulltcs/memtc01.htm](http://www.ifip.org/bulletin/bulltcs/memtc01.htm) gives the member list for every Working Group as well.

During 2023, as decided in the last GA, updated WG member lists were collected and communicated to IFIP central services. A clear distinction was enforced between active, current members (the only list to appear at IFIP central website) and emeriti and past members.

## Appendix A

# Reports from TC1 Working Groups

## WG 1.02 – Descriptive Complexity

**Chair:** Prof. Martin Kutrib, Universität Giessen, Germany

**Vice-Chair:** Prof. Rogério Reis, Universidade do Porto, Portugal

**Secretary:** Dr. Andreas Malcher, Universität Giessen, Germany

**Home page:** [www.informatik.uni-giessen.de/ifipwg1.2](http://www.informatik.uni-giessen.de/ifipwg1.2)

### 2022-23 BRIEF ACTIVITY REPORT

Descriptive complexity has historically been a multidisciplinary area of study, with contributions from automata theory, computational complexity, cryptography, information theory, probability, statistics, pattern recognition, machine learning, computational learning theory, computer vision, neural networks, formal languages and other fields. The aims of the working group are therefore to promote research in all aspects of descriptive complexity through conferences, publications, and more informal means of scientific interaction such as electronic news groups. Since 2002 particular emphasis was and is being placed on the descriptive complexity of bio-inspired computing models and the relationship between descriptive complexity and software reliability.

The scope of the working group encompasses all aspects of descriptive complexity, both theory and application. These aspects include but are not limited to

- descriptive complexity of formal systems and structures,
- various measures of descriptive complexity of automata, grammars, languages and of related systems,
- trade-offs between descriptive complexity and mode of operation,
- circuit complexity of Boolean functions and related measures,
- succinctness of description of (finite) objects,
- descriptive complexity in resource bounded or structure bounded environments,
- structural complexity,
- descriptive complexity of formal systems for applications (for example, software reliability, software and hardware testing, modeling of natural languages),
- descriptive complexity aspects of nature motivated (bio-inspired) architectures and unconventional models of computing,
- algorithmic and other descriptive theories of randomness.

Furthermore, the WG tries to promote interaction and the exchange of information across traditional discipline boundaries and to provide a point of contact for all researchers in all disciplines interested in descriptive complexity and its applications.

## Organisation of WG and Membership

### Chairpersonship

Prof. Martin Kutrib, Universität Giessen, Germany

The current chair has served for two terms from 2017–2020 and 2020–2023, and it was not possible according to the IFIP rules to reelect him for another term. During the WG meeting on July 4, 2023, in Potsdam, Germany, Prof. Rogério Reis, Universidade do Porto, Portugal, was elected as new WG chair.

## New members

The membership of the IFIP Working Group 1.02 has been maintained as follows:

Walter Savitch,  
Juris Hartmanis,  
Detlef Wotschke,  
Alicia Kelemenova,

have been excluded, since they are deceased in the meantime.

## Scientific activities and meetings

### Events organised by the Working Group

- The *24th International Conference on Descriptive Complexity of Formal Systems (DCFS 2022)* was jointly organized, under supervision of the DCFS steering committee, by György Vaszil (University of Debrecen) and Géza Horváth (University of Debrecen) and the PC co-chair Yo-Sub Han (Yonsei University) from August 29 to 31, 2022 in Debrecen, Hungary. The scientific part was consisting of 4 invited lectures and 14 regular contributions, selected by a program committee after a standard reviewing process. The proceedings have been published in the Lecture Notes in Computer Science book series. A special issue of Theoretical Computer Science, devoted to extended versions of selected papers is in preparation.
- The *25th International Conference on Descriptive Complexity of Formal Systems (DCFS 2023)* was jointly organized, under supervision of the DCFS steering committee, by Henning Bordihn (University of Potsdam) and the PC co-chairs György Vaszil (University of Debrecen) and Nicholas Tran (Santa Clara University, USA). The scientific part was consisting of 4 invited lectures and 13 regular contributions, selected by a program committee after a standard reviewing process. The proceedings have been published in the Lecture Notes in Computer Science book series. A special issue of Information and Computation devoted to extended versions of selected papers is planned.

### Formal meetings of the Working Group

- July 4, 2023, on the occasion of DCFS 2023 in Potsdam, Germany.
- The next formal meeting of the working group is planned in 2024 on the occasion of DCFS 2024 in Santa Clara, USA.

