

60 YEARS TU/e

DREAM & DARE FESTIVAL



Introducing | **PhD** research | Waldur Study Trip |
PDEng Trainee | **Open House Day** Thor | **Column**

Connecthor

Volume 9, issue 2 - June 2016

Connecthor is published by e.t.s.v. Thor and the department of Electrical Engineering at Eindhoven University of Technology. Connecthor is published quarterly with a circulation of 1500 copies and is free for all members of e.t.s.v. Thor and employees of the department of Electrical Engineering.

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Deadline copy next issue: 22 July 2016

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Looking back at the past eight years, we are filled with pride to have been part of the Connecthor editorial board and to have been able to bring this beautiful magazine to life, from the day it was born to the present. Over the years, we have experienced many events and we have cooperated with many of you. We have tremendously enjoyed the great atmosphere and motivation of our team members and especially the unique combination of staff and students in the editorial board.

We are delighted to announce that our work as editors in chief will be continued by Pauline Hoen, who is a long-time member of the Connecthor board, and we are confident that she will take Connecthor and the board to the next level. That also brings us to a number of people whom we would like to thank. First of all, Anjo Peeters, who has been our solid support for many years for layout editing of the Connecthor editions and for chasing all of us when details of articles still needed to be filled in. Without him, the magazine could not have been as beautiful. Thank you Anjo for all the good work and we wish you good luck in your new job at Witteveen+Bos. Further, we would like to thank the boards of Thor and of the Department of Electrical Engineering for many years of cooperation, support, and trust.

At this point in time, we step down from the board. We hope that you as a reader will keep on supporting Connecthor and will enjoy the magazine, as well as feed the editorial board with news, interesting articles, and scoops. If you would like to enjoy a similar experience as we have had over the years, we urge you to come forward and become a member of the Connecthor editorial board. As always, the editorial board will be glad to receive your suggestions and ideas via connecthor@tue.nl. It has been a fantastic ride for us!

Femke Verheggen and Martijn van Beurden ■



Board Issues

Sjoerd Hulshof as new Director of Education Bachelor Electrical Engineering and Huug de Waardt as new Director of Education Master Electrical Engineering. Read all you want to know about them in the board issues on page 4.



Internship Germany

Read about Sjoerd van der Heide's internship on page 28.



Whose desk is this?

Another employee reveals her different desks. Read it on page 12.



Waldur studytrip Hannover

Waldur went on a half-week studytrip to Hannover, and visited some German companies. Read the experiences of the participants at page 18!

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Board Issues

By: Sjoerd Hulshof and Huug de Waardt



When I started my Electrical Engineering studies back in 1989, I didn't know anything about the academic organization we were surrounded by, and frankly I didn't really care either. After all, I was just a first-year student, struggling with getting used to new surroundings, a new study, a new way of life and a lot of freedom. Suddenly I was completely responsible for my own actions and I only realized that after I got my first grades back.

In general, things haven't changed much for students since then, and students haven't changed much either in my opinion. As for

me the opposite is true. In the following years during my studies I got involved with the educational process as a student assistant for our 'IC-practicum' (chip design from scratch to physical product) under supervision of Martin van Gessel. Once I found out about electromagnetics I directly knew that it was going to be my specialization track. My graduation project was about the quite exotic *bunny-ear antennas* (under supervision of Bart Smolders and the late dr. Jeuken), whereupon I started working as a PhD student in the EM-group. Despite the fact that I really liked my fundamental research, I was also attracted by education a lot. As a result I obtained an

educational degree in Physics and started working as a Physics teacher in secondary school besides my research. That combination didn't really work out well, so eventually I made a choice: I became a full-time teacher. Not really something you would expect from an electrical engineer ... at that time.

Six years ago I had the chance to start working as a teacher and study counselor in my own beloved faculty where Martin now became my colleague and Bart became my supervisor. During these past years I experienced a lot, learned a lot, and organized a lot in our academic organization. Directed by Bart, we took our intake sessions to a higher level, we improved our Bachelor program in 2010, we started our new Bachelor track Automotive in 2011, we started our international program in 2012, and we saw our influx grow from 80 to 280 students; quite an achievement of both the OWI team and the students from our public-information team. Therefore I've experienced the opportunity to follow up Bart in the position of director of education as the icing on the cake.

So, what's there left for me? Apart from the upcoming accreditation I think there are enough challenges left during the next years. To name a few: both our Electrical Engineering and Automotive programs still need some optimization, as well as the Bachelor College itself. Furthermore, *activating* students has always been my main focus in education. With the growing number of students in mind I see a lot of opportunities in *blended learning*. For that, I am always open to suggestions!

Sjoerd Hulshof,
Director of Education Bachelor Electrical Engineering



With the appointment of prof. dr. ir. Bart Smolders as Dean of the Faculty of Electrical Engineering, a job vacancy occurred as Director of Education. Following the new university educational structure with a Bachelor College and a Graduate School, actually two vacancies were created; one as Director of Education for the Bachelor College and one for the Graduate School. As of March 1, 2016, I was appointed in the latter position.

My background is in Electrical Engineering and I obtained my MSc degree from TU Delft in 1980. I started my professional career at the central research institute of the Dutch PTT (DNL Leidschendam) in the Department of Physics, evaluating the performance aspects of optoelectronic devices. In a later stage I migrated to the Transmission Department where I worked on high-capacity Wavelength

Division Multiplexed optical transmission. I was allowed by PTT to combine my daily work with a PhD study, which was successfully finalized in 1995 (at TU Delft). In the selfsame year I was approached by prof. Djan Khoe to join him at his newly formed group ECO as associated professor, where I became responsible for the research track ECO-1 on long haul high capacity optical transmission. Over the years of my professional career I have witnessed a capacity growth over a single mono-core fibre from 34 Mbit/s over 12 km to 42 Tbit/s over 720 km.

In my new position as Graduate Program Director I see three areas with challenging opportunities. First the Master program. As the restructuring of the Master program has been implemented, we first have to remove some existing flaws in the alignment of the courses. Next to that, a large student population will

enter the Master phase in the years to come, requiring internships and Master graduation projects. How can we balance the quality on one side and the workload of the scientific staff on the other side? Secondly, a university-wide restructuring of the PhD trajectory is in progress. On the one hand it serves to optimize the quality and level of the degree, on the other hand it will require full support of the students and the staff. And thirdly, the PDEng programs are in a process of clustering and harmonization. Sufficient challenges for the coming four years, I should say!

Huug de Waardt,
Director of Education Master Electrical Engineering ■

TECHNIEK IS JOUW TOEKOMST

Of je nu studeert, een traineeship of technische baan zoekt. Jij wilt met de juiste functie je carrière succesvol starten. Daarom kom je graag in contact met de juiste organisaties. Hoe? KP&T vormt voor jou de schakel. Maar dat niet alleen:

- Wil jij weten hoe jij jezelf optimaal profileert en presenteert voor werkgevers?
We laten je graag zien hoe je social media en dan vooral LinkedIn hiervoor kunt inzetten
- Ben jij benieuwd naar welk bedrijf bij jou past voor jouw (afstudeer)stage of eerste baan?
Onze adviseurs geven graag persoonlijk en vrijblijvend advies. Of leggen als mogelijk direct een link!
- Ga jij graag op en top voorbereid solliciteren?
Wij voorzien je brief en cv gratis van feedback en geven uitgebreid sollicitatietips

Wil jij aan de slag met bovenstaande punten?
Bekijk dan www.kpt.nl/techniekisjouwtoekomst
voor meer informatie.



