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Netherlands Institute on Research on ICT

4TU.NIRICT	People involved
Board	Prof.dr.ir. Inald Lagendijk, TUD (scientific director) Birna van Riemsdijk, prof.dr. Marieke Huisman, prof.dr.ir. Maarten van Steen, dr. S. Stuijk and prof.dr. Johan Lukkien
Programme Manager	Eveline Vreede
Research portfolio	prof.dr.ir. Maarten van Steen and dr. Birna van Riemsdijk
Young researchers network	dr. S. Stuijk
Cooperation in education	Prof.dr. Marieke Huisman and prof.dr. Johan Lukkien
BSR	Prof.dr.ir. Wil van der Aalst, prof.dr. Arie van Deursen en prof.dr. Jaco van de Pol

Information and communications technology (ICT) research at the universities of technology primarily concentrates on refreshing and prioritising individual subdisciplines. The 4TU.Netherlands Institute for Research on ICT (4TU.NIRICT) research centre focuses on integrating, positioning, and prioritising all aspects of **ICT research**, in both multidisciplinary and chain approaches in a rapidly digitising world. Since more than 50% of research conducted at universities of technology concerns ICT, the research centre can effectively devote itself to strengthening the national ICT research network. In doing so, the decision was made to focus on researchers who are at the start of their careers. Another objective is to encourage cooperation in emerging research and educational topics that will be of significance for ICT in the future.

4TU.NIRICT endeavours to achieve these goals using a three-pronged approach involving community building, educational collaboration, and research portfolio management. Its largest research programme is the Big Software on the Run (BSR) project. BSR is an independent research programme in which seven research groups from UT, TU Delft and TU/e are taking part.

Since **WUR** joined the federation, ongoing discussions are taking place with WUR's Professor of ICT Bedi Tekinerdogan regarding expanding 4TU.NIRICT's administration and activities.

Community

In order to promote cooperation between universities of technology, it is vital to establish and develop a network in which all participants are aware of and have mutual respect for each other's ICT research. The emphasis here is on researchers who are yet to build an extensive national network. In addition to the annual community meeting, a network of younger ICT faculties has been set up under the name of **ICTng** (ICT next generation). In doing so, close cooperation was sought with the FES COMMIT/ programme (coming to an end in 2017), which pursues similar objectives. Led by Assistant Professor Przemek Pawelczak, a core team of young researchers from several Dutch universities was also created. Furthermore, COMMIT/ and 4TU.NIRECT helped to organise and fund a series of meetings featuring inspiring speakers and discussions.

Educational collaboration

All of the universities of technology develop their own curricula and educational activities, the development and implementation of which can help to strengthen each other in some areas. Educational collaboration is particularly necessary to help

increase the **efficiency** of educational development and **teaching** (where possible). An inventory of programmes, courses, materials and MOOCs has been made and, as a result, ICT researchers from the universities of technology are better informed about their colleagues' activities and resources, which in turn helps promote collaboration and the sharing of best practices. One bottom-up educational initiative, which was (financially) supported by the research centre, was the best-practices workshop MOOC, which was created by colleagues for colleagues.

In 2015, 4TU.NIRICT sponsored the European School of Information Theory. In 2016, a joint contest was held whereby the four most enterprising ICT students from universities of technology could win the chance to take part in the European Innovation Academy summer school. As part of the 4TU.BSR programme, a winter school was organised in October 2016 entitled "Big software on the run: Where software meets data", which attracted more than 80 participants.

Finally, the universities of technology are jointly responsible for implementing and designing the Master's degree programme in Innovation offered by EIT Digital. 4TU.NIRICT's Director of Research represents the research centre on the EIR Digital General Assembly.

Research collaboration

The research centre promotes and provides funding to stimulate bottom-up initiatives for collaboration on thematic research projects. It thereby develops and maintains a research portfolio, of promising issues that ultimately have a reasonable chance of receiving **external funding**. From 2014 to 2017, the universities of technology collaborated on the following topics: Data Science, Cyber Security, Antenna Research, Empathic Lighting, Wirelessly-Powered Autonomous Systems, Smart Industry/IoT, Green ICT, Human Computation and Crowdsourcing, and GPGPU. Various activities were developed as part of these partnerships, such as joint workshops, seminars and representation in the Dutch ICT landscape. The universities also collaborated on (successful) joint project applications. There were a number of exchanges between young researchers and fact-finding investigations were also carried out at various companies.

Big Software on the Run

4TU.NIRICT's largest research programme is the Big Software on the Run (BSR) project. BSR arose from a national Gravitation proposal which was submitted (and rejected) in 2013 by 4TU.NIRICT, RUN and VU Amsterdam. The aim of BSR is to analyse software "in the wild" using big data methods, and to use the results to **improve software development methods**. Software forms an integral part of the most complex things built by humans. BSR is therefore developing innovative technologies that identify how systems actually work, check where and when systems deviate from expected behaviour, predict reliability, performance and security, and make recommendations to address problems. This approach requires a huge amount of data (Big Data) and very complex software (Big Software). There is extensive **co-operation** between the participating research groups. A specific example of this is that PhD students are supervised by promotors from two different universities of technology. The groups also use the same infrastructure: in Eindhoven the groups compute large data sets in a single machine, and in Enschede the focus is on distributed computing. This **efficient use of resources** has also been organised with an eye on the future, so that it can respond to developments within joint projects in the coming years. Integrating the different disciplines and methods has generated new insights, creativity and healthy friction. Unexpected new developments have also arisen, such as the collaboration with security groups in the area of privacy in software analysis. External funding is essential for some sub-activities within BSR so as to maintain the network of collaboration which has been built up.

Agenda for 2017

In 2017, 4TU.NIRICT will continue its partnership with ICT.OPEN, the largest gathering of the Dutch ICT research community, and make a substantive contribution towards multiple tracks and offer various awards. In addition, it will organise another Community Day. ICTng is also organising a series of meetings, the first of which will be hosted by the University of Amsterdam and VU Amsterdam in March. Thematic workshops and substantive networking events will be organised by some of the researchers who are working together within smaller research partnerships. Finally, BSR will run various national consultations and a final winter school.