### Forthcoming events

- *26th International Conference on Descriptive Complexity of Formal Systems (DCFS 2024)*. The conference will be held in Santa Clara, California, USA, and it will be organized by Nicholas Tran from June, 25th to June, 27th.

### Publications

- International Journal of Foundations of Computer Science, special issue with selected and extended papers of the 23rd International Conference on Descriptive Complexity of Formal Systems (DCFS 2021), guest editors: Yo-Sub Han, Sang-Ki Ko, in preparation.
- Theoretical Computer Science, special issue with selected and extended papers of the 24th International Conference on Descriptive Complexity of Formal Systems (DCFS 2022), guest editors: Yo-Sub Han, Gyrgy Vaszil, in preparation.

- Henning Bordihn, Nicholas Tran, Gyrgy Vaszil (eds.): *Descriptive Complexity of Formal Systems – 25th IFIP WG 1.02 International Conference, DCFS 2023, Proceedings*. Lecture Notes in Computer Science 13439, Springer 2023.
- *Journal of Automata, Languages and Combinatorics* 27 (2023), special issue with selected and extended papers of the 22nd International Conference on Descriptive Complexity of Formal Systems (DCFS 2020), guest editors: Galina Jirásková, Giovanni Pighizzini.
- *Information and Computation* 284 (2022), special issue with selected and extended papers of the 21st International Conference on Descriptive Complexity of Formal Systems (DCFS 2019), guest editors: Galina Jirásková, Stavros Konstantinidis.
- Yo-Sub Han, György Vaszil (eds.): *Descriptive Complexity of Formal Systems – 24th IFIP WG 1.02 International Conference, DCFS 2022, Proceedings*. Lecture Notes in Computer Science 13439, Springer 2022.

## WG 1.03 — Foundations of System Specification

**Chair:** Prof. Dr. Fabio Gadducci, Dipartimento di Informatica, University of Pisa, Italy

**Co-Chair:** Dr. Corina Cîrstea, School of Electronics and Computer Science, University of Southampton, UK

**Secretary:** Prof. Dr. Holger Schlingloff, Fraunhofer FOKUS and Humboldt University of Berlin, Germany

**Home page:** [ifipwg13.cs.ovgu.de](http://ifipwg13.cs.ovgu.de)

## Organisation of WG and Membership

### Membership

The group is keeping a stable level of around 40 members (excluding emeritus members) and has considered four observers (Daniela Petrisan, Andre Platzer, Shin-ya Katsumata and Max Tschaikowski) in the current report period.

Among the observers, Daniela Petrisan and Andre Platzer joined the group in April 2023. Bart Jacobs, Fernando Orejas, Don Sannella, Andrzej Tarlecki, and Martin Wirsing were granted emeritus status.

## Scientific activities and meetings

### Meetings

A meeting, attended by 14 members and 2 observers, was held in Lipari, Italy, between 5-9 September 2022. The programme consisted of 2 observer talks (Shin-ya Katsumata and Max Tschaikowski) and 9 member talks.

A second meeting was held in Paris, France, between 24-25 April 2023. It was attended by 23 members and 3 observers and included one virtual participation. The programme consisted of 13 talks, three of which were given by observers (Daniela Petrisan, Andre Platzer and Max Tschaikowski).

The next meeting will be held in Salzburg between 5-9 February 2023 and will be organised by Ana Sokolova.

### Published Proceedings

- Alexandre Madeira and Manuel A. Martins (eds), *Recent Trends in Algebraic Development Techniques (26th IFIP WG 1.3 International Workshop, WADT 2022), Revised Selected Papers*, Springer Lecture Notes in Computer Science, volume 13710, 2023.
- Maribel Fernández and Christopher M. Poskitt (eds.), *Graph Transformation (16th International Conference, ICGT 2023), Proceedings*, Springer Lecture Notes in Computer Science volume 13961, 2023.
- Paolo Baldan and Valeria de Paiva (eds), *Algebra and Coalgebra in Computer Science (10th Conference, CALCO 2023), Proceedings*, Leibniz International Proceedings in Informatics (LIPIcs), volume 270, 2023.

### Special Issues

- Timo Kehrer and Fabio Gadducci (eds.), *Special issue on Application-oriented aspects of graphs and graph transformation (ICGT 2020)*, Science of Computer Programming 221: 102845 (2022).