From the President

By: Daan Daverveld



There is a time of coming and a time of going. This is a Dutch saying implying that things can start but will end after all. We have started our last real quartile as the Board of Thor. After this quartile the holidays will start and after that we will soon be discharged as the 59th Board of e.t.s.v. Thor. This will probably be the last 'From the President' for me. That is a strange idea, bringing the end even closer for my feeling. It is strange how fast this year went. I fondly think about what it was like to be a kandi (candidate), to grow into your role as a Board member and to execute everything you want to accomplish within a year. In my opinion we did quite good so far, but we are still not done yet. There are some things we still want to accomplish. Normally, Thor throws a 'promotion market' where all the students who want to do something extra beside their studies can see what they can do for Thor. It used to be a row of tables where some people were standing answering questions about a committee. This year we wanted to make something new out of it by really making this

an event. We decided to build our own Thor Explore Room! This is an escape room that highlights the different things our committees, which our students can join, represent. In this way, students familiarise with the possibilities within Thor by playing a game. I think this is one of the last things I personally will be working on with respect to the plans we had in the beginning.

We have our own kandi's now. They form the group of people who should take over our position as the Board next year. It is exciting to see that every year there are a lot of ideas for making Thor a better place for our students; plans that emphasize the support we want to give the students in an educational way, but also in a relaxing ethos. We personally want to give the new group the best start we can possibly give them. We think that if we do not do this, we throw away our own efforts in making things better. We also throw our kandi's in the deep so that they really need to adjust to all that is new and that is coming at

you when you start as a Board. No, we want to really work together and already wish them all the best and good luck in their coming year.

What will I be doing myself after this year? I will be back in the lecture rooms, trying to finish my studies. After a year of not being able to study as much as usual, you really start to miss it. The time comes that you want to finish your Bachelor and start as a Master student. But before that happens, there are still some things that you need to do as a just discharged Board. One of those things is organizing the Dies of Thor, the week where we celebrate that Thor becomes a year older. It is fun to do that because it is the one time that you only have to focus on one event at a time. However, we are not done yet! We still have some time to enjoy this year. We are still energetic and will proceed with this year as we have done before: with laughter, pride, and dignity.

Veel gedonder!

Daan Daverveld ■

Introducing...

My name is Ulf Johannsen. I was born in Flensburg, a town located at the Danish border in the far north of Germany. In 2003, after leaving school, I moved to Hamburg where I studied Electrical Engineering at the Hamburg University of



Technology (TUHH). During my time there, I ventured out to two internships abroad, first to NXP Semiconductors in Shanghai, China, and directly afterwards to NXP in Nijmegen here in the Netherlands. During the Nijmegen internship, I spent a part of my time at TU/e, working with the EM and MsM groups on a silicon integrated antenna concept. As I thoroughly enjoyed the atmosphere at TU/e as well as the research topic, I came back to TU/e, after graduating with a MSc from the TUHH, to work as a PhD student on the same subject. In 2013, after obtaining my PhD and after having spent nearly ten years in a university environment, I decided that it was time to broaden my views and to gain experience in industry. And as I thought that the underwater domain, where rather acoustic than electromagnetic waves are primarily used, would be an interesting challenge from a technical perspective, I started as Systems Engineer at ATLAS ELEKTRONIK in Bremen, Germany, where I have been working as Engineering Manager for Autonomous Underwater Vehicle (AUV) systems for the past three years, and where I have enjoyed working in and leading a multi-disciplinary system development team.

During my time in industry, I came to the understanding, however, that the foundation for making a real difference for society is laid in academia. This is where sustainable, long-term research is being conducted and the next generation engineers and scientists are being educated. From a personal perspective, I realised that my desire to continuously gain deeper and further knowledge is best addressed here and that this is the best place to work when seeking an innovative and creative work environment. Hence, I will start at the EM group as assistant professor from July 1.

Building up on my PhD work, I will be focusing on the co-modelling, co-design and interaction between active and passive on-chip components with the aim to support the development of wireless systems on chip and, in the long run, entire systems on chip without wired interfaces, often referred to as smart dust. Next to my research, I will also be giving courses and lectures as well as supervising and supporting students on their way to become engineers.

I am very much looking forward to becoming, once again, a member of this dynamic and innovative university! ■

Hello everyone! My name is Marina Nano and I just moved to Eindhoven to join the SPS group as a PhD candidate. I grew up in Greece, in the beautiful city of Piraeus, which lies along the east coast of the Saronic Gulf. I received my diploma (BSc and MSc) from the Polytechnic University of Patras, Computer Engineering and Informatics Department.

In my spare time, I like working out and experimenting in the kitchen. Food is an important part of the Greek culture, which gives me the opportunity to spend quality time with my family and friends. One of my latest passions is traveling, exploring different places, customs, cultures, and meeting people with

different perspectives and world views. My last trip was to Nigeria (see picture) and it was a unique experience. For the next four years, I will be working at the university. I am looking forward to meeting and working with you all and making awesome new friends! ■



Then I moved to the Netherlands. The past two years I spent my time at both Delft and Eindhoven, being a Master student at TU Delft. I received my degree from the Electrical Engineering faculty, in the Signals & Systems track. I carried out my internship at Philips Research and my Master Thesis at Máxima Medisch Centrum. I worked on apnea detection in both adults and preterm babies. Both positions offered me great experience and insight into how research is carried out in both a leading company and a hospital. My PhD project is part of the Impuls program, a collaboration between TU/e, Philips and Kempenhaeghe.

European Research Council Grant

The European Research Council (ERC) has awarded an Advanced Grant to prof. dr. ir. Paul van den Hof, who works at the Control Systems group in the Department of Electrical Engineering. The amount, 2.5 million euros, represents one of the largest research subsidies that can be awarded to an individual researcher. The grant, which is intended to fund five years of research, will enable Van den Hof to undertake fundamental research on the data-based modeling of dynamic networks. These are complex systems that contain a large number of components and unpredictable connections.



Cum Laude promotion

Víctor Manuel Dolores Calzadilla was promoted cum laude on Thursday April 14, 2016, for his research for which he designed parts for future optical chips. He did his research within the group Photonic Integration, under guidance of professors Meint Smit and Andrea Fiore.



Goodbye Monica Kloet

Monica Kloet, who was receptionist at Electrical Engineering from 7 May 2012 till 1 March 2016, was offered a farewell party on 24 February 2016.



Explore Your Master 2016

Every year the StudentBody organizes the Explore Your Master event. For EE students there are a lot of Master programs that you can do and we show all of them during the event. We ended up with 20 presentations. Not all presentations were on the same day, they were divided over Monday 25th and Tuesday 26th of April. After the last presentation on Tuesday there was a promotion market. During the market the various Master programs could show their research and students had a chance to informally ask questions. Both parts of Explore Your Master were well attended. We had an average of 57 students during the presentations and many more during the promotion market.



Anjo Peeters leaves editorial board

After many years of service to the Connecthor, Anjo Peeters has stepped down from the editorial board after obtaining his Master's degree. Anjo has been one of our layout editors and he has coordinated the work among a small team, while chasing the rest of the board to deliver copy up to the last detail. We are grateful for all the time he has put in and we wish him good luck in his new job.



Manager Operational Management

Since the 1st of February 2016 the EE and TN Management Office receives extra support in the form of a Manager Operational Management. Corine Spoor has been appointed to this position. She is already known to many people in the two departments. From 2014 onwards, Corine has been involved in the move to Flux, initially with the preparations and subsequently with the logistics of the move and the interior of the Flux building. Corine will be responsible for internal affairs, health and safety, facility services, workplaces and ICT management for the EE and TN departments. Overall responsibility rests with the Managing Director. We wish Corine success in her new position.



Scaffolding in Flux

In February, scaffolding was built up in the central hall of Flux to install equipment for cleaning the windows on the inside of the central hall. In the same period, also the reception desk was adapted to block direct sunlight in the afternoon.



Goodbye Femke and Martijn

Femke Verheggen and Martijn van Beurden have decided to step down from the Connecthor editorial board. They both have been part of the editorial board since the beginning in 2008 and Femke has been editor in chief since that moment. Since 2010, Femke and Martijn have jointly been the editors in chief. The editorial board is grateful for all their contributions and efforts and wish them good luck.



ICT services Flux

Please be informed that as of Monday February 6th, an ICT desk is situated on floor 0 for all your ICT questions. From Monday to Friday a student assistant will help you solve your ICT issues.



Dream and dare festival

From Friday 22 until Sunday 24 April 2016 the Eindhoven University of Technology campus was transformed into a festival terrain as the university celebrated its sixtieth birthday! Technology, innovation, music, art, debate, science and a highly varied food line-up turned the campus into a living landscape where young and old, students and staff, locals and non-locals got together.



Goodbye Rianne van Eerd

After 6 wonderful years at the Faculty of Electrical Engineering, Rianne van Eerd has left us. On April 1, 2016 she made the switch to her new job: Secretary to the Executive Board at TU/e. She will plan and support the meetings of the Executive Board. Next to that, Rianne will be responsible for the delivery of the TU/e year reports and the Executive Agenda. Furthermore, she will coordinate a couple of projects, such as the digital meeting environment. We thank Rianne for her input for the department.



Institute for Photonic Integration

By: Chigo Okonkwo

On the 25th of April, the launch of the Institute for Photonic Integration, sponsored by STW (Dutch Technology Foundation) took place at the TU Eindhoven. The new institute was launched to further exploit the research that has been ongoing within COBRA Research School (involving Electro-Optical Communications, Photonic Integration group and Applied Physics) and enables small-to-medium and larger enterprises to develop their applications for these photonics devices and systems.

The sessions included talks from prominent speakers from United States, China, and Europe providing the background on the research ongoing in their respective countries. From the Netherlands, the European business focus of this initiative to further accelerate the adoption of photonic integrated circuits in new market segments were discussed. Eight different companies gave an overview of industrial activities in the Netherlands. Finally, the last session provided an overview of the integrated photonics activities in the Netherlands and the Eindhoven region, and the founding of the Institute for Integrated Photonics by TU/e was announced. The symposium was very well attended and concluded with a networking reception.

The main driver behind this photonics initiative is the explosive growth of online video, mobile data and the variety and ubiquitous connectivity of devices to the Internet. Hence, current capacity in optical systems cannot sustain this growth. In addition, the key devices, which power the Internet such as the transceivers, switches and routers should also conform to reducing power consumption inline with the societal drive to be green. Therefore, photonic integrated devices and photonic systems that operate by manipulating photons rather than electrons have shown great promise miniaturizing devices required for the Internet as well as reducing the amount of power required to control them, whilst increasing the density and the capacity of the components required.

Therefore at TU/e, the institute will exploit years of research in integrated photonics and photonic systems technology that has been funded by national and European projects. The aim is to attract significant funding to bring the technology further towards commercial applications. Already in the United States, a

similar initiative by President Obama - the American Institute for Manufacturing (AIM) Photonics - has earmarked an investment of \$600 million for research and development of integrated devices. Here at TU/e the new institute will drive the European activities to further achieve market penetration for photonic integrated devices and systems.

Explosive data growth

The data usage from people and by devices ('Internet of Things' where in-home devices are connected to the Internet) is growing explosively with a conservative range for the compound annual growth rate of between 25-40% every year. Already several data centers (from Google, Microsoft, Amazon etc.) around the world are using up 3-5% of all available electricity available at their location, and without further action this is expected to grow to tens of percent of the electricity produced globally. In addition, the current capacity for interconnecting data centers and supporting the traffic growth for emerging mobile services such as 5G, where high capacity are coupled to low latency requirements, leading to further exponential traffic growth.

Photonics offers a viable solution

In contrast to electronic systems where electrons are manipulated and interconnected, in photonic systems and networks, photons are transmitted through the media that have the lowest absorption at the frequencies of the photon e.g. low-loss fiber optic cables and waveguides in order to transmit data from one point to another. Exploiting the speed of light, these connections can be very low-loss, adaptive and extremely fast guaranteeing the latency requirements of the data being transmitted. In addition, less energy is required for the capacity available. Today's deployed systems tend to convert photons back to electrons for processing at the intermediate nodes with microelectronic chips. Although this technology is well established and widely applied, there are obvious bottlenecks in further reducing the energy required to drive these systems. At TU/e, researchers and scientists believe that replacing some of these intermediate nodes with photonic chips will make the Internet much more cost and energy efficient. The Institute for Photonic Integration will focus on further developing photonic integrated technology to meet these requirements.

Exploiting World Class COBRA Research Output

The new institute has a remit to connect the ongoing world-class research at COBRA Research school and extend this scientific research to develop prototypes that can introduce new photonic products to the industry and further drive economic growth in the Brainport region, in Europe and globally. Photonics researchers at TU/e are constantly innovating from developing faster fiber connections recently demonstrating the highest transmission capacity in fiber, to developing the devices with the smallest footprints, which can enable more complexity and functionalities of an optical system to be integrated and operating with very low power. Therefore, in close cooperation with companies not only located in the Brainport region but globally, the concept of open innovation will be embraced, so that the technology improves and reaches the market faster. With the best talents attracted, the main tasks of the institute are to further increase chip-component density, decrease energy consumption, and unlock more functionality by exploiting the capabilities of photons that electrons do not possess. This will enable photonic chips to be more cost effective.

Market Viability of Photonics

Market analysts have predicted that the market for photonic integrated circuits is worth about US\$ 500 billion (20% of the electronics industry) and expected to grow within twenty years by hundreds of billions of euros. That includes not only high-capacity data communications, but also other applications such as in bio-medical, heavy industry and even automotive industries. Photonic chips are suitable for sensing materials and tissues, and can access a plethora of new applications such as healthcare, process industry, safety, mobility and agri-food. Photonics is expected to create 300,000 new jobs and will benefit the Brainport region immensely by driving economic growth. In 2013, COBRA research school received a €20 million subsidy from NWO. Hence, the institute targets funding of between €150-200 million to further drive the research forward. For more information on the new institute visit <https://www.tue.nl/onderzoek/research-centers/institute-for-photonic-integration>. ■

New employees

Name	Research group	Function	Starting date
Anastasiia Panfilova	SPS	PhD	13-1-2016
Onur Garhacioglu	ES	PDEng	25-1-2016
Gonenc Berkol	MsM	PhD	1-2-2016
Mahir Mohammed	ECO	PhD	1-2-2016
Mladen Skelin	ES	Post Doc	1-2-2016
Victor Sanchez	ES	Knowledge valorization	1-2-2016
Fernando Nunez Serrano	ECO	PDEng	15-2-2016
Marcela Gomez Medina	SPS	PDEng	15-2-2016
Beatrijs vd Hout-vd Jagt	SPS	PD	1-3-2016
Carlos Mendes da Costa	MsM	PhD	15-3-2016
Jochem Bonarius - de Hoop	ECO	Researcher	1-4-2016
Marina Nano	SPS	PhD	1-4-2016
Anweshan Das	VCA	PhD	15-4-2016
Vo Thai Hai	EES	PD	1-5-2016
Guiseppe Belgioioso	CS	PhD	1-6-2016
Qilong Liu	MsM	PhD	1-6-2016
Ulf Johannsen	EM	UD (TT)	1-7-2016
Merel van Gilst	SPS	Researcher	1-8-2016

Whose desk is this?