This special issue collects extended versions of selected papers presented at the 13th International Conference on Graph Transformation (ICGT 2020), held on June 25 and 26, 2020, as a virtual event due to the pandemic situation. At ICGT 2020, 22 papers have been presented at the conference, 20 of which have been included in the conference proceedings. Out of those papers, we explicitly invited the authors of excellent papers that highlight the relevance of graphs and graph transformation in different application domains to this special issue, but also opened the special issue to other contributions in the form of an open call for papers. As a result, we have received nine submissions, three of which have been deemed out of scope. Each of the remaining six papers was reviewed by at least three reviewers. After a rigorous review process, we decided to include four of them in the special issue.

- Fabio Gadducci and Timo Kehrer (eds.), *Special issue on Theoretical Topics in Graph Transformation*, Theoretical Computer Science 931: 155–156 (2022).

This special issue collects extended versions of selected papers presented at the 13th International Conference on Graph Transformation (ICGT 2020), held on June 25 and 26, 2020, as a virtual event due to the pandemic situation. At ICGT 2020, 22 papers have been presented at the conference, 20 of which have been included in the conference proceedings. Out of those papers, we explicitly invited the authors of six excellent papers having a strong theoretical focus to this special issue. In addition, we also invited our keynote speaker, Bob Coecke, to submit a paper based on the short summary of his talk. As a result, we received five submissions, including the paper from Coecke and colleagues. Each of these papers was reviewed by at least two reviewers. After a rigorous review process, we decided to include all of them in the special issue.

## Events organised by the Working Group

- The *10th Conference on Algebra and Coalgebra in Computer Science* (CALCO 2023) was held at Indiana University, from June 19th to June 21st 2023, co-located with the *39th Conference on Mathematical Foundations of Programming Semantics* (MFPS). It was organised by Paolo Baldan (University of Padua, Italy) and Valeria de Paiva (Topos Institute, Berkeley, CA, USA). The conference attracted 32 submissions and it had around 55 participants in presence and 60 remote.

The conference featured invited talks by Roberto Bruni, Jeremy Siek and Elaine Pimentel and a Special Session on “*Category theory in Machine Learning*”, organised by Brendan Fong, Brandon Shapiro and Fabio Zanasi, with talks by Jean-Simon Pacaud Lemay on “*Differential Categories and Machine Learning*”, Brandon Shapiro on “*A dynamic monoidal category for deep learning*” and Prakash Panangaden on “*Is there a place for semantics in machine learning?*”. Moreover, Assia Mahboubi and Bob Harper were joint invited speakers for CALCO and MFPS, and there was a joint special session on “*Machine-checked Mathematics*” organised by Assia Mahboubi, with talks by Floris Van Doorn on “*Formalizing sphere eversion using Lean’s mathematical library*”, Yannick Forster on “*Synthetic Computability in Constructive Type Theory*” and Andrei Popescu on “*On the exquisite pleasure of doing coinduction and corecursion in Isabelle*”. Post-proceedings were published in the LIPICS series.

- ICGT 2023

## Forthcoming events

- The *17th International Workshop on Coalgebraic Methods in Computer Science* (CMCS 2024) will be held in Luxembourg in April 2024, as part of the *European Joint Conferences on Theory and Practice of Software* (ETAPS 2024). The PC chairs are Barbara König and Henning Urbat.
- ICGT 2024 and WADT 2024

# WG 1.05 — Cellular Automata and Discrete Complex Systems

**Chair:** Nazim Fats — Inria Nancy Grand-Est, Nancy, France

**Vice-Chair:** Henryk Fuks — Brock University, St. Catharines, Ontario, Canada

**Secretary:** Luca Mariot — Digital Security Group , Radboud University, Nijmegen , 6525 EC, The Netherlands

**Home page:** <https://ifipwg15.inria.fr>

## 2022-23 BRIEF ACTIVITY REPORT

The Working Group 1.5, on *Cellular Automata and Discrete Complex Systems*, reestablished in 2008, has the following attributions:

- To establish and maintain a permanent, international, multidisciplinary forum for the collaboration of researchers in the field of Cellular Automata (CA) and Discrete Complex Systems (DCS).
- To provide a platform for presenting and discussing new ideas and results.
- To support the development of theory and applications of CA and DCS (e.g. parallel computing, physics, biology, social sciences, and others) as long as fundamental aspects and their relations are concerned.
- To identify and study within an inter- and multidisciplinary context, the important fundamental aspects, concepts, notions and problems concerning CA and DCS.

The scope of the working group encompasses all fundamental aspects of cellular automata and discrete complex systems, including: Dynamics, Algebraic aspects, Complexity issues, Emergent properties, Formal language processing, Models of parallelism and distributed systems, Phenomenological descriptions, Scientific modelling and Practical applications.

## Organisation of WG and Membership

### Chairpersonship

In December 2021, the group elected its new head with the Belenios online voting system. Nazim Fats was elected as the new chair of the working group for the triennium 2022-2023-2024. Henryk Fuks and Luca Manzoni were respectively nominated as the new vice-chair and secretary.

### Events

A review on the memberships was carried out in the beginning of June. The group now counts 36 active members ; there are 9 members who did not answer and still need to confirm their status. The page of the working grouping was updated accordingly : <https://ifipwg15.inria.fr/members/>

AUTOMATA 2023 took place in Trieste, Italy, from August 30 to September 1. It was organised by Luca Manzoni (Trieste Univ.) and Luca Mariot (Radboud University, NL). The workshop went well, in a friendly and benevolent atmosphere, although there was only 15 registered participants. As the previous workshop went online, an opportunity to present in person the articles of last year's edition was offered and one talk was related to AUTOMATA'22. It should be noted that two Indian colleagues could not come as they visa was not delivered on time.

The business meeting of the working group took place in a hybrid format. Aside from the usual questions, a discussion on what should be done to give a new impulse to our workshop. There was a general consensus on the opportunity to have a col-location of the workshop with one or several other conferences. However, it was not clear yet with we would associate. It was noted that the opportunity to present extended abstracts was a good move, as some authors do not want to publish in LNCS and prefer well-rated journals for purely administrative reasons. With this respect, it was said that it would be good to know more precisely the evaluation procedures in various countries. It was also mentioned that the committee should play a more active role in the promotion of the workshop and that we could invite authors who published in related conferences to present their papers in AUTOMATA, of course only if they can afford to pay the registration fees. A consultation will be opened to clarify all these points, as well as the opportunity to continue to publish with LNCS, even with a low number of submissions.

A bid for the next edition was presented by Maximilien Gadouleau in order to organise AUTOMATA'24 in Durham, UK, from 22 to 24 of July. This proposition was unanimously approved.

### **New members**

Maximilien Gadouleau, Durham University, GB, was admitted as a new member of the group.

### **Publications**

The LNCS proceedings were edited combining the articles of AUTOMATA 2022 and AUTOMATA 2023 together, see :

<https://link.springer.com/book/10.1007/978-3-031-42250-8>.

## WG 1.06 — Rewriting

**Chair:** Dr. Cynthia Kop, Radboud University Nijmegen, The Netherlands

**Co-chair and Secretary:** Dr. Carsten Fuhs, Birkbeck, University of London, United Kingdom

**Home page:** <https://ifip-wg-rewriting.cs.ru.nl/>

The Working Group aims to promote research efforts in rewriting and its applications. To do this, it aims to establish a close cooperation between existing groups and to facilitate the emergence of new ones. It wants to increase awareness of rewriting techniques in the computer science community at large and foster development of applications of theoretical advances.

## Organisation of WG and Membership

The annual meeting of the IFIP WG 1.6 in 2023 was co-located with FSCD 2023 in Rome, Italy on 5 July. At this meeting, we have welcomed Thomas Genet, Temur Kutsia, and Frédéric Blanqui as new members. This meeting was held in a hybrid fashion, allowing both in-person and online participation.

Like last year, we have decided to additionally hold a fully online meeting, in August or early September. This will allow us to schedule the meeting so that members from all timezones can reasonably attend, and makes it possible to account for the planning of FSCD 2024 in our discussions regarding rewriting workshops.

The Working Group currently comprises 11 honorary members and 47 active members.

## Chairpersonship and Secretary

Cynthia Kop is the current Chair of the Working Group. Her term will end in 2024. Carsten Fuhs is the current Co-chair and Secretary of the Working Group. Like the Chair's term, his term will end in 2024.

## International School on Rewriting

The 13th *International School on Rewriting* (ISR for short) took place in the week of 19–26 September 2023, within the Computational Logic Autumn Summit in Tbilisi, Georgia. The school was organised by Besik Dundua and Temur Kutsia, and is described at: <https://viam.science.tsu.ge/clas2022/isr/>.

The 14th ISR will be organised by Aart Middeldorp in Obergurgl, Austria, from 25 August to 1 September 2024. It has three tracks:

- a basic track which introduces students to term rewriting;
- a basic track which introduces students to lambda calculus and type theory;
- an advanced track that includes topics from active research.