By: Marieke van Beurden

These are three photos of different desks belonging to the Project Officer Care & Cure of Electrical Engineering (EE). Since December, I have started in this role, and the aim is to increase visibility for the expertise of each EE group in the domain of Care & Cure. The Care & Cure expertise of EE is intended to resonate with the TU/e Strategic Area Health roadmap and also with the Dutch and European health innovation agenda outside the university. Therefore, I facilitate earlier steps taken in the faculty towards developing a shared vision and strategy to perform multi-disciplinary research in healthcare.

I am employed by the Innovation Lab. Therefore, on Wednesdays my laptop sits there in the Multi Media Paviljoen on a few paper piles. The Innovation Lab supports valorisation and research activities, and it also manages strategic relations between the TU/e and government organizations as well as industry.

The Project Officer is a spider in the web of Care & Cure for the TU/e and, in particular, for EE. For me, those three different desks are metaphors for building bridges between people, groups, faculties, the university, and companies with multiple perspectives. I like to work with people with diverse interests and that is why those desks are very helpful to meet a lot of people and to connect them



Desk at Flux ground floor 0.156 for Mondays and Tuesdays

with each other or with people outside the TU/e from care organizations and industry. Having different places to work brings me creativity, broad vision, and flexibility.

To me, it is important that people within EE know how to find me if they have any questions, ideas or suggestions regarding Care & Cure innovation initiatives. Below the pictures, you can see where I am every working day.

I can support you with looking for funding opportunities, creating visibility for projects, and finding partners. So please do not hesitate to contact me because, with great enthusiasm, I am looking forward to cooperating and working with you.

By the way, there is a fourth desk, which is in fact the dining table at my own house :-)



Desk at MMP Innovation Lab 0.22 for Wednesdays (on the left) and at Flux 7th floor 7.074 office of Massimo Mischi for Thursdays (on the right)

Excursion KPN

By: Quinty Peters

Where is the TU/e storing its data and servers at the moment? That question is easy to answer now, because in July last year KPN opened the door of its new data center on the High Tech Campus and our university decided to move everything over there.

It is not very usual to visit data centers. That's why just 28 students of our university had the privilege to participate in this excursion. There were two groups, one in the morning and one in the afternoon. We gathered in front of Flux and together we biked to the High Tech Campus.

Due to the fact that you cannot just visit the place, we all needed to show our identity card and sign a contract. After that it was all less formal. You could get a drink and an employee gave a presentation about the new data center and how it is different from other data centers. Although this data center is not as big as the others and just for local businesses, it is unique in its own way. It is the first Tier IV data center in the Netherlands. This means that the chance of a crash is so small that the customer is guaranteed that its data will not be lost. Another good quality



of this data center is its usage of heat that occurs during all the processes. Instead of just cooling, the heat can be used for households. Then cold air is returned that the data center can use. They also use 'green energy', which is environmentally friendly as well.

When the presentation was done, we got a tour through the building. It was very impressive, because we could see everything up

close, including TU/e's own rack. We could see that the data center had their machines twice, so that in case of a failure the data center has back-up equipment, allowing it to keep on functioning.

We got a small presentation afterwards and we could ask questions. After that, we went back with our bikes again. Overall, it was quite special to see what's behind storing data.

Excursion Alliander

By: Laurens Kok

On March 24 at 7:45h, we gathered with a group of about 12 people at the Eindhoven train station to get on the train to Haarlem to visit Alliander. Once there, and being allowed through the strict security system, we were brought to a meeting room where we were welcomed with coffee, tea and some delicious muffins and we got a brief introduction about Alliander.

In the introduction we were told that Alliander is a company that distributes energy to a large part of the Netherlands and controls electrical cables as well as gas pipes. Alliander focusses on everything from the high-voltage lines to the electricity networks of residential areas.

After the introduction we were taken to the emergency room; a super classified location where the people high up in the company come together in stressful situations. Here they discuss what to do without disturbing the people in the control room. In this room we were shown a movie about Alliander, about what they do and how the company is managed.

Afterwards, we were brought to the control room; the room where the magic happens. In the room the first thing that you see are

two screens, which both are about the size 1.5 times of your average office wall. On this massive screen you see a hugely complicated drawing of the system Alliander manages. We were told that there are always at least four people present 24/7, to supply us with the energy we need. I never really thought about the huge system that gives us the ease of energy whenever we want.

Once the tour through the control room was finished, we had a small interactive quiz, organized by two trainees who follow an educational program within Alliander. We ended the day with an informal drink together with the people we had spoken earlier that day and then went back to Eindhoven by train. It was a very interesting day, and a huge eye-opener to see what happens behind the scenes of the energy industry.



Networked anomaly detection

By: Hedde Bosman

Most of you probably don't know me, so I shall first introduce myself. My name is Hedde Bosman and I am currently wrapping up my PhD in the Electro-Optical Communications group of Prof. Ton Koonen, under the supervision of Prof. Antonio Liotta. Although you might expect my research to be about optical communication, I am actually working on the application side of wireless networks (which can be optical wireless these days), and specifically I research how to employ machine-learning methods on small networked embedded devices in order to detect patterns or behaviors from incoming signals that are out of the ordinary, or, anomalous.

What is the motivation for doing this on networked embedded devices you may ask? Well, let's take a stroll down a part of my memory lane. As an enthusiastic Master's graduate in computer science from the University of Groningen, I started to work in a research institute in Assen, called INCAS3. Their global focus is towards sensor systems that monitor remote, inaccessible areas, and it wasn't long before I started working with embedded devices, sensors and the data coming from them. Often, however, you don't know what you are specifically looking for if you get data from some remote inaccessible environment, so you try to find, for example, patterns and deviations therein to investigate. If you are lucky, you can also find data that may help you explain those deviations, such as in weather databases, and you have

a result. Thus, my research topic was born, and I ended up as an external PhD student in Eindhoven.

The past decades have seen enormous technological advances and, together with the ever decaying prices of electronic components, networked embedded systems have grown ubiquitous in our lives. Think of a popular system on chip that includes a WiFi radio, such as the ESP8266, or an Arduino with a Zigbee radio. Such embedded systems can be found in, for instance, hobby projects, home automation (like the NEST thermostat), automated transportation or, as mentioned before, large scale environmental data collection. You could also think of smart phones, smart watches, or Internet enabled fridges and washing machines. Researchers and developers of these systems are driven by a vision of an Internet of Things (IoT), a worldwide network of electronic devices. These devices are, in most cases, endowed with sensing, actuating and networking capabilities, and are oftentimes connected to the Internet to enable data processing at remote (central) locations (sometimes referred to as 'the cloud'). The increasing number of devices results in a large amount of data to be sent, stored and processed to enable a desired collective behavior.