See the School's website for further information on the organisation of the school: <http://cl-informatik.uibk.ac.at/isr24/>

## Events organised by the Working Group

- The annual meeting of the WG in 2022 took place on 31 July 2022.
- The virtual business meeting of the WG in 2022 took place on 4 October 2022.
- The annual meeting of the WG in 2023 took place on 5 July 2023.
- The 13th ISR was held in Tbilisi in September 2022.
- The 14th ISR will be held in Obergurgl in August – September 2024.

## **Forthcoming events**

The next *virtual* meeting of the working group is planned for early September 2023. The next *physical* meeting is planned for July 2024, likely co-located with FSCD 2024 in Talinn, Estonia.

# WG 1.07 — Theoretical Foundations of Security Analysis and Design

**Chair:** Prof. Sebastian Mödersheim, Technical University of Denmark

**Vice-Chair:** Prof. Véronique Cortier, University of Nancy, France

**Secretary:** Prof. Luca Viganò, King's College London, UK

**Home page:** <http://ifipwg1-7.compute.dtu.dk>

## 2022-23 BRIEF ACTIVITY REPORT

The WG 1.7 promotes activities in the area of theoretical foundations of security analysis and design, and has been established in 1999. It mainly aims at investigating the theory of security, as well as of privacy and trust, at discovering and promoting new areas of application of theoretical techniques in computer security and at supporting the systematic use of formal techniques in the development of security related applications.

## Organisation of WG and Membership

Currently the WG has 26 members, from 11 countries and 3 continents:

- Europe: 18 (Germany: 5, France: 3, UK: 3, Italy: 2, Belgium, Denmark, Luxemburg, Spain, Switzerland: 1)
- America: 6 (USA)
- Australia: 2

## Chairpersonship

Assoc. Prof. Sebastian Mödersheim, Technical University of Denmark (DTU), elected on 27 June 2019.

## Scientific activities and meetings

In the summer 2022 we celebrated the 66.66<sup>th</sup> birthday of one of our founding members, Joshua Guttman with a Festschrift which was a very nice success. As a workshop of the Federated Logic Conference (FLoC) it attracted over 30 participants from the community.

This event has sparked several ongoing collaborations between members of the working group in the past year, namely on the field of formally modeling and verifying privacy-type properties of security protocols.

## Forthcoming events

- We now plan to make a general meeting in October with all members of the working group to discuss these collaborations and other opportunities. This will have the form of a workgroup-internal workshop, to both involve members who have not been part of any activities of the workgroup for a while and to connect existing research efforts, possibly leading to joint papers or applications for funding.
- We had organized the informal workshop Hot Issues in Security Principles and Trust (HotSpot) organized for several years. We consider to re-apply for a workshop at the next Euro-S&P.

## WG 1.08 — Concurrency Theory

**Chair:** Prof.Dr. Pedro R. D’Argenio, Universidad Nacional de Córdoba & CONICET, Argentina

**Secretary:** Asoc.Prof.Dr. Ana Sokolova University of Salzburg, Austria

**Home page:** [www.concurrency-theory.org/organizations/ifip](http://www.concurrency-theory.org/organizations/ifip)

### 2022-23 BRIEF ACTIVITY REPORT

The aim of this working group is to develop the theoretical foundations of concurrency, exploring the frontiers of existing theoretical models such as labelled transition systems, process calculi, event structures and Petri nets, and various forms of enriched automata, so as to obtain a deeper understanding of concurrent systems and push forward the associated verification techniques.

## Organization of the WG and Membership

Currently, the WG has 53 members (12 women, 41 men). Since the WG creation in 2005, there has been a turnover of -16, +17. We have been constantly trying to improve the gender balance within the WG, both when recruiting new members and when choosing invited speakers and sending personal invitations for the events organized by the WG.

In the last business meeting, we decided to include the category of Emeriti Members for members that have long served the Concurrency Theory community and the WG and have already retired from their regular jobs. In this context, one of the WG members was appointed Emeritus.

In addition, we have incorporated 4 new members, 2 of the old members ceased to belong to the WG and, as mentioned, one was made Emeritus member.

## Chairpersonship

Prof. Pedro R. D’Argenio (UNC & CONICET, Argentina) and Dr. Ana Sokolova (University of Salzburg, Austria) started coordinating the WG 1.8 in January 2021 respectively as chairperson and secretary of the WG. A round of elections was held by the TC chair in December 2020, which led to their election. At the end of this year, a new election should be called as the three year term of office ends.

## Events organized by the WG

### 1) TRENDS (Trends in Concurrency Theory)

[See <https://concurrency-theory.org/events/trends/>.]

Since 2012, the WG organizes an annual event called TRENDS, in affiliation with the conference CONCUR (the main conference in the field). TRENDS was originally a half-day workshop, consisting of invited talks only. Since 2016, it was turned into a full-day workshop, with both invited talks and a number of “highlight talks” given by WG members or other participants. The aim of TRENDS is to stir discussion on recent trends and open problems in Concurrency Theory. It is informal, without proceedings. Editions 2020 and 2021 were held online due to the sanitary crisis. TRENDS 2022 returned to its in-person form but kept a hybrid format, so lectures were broadcasted and questions were accepted through chats. The 2022 edition consisted of only three invited talks.

TRENDS 2023 will take place physically next September 23, 2023. (<https://concurrency-theory.org/events/trends/2023/>). As usual, it will be co-located with CONCUR 2023 within the umbrella event CONFEST 2023 (<https://www.uantwerpen.be/en/conferences/confest-2023/>). It will consist of four invited talks. So far, the following three speakers are confirmed:

- Marco Bernardo, Università di Urbino, IT
- Simona Ronchi Della Rocca, Università di Torino, IT
- Uwe Nestmann, TU Berlin, DE

The workshop will be followed by the WG business meeting.

## 2) OPCT (Open Problems in Concurrency Theory)

Another event that is regularly organized by the WG 1.8 is the workshop OPCT (Open Problems in Concurrency Theory), which aims at identifying the most important open problems in Concurrency Theory. This is a research seminar without proceedings, where participation is on invitation only. Its average duration is of four days, and its frequency is of one edition every 2-3 years. The four editions of OPCT took place respectively in 2014 in Bertinoro, in 2017 in Vienna, in 2019 in Lisbon, and the last one, 2023, again in Bertinoro. They have always been very successful, gathering each time an attendance of 50-60 people. See the following links:

OPCT 2014: <http://www.sti.uniurb.it/events/opct2014/>

OPCT 2017: <http://opct2017.famaf.unc.edu.ar/Home.html>

OPCT 2019: <https://popl19.sigplan.org/track/opct-2019-papers>

OPCT 2023: <http://www.sti.uniurb.it/events/opct2023/>

While OPCT is usually organized as a stand-alone event, its 2019 edition was held in affiliation with the POPL conference: <https://popl19.sigplan.org/>.

Some words are in order for the 2023 edition, as it happened in the reported year. OPCT 2023 took place in the University Residential Center of Bertinoro, Italy, that provided an excellent atmosphere for fruitful interactions and discussions. It was held between the 26th and 30th of June. It was locally organized by Marco Bernardo and co-organized by Pedro D’Argenio, Chair of the WG 1.8, and Ana Sokolova, Secretary of the WG 1.8. The event accounted 51 participants (11 women, 40 men) and a total of 48 presentations.

The next edition is expected to take place in 2025 or 2026.

## 3) TTCS (Topics in Theoretical Computer Science)

A further event that is sponsored by the WG 1.8 is the international conference on Topics in Theoretical Computer Science (TTCS), whose first two editions were held at the School of Computer Science, Institute for Research in Fundamental Sciences (IPM), Tehran, Iran, respectively in 2015 and 2017, while the third one in 2020 was held online. See the following links:

TTCS 2015: <https://doi.org/10.1007/978-3-319-28678-5>

TTCS 2017: <https://doi.org/10.1007/978-3-319-68953-1>

TTCS 2020: <https://doi.org/10.1007/978-3-030-57852-7>

## Publications

In the past, four special issues of the Journal of Logical and Algebraic Methods in Programming (JLAMP) have been organized: two of them as an outcome of OPCT 2014 and 2017, and the other two as an outcome of TRENDS 2014, 2015, and 2016:

OPCT 2014: <https://doi.org/10.1016/j.jlamp.2015.10.002>

OPCT 2017: <https://doi.org/10.1016/j.jlamp.2022.100823>

TRENDS 2014-2015: <https://doi.org/10.1016/j.jlamp.2017.01.002>

TRENDS 2015-2016: <https://doi.org/10.1016/j.jlamp.2019.07.001>

We are currently preparing a call for a special issue after OPCT 2023.

## Contribution for creating the CONCUR Test-of-Time award

[See <https://www.concurrency-theory.org/events/tot-award/>.]