The applications of IoT devices harbor some hard problems related to the envisioned (large) scale and lifetime of the network deployments. While many problems originate from the limited energy available due

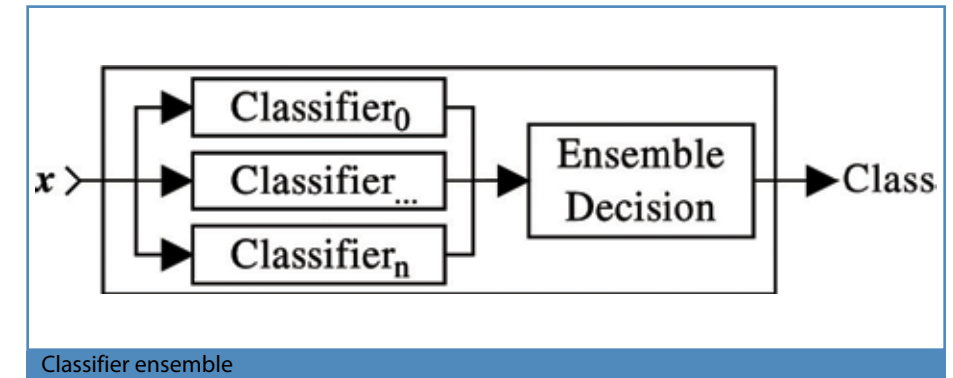
to operating on batteries (limiting other resources, such as communication and processing capabilities), we focus on the challenge of analyzing large amounts of data (requiring large communication and processing capacities). All the collected data are often analyzed in order to find specific information, patterns or behaviors that are meaningful for the application to act upon, at a point in time. Often, the information of interest is considered anomalous. For example, one can think of earthquake detection (relevant to the earthquake cases in Groningen these days) or precursors to a failing machine. Detecting such anomalies on the networked embedded systems, for example, enables pre-filtering the data collected over the network, provides measures of reliability of the data, gives timely responses to local anomalies and events, or allows the creation of more autonomous systems. Anomaly detection, therefore, can play an important role in managing the problems arising in such systems.

Anomaly detection, closely related to the fields of fault and outlier detection, is of increasing interest to researchers and developers of a wide range of applications, as the technological advances allow more and more data to be gathered. These applications range from fraud detection for credit cards, anomalous behavior or behavioral patterns in security card access, (sensor) fault detection in safety critical systems, (network) intrusion detection in security, to military applications, or safeguarding airlines by detecting anomalies in sequences of discrete sets of symbols (from switch sensors in aircraft cockpit). When we have enough a-priori knowledge of the process or environment that the application measures (for example, how many switches there are in a cockpit and what can go wrong with the airplane), we can make a formal mathematical model of that process or environment. This model can then be used to check if newly sensed data fits the model. If not, then the data is considered anomalous.

However, we often do not know much about the remote and inaccessible environments that we target. Therefore, we use data-driven methods that find their origins in disciplines such as statistics, machine learning, pattern recognition, computational intelligence and data mining. These methods require a relatively large amount of processing power and storage capacity, which is widely available

in centralized computing facilities, to 'learn' models from the data. The Argo project, for example, has more than 3500 sensor nodes floating around the world's oceans. They collect temperature and salinity measurements at different depths, and send the collected data via satellite once the so-called floats reach the surface. The collected measurements are first analyzed automatically for anomalies, then manually checked by domain experts, and finally used to create better models and understanding of the oceans. Such remote locations or environmental circumstances, together with a limited energy supply, make the collection of data at a central facility resource heavy (communication costs are relatively high). Moreover, due to the nature of the measured processes, data from different sensors and locations tends to be highly redundant.

Therefore, networked embedded sensor systems can benefit from an initial stage of decentralized (in-node, without central control) online anomaly detection (or other processing) to reduce resource usage of communication or storage, to reduce redundancy, or to indicate (and respond to) information of interest at an early stage. To eliminate the need for central processing and controlling of anomaly detection approaches entirely, a model of what is 'normal' should be generated, and possibly distributed, within the wireless sensor network itself. There are, however, very few methods that can learn a model in a resource-limited environment found in embedded systems (where memory in the order of only kilobytes is available). Most methods still employ a central facility to analyze all the data or to learn a model that



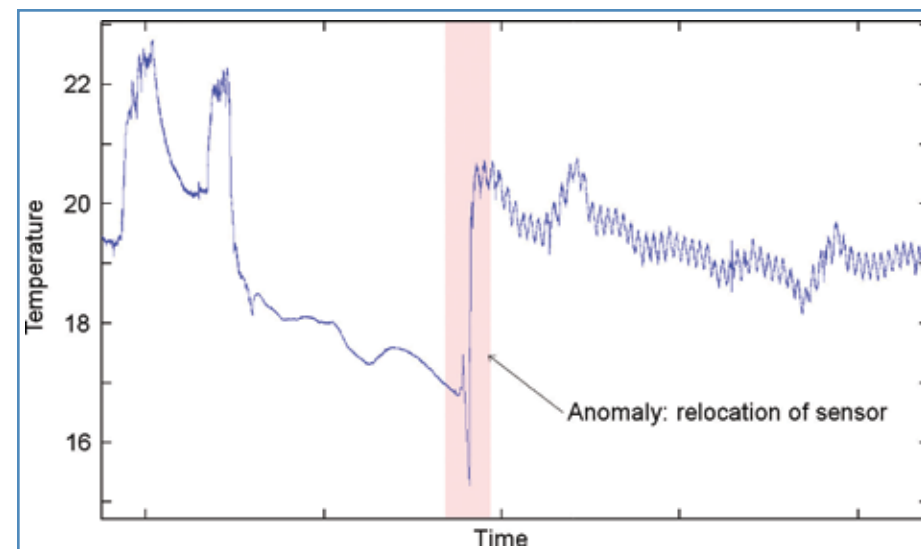
gets deployed in the embedded system. In our research, however, we aim to provide a decentralized online anomaly detection framework, applicable in networked embedded systems.

We approach this task from a new angle by assessing the viability of localized (in-node) anomaly detection methods based on unsupervised machine learning, for unknown environments (providing spatio-temporally correlated data), while operating with limited resources and without the need for a central facility. To achieve this, we employ incremental learning techniques, which update a model when new data arrives. This removes the need to store all measured data in the limited memory available to typical embedded IoT systems. In particular, our framework not only learns linear correlations between inputs using a method called recursive least squares, but it can also learn a single-layer feed-forward neural network using a method called online sequential extreme learning machine. The latter allows more complex, non-linear models to be learned incrementally within the limited resources available.



Moreover, we have demonstrated that we can employ multiple of the learned models in parallel in a so-called ensemble. That is, the outcomes of these methods are combined using, for instance, majority voting, similar to a panel of experts giving advice. This has shown to give a more reliable detection. Similarly, the embedded IoT devices can also use data of neighboring devices. In a typical deployment scenario of embedded IoT systems you can expect multiple devices to be placed in the same environment, or, neighborhood. If that is the case, then the measured data is very likely to be spatially correlated and, thus, may contribute significantly in the detection of anomalies. Typically, a central facility can recognize and model the correlations of those neighbors, but making use of the neighborhood information at the embedded IoT device removes the need for this central facility.

To evaluate the framework, we use not only simulated data, but also real-world scenarios. While the simulated data allows us a-priori knowledge of the system, the time and the location of anomalies (for evaluation), the real-world data allows us to see if our methods and assumptions would hold in the real world. Data from the latter has been gathered from, for example an office monitoring setup in the INCAS3 building, and from results publicly available at the École Polytechnique Fédérale de Lausanne, which deployed a sensor network in the Grand St. Bernard pass in Switzerland. With these, we have demonstrated that decentralized online anomaly detection is feasible and that you can combine different classifiers and fuse data from local and neighborhood sensor measurements. Moreover, our evaluations show that these methods perform on par with their offline centralized counterparts. Thus, these methods can make investigating data from the IoT easier and, to some extent, maybe even automatic. Currently I'm writing my thesis about this methodology and our findings. So, if you want to know more, check it out at the end of the year! ■

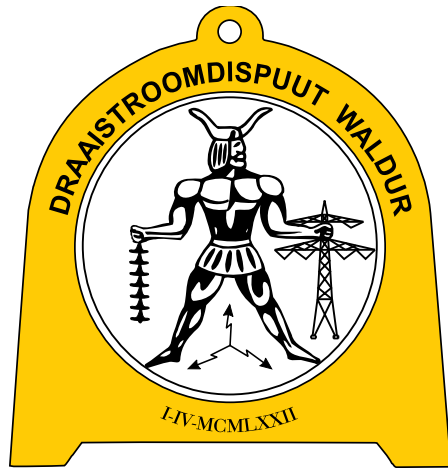




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|---------------------------------|-------------------------|
| 1. Back to the kelder party | 16. Tappersopdracht Sam |
| 2 & 3. Exam training Signals I | 17. ACCI Feest |
| 4. Literadje Thor - Gewis | 18 & 19. Ivaldi Karaoke |
| 5. Carnaval Party | 20 -22. ACCI Traingames |
| 6. KP&T pubquiz | |
| 7 - 9. Ivaldi Open House Day | |
| 10 & 11. Actieveledenactiviteit | |
| 12 & 13. ACCI Karting | |
| 14. Ivaldi Laser | |
| 15. Lunch lecture NS | |

Studytour Waldur

By: All participants



Tuesday, 9th of February

Zzzzzzzzz... That is how most participants felt when gathering the Tuesday after Carnival at 12.00h in the Walhalla. They were (sort of) ready to embark on the epic Waldur Duitsland Reis to Hannover to visit some interesting companies and the city itself. Before leaving there was a Hann(g)over breakfast to recharge, including microwaved egg cups (great tip for students who don't like the mess of baking).

Fully equipped transportation vehicles were arranged: a Mercedes Vito van and a Toyota car. Both included a rear-view camera (not sure if this was just a luxury accessory or that Europcar accounted beforehand for our great parking skills) and reminded some of a school trip. With music pumping over the speakers, soon the famous German Autobahn was reached. Unfortunately it rained such that the full potential of the cars couldn't be tested.

After approximately 5 hours we arrived at the hostel. Keys could be retrieved in a luxury hotel, which put a smile on the face of most. This smile only lasted for a brief moment... The keys gave entrance to a 16-people sleeping room (although it wasn't too bad). Our group consisted of 13 people, which left 3 beds unoccupied. One of them was booked by a German guy doing an internship in the hospital. He was never seen after the first evening. This sounds like a good thriller and therefore we are still examining the possibilities of his sudden disappearance. The smell of our group after the extensive Greek diner (and beers) that night is high on the list. When the group arrived at the hostel again, most people went to bed early because they were

still tired of the Carnival weekend and tried to recover before the first company visit planned for the next day.

Wednesday, 10th of February

On Wednesday, we started with the first part of our company tour through Germany. First up was Lenze in Hameln. Some of you might know Hameln from the tale of the "Rattenvanger van Hamelen", which is pretty well-known in The Netherlands.

When we arrived at Lenze's Headquarters we first lined up for a group photo up in their lobby. Thereafter, we received a short presentation about Lenze itself, during which we could enjoy some coffee and biscuits. They explained that Lenze is a global specialist in Motion Centric Automation (MCA) and offers engineering services and tools. It was also quite clear that Lenze's focus lies on the customer. They really are alongside the customer during the entire development process of a particular machine.

After the presentation we got the chance to look around in the visitor's center before we were taken on a factory tour and inspected the various kinds of production lines at the Hameln site. Most of us were quite surprised by the extremely low error rate, which they are able to achieve through highly automated production lines. We got to see an inverter production line that is completely automated, very impressive stuff. Luckily our guide was more proficient in the English language than the presenter we had in the morning, so he was able to explain everything clearly, and had answers to all of our questions.

Then it was time to have ourselves a nice and tasty lunch, which all of us really enjoyed. After our bellies were filled we had one last presentation by a developer of Lenze who



talked about his latest research, the Highly-integrated Drive; a compact, innovative design that combines the inverter into the motor itself. He knew a lot about the topic and it was pretty interesting. At about 14:00h we left Lenze and went back to Hannover.

Thursday, 11th of February

After our exciting trip to Lenze, we all woke up early on Thursday as the next major automotive company, Bosch, was expecting our arrival! After a short drive from our hostel to Hildesheim, we arrived at Bosch Car Multimedia. Upon arrival we were taken to a building in the middle of the grounds and were asked to pick up our safety shoes. Here we had to wait for a Bosch representative who would give the first (general) presentation about Bosch: Mr. Kleine-Besten. His presentation was focused at the huge variety of products that Bosch offers to its customers. To give you an idea of how big this variety is, Bosch manufactures about everything that is electrical in your car (motors included), but also sells toolsets with drills and such. After this presentation, we got a short presentation from our lovely hostess, Mrs Schmidt, who told us about the different (Bachelor, Master, PhD etc.) career pathways to the Bosch group. When she was done, she told us to put on our safety shoes, because we were going to see the production line of EM-motive!

EM-motive is a joint venture founded by Bosch and Daimler. At the facility we visited they produced the two main components of an electromotor, the stator and rotor. Immediately after entering the plant it became clear how much work goes into those



components. The highly automated production line was very interesting and we could see really well how the motors are built.

Still stunned by the impressive factory, we went back for two more presentations. First we got a funny interactive presentation about car multimedia products from Mrs Zelenay. She talked about how Bosch tries to make your driving experience better. Finally we had an interesting presentation from Mr Wildschütte about the Corporate Research division. They do research in many different fields and the presentation really showed how diverse Bosch's work is. At the end of the day we went back to Hannover for dinner and some drinks.

Friday, 12th of February

Friday the 12th of February was all about Volkswagen. From our base in Hannover, we drove one hour to Wolfsburg, the beating heart of Volkswagen. After finally finding a



parking spot, we met our overenthusiastic guide for a tour through the immense factory. The factory has been here since 1938 and is nowadays seen as heritage. This means that the whole car manufacturing process has to be fitted into the existing building, as it is not allowed to affect this heritage from the outside. The guide drove us around in a specially designed 'touring' car, as the roofed premises was the size of Monaco, and the tour length was 6 kilometers. While the tour guide told us all kind of facts about the factory, we got to see the whole process of building a car. At the Wolfsburg factory they are producing four Volkswagen models: the Touran, Golf 8, Golf Sportsvan, and the Tiguan, and a total of 3800 cars leave the factory each day. It was very impressive to see this large factory and the whole process from steel sheets to cars.

After this tour of 70 minutes it was time to visit Autostadt, which is an automobile theme- and experiential park close to the Volkswagen factory. Here we could visit several pavilions where all the brands of the Volkswagen Group, ranging from Skoda to Seat and from Bugati to Lamborghini, showed their latest models. We also could make a test drive in the VW e-Up!, the e-Golf, or the Golf GTE and experience the immense acceleration and the future of mobility. The committee went all in and did an off-road track with the VW Touareg. At 6 pm, playtime was over and we drove to the McDonald's for some dinner.

Back in Hannover, we had the evening off. With the outlook on sleeping late the next morning, Hannover city was explored to a great extent.



Saturday, 13th of February

Saturday morning was the first time we did not have to wake up early, but of course that did not mean everybody had a good night of sleep after our long Friday night out. After our traditional egg and bacon breakfast (and for some people even a beer) we met up with two students, Paul and Marcel, from the Electrical Engineering Department of Hannover University. Starting from the town hall, the guided tour led us through Hannover, where even our German colleagues learned some new stuff about their city. One of the most special old parts of town was the Aegidienkirche. This church was not rebuilt after being bombed in WW II, and its ruins were kept as a memorial. We did a lot of sight-seeing and our guide told us all the interesting stories about buildings, streets and the life in Hannover throughout the history. After the tour we went to visit the university where we got a small tour and some German Glühwein. During the tour we got a presentation from the formula student team called Horsepower Hannover. After that we searched for a place to dine. Since we are students we ended up drinking some beers from a kiosk while eating at a kebab. Unfortunately they did not have any 'kapsalons'.