Our WG contributed to the creation of a Test-of-Time award for the papers published in the CONCUR conferences. The first edition took place during CONCUR 2020 and papers for the periods 1990-1993 and 1992-1995 were awarded. The second edition took place during CONCUR 2021 and papers for the periods 1994-1997 and 1996-1999 were awarded. The third edition took place during CONCUR 2022 and papers for the periods 1998-2001 and 2000-2003.

The fourth edition will take place during CONCUR 2023 (September 19-22, 2023, Antwerpen) and a paper for the period 2002-2005 was awarded. The Jury of the Award for this last edition was Chaired by Marta Kwiatkowska, and composed by Bengt Jonsson and Igor Walukiewicz. In particular, Marta Kwiatkowska is member of the WG. The selection has already been made public and it is worth mentioning the awarded paper was co-authored by a WG members.

1st CONCUR ToT award: <https://concur2020.forsyte.at/test-of-time.html>

2nd CONCUR ToT award: <https://qonfest2021.lacl.fr/test-of-time.php>

3rd CONCUR ToT award: <https://concur2022.mimuw.edu.pl/tot-award/>

4th CONCUR ToT award: <https://www.uantwerpen.be/en/conferences/confest-2023/concur/awards/>

## WG 1.09/2.15 — Verified Software

**Chair:** Prof. Jim Woodcock University of York, UK

**Secretary:** Dr. Natarajan Shankar, SRI International, US

**Past-Chair:** Dr. Jean-Christophe Filliâtre, CNRS, Orsay, France

**Home page:** <https://www.lri.fr/~filliatr/1.9/>

### 2022-23 BRIEF ACTIVITY REPORT

The aims of 1.9/2.15 are to contribute to a comprehensive theory of programming that covers the features needed to build practical and reliable programs; to contribute to a coherent toolset that automates the theory and scales up to the analysis of industrial-strength software; and to collect realistic, verified programs as part of the Verified Software Initiative (VSI) Repository.

Since the creation of the group in 2011, we had twelve physical meetings. These meetings are sometimes co-located with conferences of our domain (e.g. CAV, POPL) to limit travels, though this is not a rule.

We invite different observers to attend our meetings each time, and we collectively decide to elect some of them as new members whenever they participated actively and constructively to our meetings.

Our meetings encourage talks on work in progress and leave much room to discussion. Each talk is typically given one hour.

We also run the VSTTE conference and the Verified Software Competition ([vscomp http://vscomp.org/](http://vscomp.org/), not to be confused with the VerifyThis competition, another competition of our domain).

## Organisation of WG and Membership

There are currently 21 members of the working group.

### Chairpersonship

Jim Woodcock FREng (University of York) continues to be chair of the working group.

### New members

No changes in the members during the period.

The current number of members of the group is 21 (+ 3 emeriti).

### New organisation rules

No changes in the organisation rules during the period.

## Scientific activities and meetings

### Events organised by the Working Group

We had no physical meetings of the working group in the period (July 2022 – July 2023), due to recovering from the COVID-19 situation.

The postponed “Verified Software” Programme at the Isaac Newton Institute took place in Cambridge between the 4th of July 2022 and the 12th of August 2022.

Although we have not met within the reporting period, we have set up a Zulip topic-based thread and we are planning meetings in the next reporting period.

## WG 1.10 – String Algorithmics & Applications

**Chair:** Prof. Jan Holub, Czech Technical University in Prague, Prague, Czech Republic

**Home page:** <http://www.stringology.org/ifip/>

### 2022-23 BRIEF ACTIVITY REPORT

The WG 1.10 aims to promote research in String Algorithmics (combinatorics on words, string algorithms) and applications. It proposes a unique forum for the best available research that will provide sustained inspiration within the stringological community for still better research. We intend to take advantage of the applied nature of a very theoretical topic to encourage both theory and practice in the group. At both ends our main concern is to promote relevant research of the very highest quality.

The scope the group is paradoxically both well-focussed and broad: well-focussed because the underlying combinatorial object is text, a simple word, a piece of string; broad because of the numerous applications (combinatorics on words, finite automata), but also algorithms on strings, and so the application areas for those algorithms, of which a partial list follows:

- computational biology (including system biology, biology/PPI networks),
- text compression,
- natural language processing,
- information retrieval, both on and off the Internet (including search engines, massive indexing applications),
- data mining,
- pattern recognition,
- software engineering,
- cryptology,
- computational geometry,
- computational musicology.