After this amazing dinner we ended up in our favorite cocktail bar Extrablatt. It was already the last evening in Hannover, so everybody enjoyed this moment very much, with lots of different cocktails. Thereafter most of the group decided to go to one of Hannover biggest clubs for the last German beers and some 80's music. The group who went out came home ranging from 3 o'clock until 10 o'clock in the morning, which was just in time for our ride home at 11. Hannover's Saturday night jawohl! ■

Excursion Tata Steel

By: Pieter van Diepen

One of Thor's excursions for February was to the company Tata Steel. To reach the company, we had to go to IJmuiden. We gathered around 7:45h at the train station, all a bit tired, to take the train to Beverwijk, followed by a bus ride arranged by Tata Steel to their site

As we arrived at their visitors building we got an introducing presentation. Tata Steel is by origin an Indian company. The company has multiple subsidiaries all over the world. One of them is Tata Steel Europe, which took over the former Corus in 2007. This made the steel-production site in IJmuiden part of the Tata Steel Group.

In IJmuiden they are specialized in steel for the car industry and packaging industry. An examples of the latter is the steel used for Coca-Cola cans.

The site has cokes, pellet and sinter factories. These products are used to get the temperature in the blast furnaces high enough to extract the iron from iron ore. To get the iron ore to the IJmuiden site and ship their product to all the countries that have costumers, they

have five harbors. Some of these harbors are covered, so they can even load the ships when there is bad weather.

The steel sheets that roll out of production are only 10 meters long and 30 centimeters thick. The steel used for packaging however is only 1 millimeter thick. To get the steel to the right thickness they have a cold strip mill and a hot strip mill to roll the sheet flat. At the end of the process the sheets can become up to 2 kilometers long. At the site, there are also multiple installations to treat the steel sheets to make it for example stronger, more flexible or to give it a certain color.

When the presentation was finished, we all got a nice lunch. After lunch, the group was split in two and we visited the Tata Steel production site. We got a trip around the site in the bus. At first, some people were disappointed since we would not enter the building with the blast furnaces, where the molten steel was. However, when we drove past this building we saw the molten steel being loaded into torpedo-like train wagons. The site has a large network of rails to move all the materials.

The buildings we did visit were the hot strip mill and the dip galvanizing line. At the hot strip mill there were huge bulky machines to flatten the steel sheets to a thickness of 1 millimeter. This process made a lot of noise and exposed lots of heat and smoke, which made it very fascinating to look at. At the second site the steel sheets were given a treatment to make the steel even stronger. Inside the building they used different color coatings to indicate the purpose of machines, pipelines, and ground plans. For example, all the pink parts indicate that it can move and you should be really careful when coming close to those parts.

When the tour was over we got presentation from a former TU student about what it would be like to work at Tata Steel.

During the whole day, they emphasized a lot that they need Electrical Engineering students. The company provides traineeships, both technical and business related, and internships. So, if you are interested to work at this company, don't wait and contact them. ■



Trust me, I'm a PDEng Trainee

By: Nick Ilieskou

Well, I 'was' once. My name is Nick Ilieskou and I recently graduated from the PDEng ICT program of Electrical Engineering Department. The PDEng program was an experience I will always remember and I definitely recommend it to anyone who is technology enthusiastic and motivated to become a top professional engineer. But what it is like to be a PDEng trainee? What are the benefits, and the challenges? And what is the difference between PDEng and Masters/PhDs?

In order to answer the first question, I have to start by the first day as a PDEng trainee. Back in 2014 when I started, I didn't know exactly what I was facing. I knew that my PDEng program consisted of a two-year project, technical and soft-skills courses, as well as a team project. I had to start my project at Océ technologies and at the same time I had to follow many courses and workshops at TU/e. Initially, I was a bit anxious about all the activities I had to do and if I could make it to the end. In a really short period of time, I realized that being a PDEng trainee was all about working hard. However, all the people involved in the program transformed this trip into a unique experience.

Also, all the trainers involved in the courses and organizational matters are more like a family. Especially the ICT and HSD PDEng program secretary, Rian van Gaalen, is a unique person who treats us like a mother



case, as I mentioned before, I had a project in the industry. For that reason, I had to spend just 25% of my time at TU/e. However, this was something that helped me develop professionally both as an engineer and as a team player. Sometimes engineers are not very good with communication. The PDEng program was able to teach me all the neces-

of memory intensive algorithms for transforming an image into a sequence of nozzles fire moments. The faster the algorithms run the faster the printing can be done. My main goal was to use any software and hardware means to optimize these memory intensive algorithms. During my project, I had to play with SIMD, GPUs, and Multithreading, as well as with many software optimizations like loop transformations, software prefetching etc. During this experience, I was under the supervision of prof. dr. ir. Twan Basten, who is always able to take the best out of you. Of course, similar stories can be heard from almost all the PDEng trainees as TU/e professors encourage us and lead us towards the correct direction.

I consider myself a lucky PDEng. Lucky in the sense that instead of having many technical courses I chose to have a secondary project in Océ. I believe that one of the biggest challenges of being a PDEng is to cope with the amount of work coming from the technical courses and the various projects.

To sum up, being a PDEng trainee is definitely an experience that I will never forget in my life. The people I met and the skills I was able to develop changed my life in a positive way. ■

She is the one who created, in the first place, the idea of a 'PDEng family' and that is indeed what we are, a family.

and a friend at the same time. Without her, the PDEng experience would not be the same. She is the one who created, in the first place, the idea of a 'PDEng family' and that is indeed what we are, a family.

The life of a PDEng trainee though differs a lot depending, on the courses he/she chooses and the project he/she has. In my

sary skills to become a successful engineer.

Working in a big company like Océ was a great experience. I got the opportunity to enlarge my network, learn the challenges that big industries have, and understand how they work. My main project at Océ was Optimizing Memory Intensive Algorithms. Océ wide-format printers use a data path

Werken bij Prodrive

Eigenzinnig waren Pieter Janssen en Hans Verhagen, de oprichters van elektronicafabrikant Prodrive Technologies, vanaf het begin in 1993. Ze wilden kosten-, product- én relatieleider zijn en bewijzen dat produceren in een hogelonenland loont. Met succes, want Prodrive Technologies is uitgegroeid tot een volwassen onderneming met een omzet die in 2015 naar verwachting 130 miljoen euro bedraagt. Vorig jaar groeide het met bijna 20 procent en voor de komende jaren wordt verdere groei voorzien. Het bedrijf is er helemaal klaar voor, dankzij investeringen in automatisering en nieuwe huisvesting.

Conceptueel denken

Prodrive Technologies ontwikkelt en fabriceert industriële- en consumentenelektronica voor uiteenlopende markten, van media en medisch tot industrie, automotive en energie. In de kern gaat het steeds om een elektronica-product of -platform en daar komen meer en meer software en mechanische onderdelen voor bijvoorbeeld behuizing of koeling bij. Zo ontwikkelt Prodrive Technologies zich tot system supplier. Het eigenzinnige van Prodrive Technologies begint ermee dat het vanaf het eerste moment samen met de klant de kosten onder de loep neemt. De fout is vaak dat men pas achteraf gaat kijken naar de kosten. Die zitten echter al in het concept van een nieuw product besloten. Met concep-



hele voortbrengingsproces van elektronische producten en systemen. Dat omvat ontwikkeling, engineering, testontwikkeling, productie, lifecycle management en service, en dat doen we allemaal in Nederland. We hebben hier daarom heel veel technologie-



werkzaam. 'De samenwerking met de TU/e is niet alleen belangrijk voor de nieuwste technologie, maar ook voor de aanwas van talentvolle medewerkers. Inmiddels is een van onze medewerkers van het eerste uur, Korneel Wijnands, benoemd tot research fellow in de afdeling Electromechanics and Power Electronics van de faculteit Elektrotechniek. Hiermee vloeit kennis en ervaring uit het bedrijfsleven ook weer terug in de universiteit en worden de banden verder versterkt', aldus Janssen. Verhagen: 'Technologie is de drager van ons succes en daarom intern de baas. Buiten is dat natuurlijk de klant, maar hier binnen staat de ingenieur centraal. De bereidheid om te investeren in technologie is hier ook gigantisch.' Zo is technologie leidend en bewijst Prodrive Technologies zich daarmee als kosten-, product- én relatieleider, stelt Verhagen: 'Met conceptueel denken zet je de juiste producten en processen neer, met operational excellence zorg je voor het juiste kwaliteitsniveau tegen de laagste kosten en met ons salesteam bereiken we customer intimacy. De klant behagen, dat staat steeds centraler, bijvoorbeeld door de complete verantwoordelijkheid voor elektronicasystemen te nemen.' ■