## Organisation of WG and Membership

### Chairpersonship

Jan Holub is a chair of WG since 2019 when the WG was re-established.

### New members

No changes in the members during the period.

### New organisation rules

No changes in the organisation rules during the period.

## Events organised by the Working Group

- 29th International Symposium on String Processing and Information Retrieval (SPIRE 2022). Concepcion, Chile, November 8–10, 2022,
- 34th Annual Symposium on Combinatorial Pattern Matching (CPM 2023). Paris, France, June 26–28.

## Forthcoming events

- 26th Prague Stringology Conference (PSC 2023). Prague, Czech Republic, August 28–29, 2023,
- 30th International Symposium on String Processing and Information Retrieval (SPIRE 2023). Pisa, Italy, November 26–28, 2023,
- 35th Annual Symposium on Combinatorial Pattern Matching (CPM 2024).

## WG 1.11/2.17

**Chair:** Prof. Ina Schaefer, Karlsruhe Institute of Technology, Germany

**Secretary:** Prof. Tobias Osborne, University of Hanover, Germany

**Home page:** [el.kit.edu/english/activities/IFIP\\_Working\\_Group\\_on\\_Foundations\\_of\\_Quantum\\_Computation.php](http://el.kit.edu/english/activities/IFIP_Working_Group_on_Foundations_of_Quantum_Computation.php)

### 2022-23 BRIEF ACTIVITY REPORT

Arguably quantum computing is coming of age. With the race for quantum rising between major IT players, and the announcement of new prototype, proof-of-concept machines, it seems we are in the verge of a real shift. For the first time the viability of quantum computing may be demonstrated in a number of real problems extremely difficult to handle, if possible at all, classically, and its utility discussed across industries. In a sense, Feynman's dream of letting Nature, suitably engineered, compute for us through its own natural quantum behaviour, seems to be closer, even if the project of a universal quantum computer still has a long way to go. In the somehow emphatic language of the media, a "second quantum revolution" is quickly approaching. It is characterised by the ability to harness weird quantum phenomena, namely superposition, interference and entanglement, as computational resources, with practical advantage. In this move the role of software, and its foundations and engineering, cannot be underestimated.

The conceptualisation of quantum computing predated its technological realisation: in a way physicists are making it happen. Similarly, in the 1930's, Turing machines anticipated digital computers. It seems history is repeating itself. Differently, however, from what happened before, we have now the chance to get theory in place before technologies emerge and popularise. IFIP cannot be strange to this challenge.

Such is the aim of this new Working Group. Operating under both TC1 and TC2, it will be oriented towards the development of foundations and rigorous, mathematical methods for Quantum Computer Science, including the theory and methods of quantum information science, quantum computation and quantum software engineering, and its application to strategic, emerging problem-areas. Furthermore, fulfilling its mandate as an IFIP technical asset, the new WG will contribute to the scientific and technical development of this new dimension of Computer Science.

#### Main Research Topics

- Quantum Algorithms
- Quantum Programming Languages and Compilation
- Quantum Foundations
- Formal Methods for quantum computing

## Organisation of WG and Membership

### Chairpersonship

*Prof. Ina Schaefer*, Karlsruhe Institute of Technology, Germany

Elected in the first in-person business meeting, 24 July, 2023. *Prof. Tobias Osborne* was chosen as WG 1.11 Secretary in the same meeting.

## **New members**

The membership of the IFIP Working Group 1.11/2.17 has been maintained, with two new additions from July 2023:

- *Mio Murao*, University of Tokyo, Japan
- *Anna Pappa*, TU Berlin, Germany

## **Scientific activities and meetings**

### **Formal meetings of the Working Group**

- The WG has a first virtual meeting in July 2022, after which a distribution e-mail list and a WG website were created.
- The first in-person meeting was organised by Benoit Valiron and Shane Mansfield, at INRIA, Paris, 24-25 July, 2023, with 9 talks, 15 participants and very lively discussions.
- A business meeting, on the 24th July, further clarified the WG focus, defined its dynamics and elected the Chair and Secretary. A decision was taken to proceed with a second round of direct invitations (up to 10-15 new members) to better cover the areas listed in the WG scope. A concern for gender balance, coexistence of academic and industrial profiles, countries/continentes representation, etc. was expressed and will be taken into account in this process.
- The next formal meeting of the working group is planned for 2024, possibly organised back to back the 2024 Quantum Compilation workshop.