PRODRIVE
TECHNOLOGIES

tueel denken focust Prodrive Technologies zich daarom in de beginfase op die kosten.

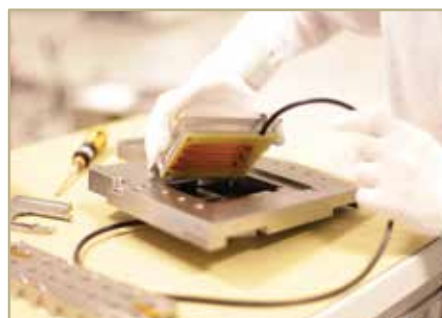
Maximaal automatiseren

De tweede winst valt te behalen in de productie. Verhagen: 'Als je in het begin focust op de kosten, dan word je kritisch op je eigen processen. Daarom is er veel interactie tussen engineering en productie en bemoeien wij ons als management intensief met wat wij als het primaire proces beschouwen, het

ruimtes, waaronder een kwalificatieruimte voor de vrijgave van producten. Dit is een soort High Tech Campus, heel compact in één gebouw.' Vanuit de focus op efficiënte productie kiest Prodrive Technologies ervoor om maximaal te automatiseren.

Technology

Prodrive Technologies onderhoudt nog steeds nauwe banden met de TU Eindhoven. Janssen studeerde er en Verhagen was er



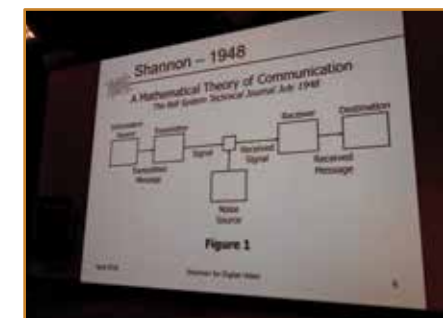
Shannon Centenary Symposium

By: Martijn van Eerd

Claude Shannon was born on the 30th of April 1916 in Petoskey Michigan. In 1948, he published a landmark paper that is the basis for all information theory. Without his ideas, information theory as we know it today would not have existed, and with that a lot of technologies we take for granted would not have been possible. In optical communications, the Shannon capacity limit, which is expected to be reached by currently deployed single-mode optical systems sometime within the next decade, is resulting in the development of new photonic chips, modulation and coding schemes based on Shannon's contribution information theory concepts and optical fiber technology from key stakeholders.

For Shannon, the year 2016 marks the 100th anniversary of his birth and for this occasion, the IEEE Benelux Chapter on Information Theory and the Werkgemeenschap voor informatie- en Communicatietheorie have organized a symposium to celebrate Shannon's achievements. This event was held on the 13th of April in the Zwarte Doos at TU/e Eindhoven.

The symposium focused on interesting inventions from the Brainport region, which include a lot of the things Shannon made possible, such as the Compact Disk, Wi-Fi, Bluetooth, MPEG coding and finally AES. Frans Willems from the SPS group who organized this workshop, officially opened the symposium with two very fun videos about the life of Shannon.



Dr Kees Immink held a talk called: Shannon, Beethoven and the Compact Disc. He started elaborating on the coding used on the CD. This was made in a special way to ensure burst errors, which can occur because of scratches on the CD, can be recovered. Although this was very interesting, the best parts of the talk were all the anecdotes Kees provided to the crowd. For instance, the length of a CD recording always seemed pretty strange to me. At 74 minutes, this seems so arbitrary. In fact, the reason it is this length is because the president of Sony demanded that a recording of Beethoven's ninth Symphony needed to fit on the disc. The funny thing is that this recording was only sold on CD at least 15 years later than the first CDs were sold.

After that, Wolter Lemstra talked about Wi-Fi. Wolter has written a book about the creation of Wi-Fi and he discussed with the audience the events leading up to the invention of Wi-Fi making it such a big success. One of the things he told, which was vital for the final



adoption of Wi-Fi over other systems, was the interest of Steve Jobs to have it included in his iBooks which was very interesting to know.

Then after a short break, the symposium continued with a talk from Jaap Haartsen called 'Bluetooth inside'. He was one of the developers of Bluetooth and he focused his talk on why there was a need for an entirely new wireless system instead of adapting existing standards. The main reason was that all the other systems present at the time were focused on long haul communication and they were neither power nor cost efficient to use at short range. Also, Bluetooth was designed to be used in the entire world and had to respect regional spectrum allocations. That was a hard task because there are different regulations everywhere and Bluetooth has to comply with all of them.

After a short break, the symposium continued with the last two presentations. Firstly, Jan van der Meer told about his experiences with MPEG coding. As an engineer at Philips, Jan was very involved in constructing the standards about MPEG and as such is one of the leading authorities in this field. Last but not least was the talk from Joan Daemen and Vincent Rijmen about AES. I found this presentation the most interesting of the day, partly because I did not know AES was invented in the Benelux, but also because encryption was something Shannon was already thinking about and the basic ideas of Shannon in this regard were the starting points of AES.

This symposium really celebrated the life of Shannon and all the things he made possible by showcasing some of the very important inventions made possible with his ideas in mind. It was very interesting to learn how all these inventions came to be and also how broad the influence of information theory is on our daily lives. ■



The first lay of Helgi Hundingsbane

By: Fer Radstake

Besides being named after the Norse god of thunder, e.t.s.v. Thor has much more to do with the Vikings. The names of committees like Kvasir and Ivaldi, our fileserver Mjolnir and our pub Het Walhalla all come from Norse mythology. Our members like to behave like a bunch of Vikings too, loudly chanting the Thorlied on every occasion and cheerfully raiding the “constitutieborels” of the other associations, never returning without some kind of loot. Even the IEEE SBE joins in with the Viking theme with their yearly sailing weekend.

But is this really how the Vikings behaved? To find out, we have to go back in time to about 1070, when an Icelander composed an alliterative poem about the legendary hero Helgi “Hundingsbane” Sigmundsson. Like with so many sagas, the origins of the Helgakviða Hundingsbana I are not quite clear. The 19th century scholar Sophus Bugge however makes an excellent case for a historical origin, based on certain similarities with the Beowulf epic. He identifies the battle between Helgi and Höðbrodd with an ancient war between the

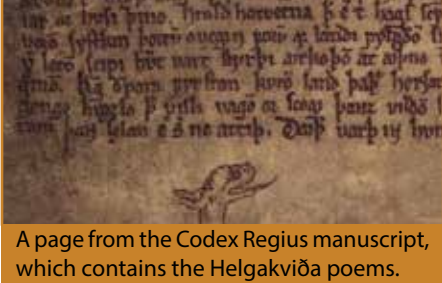
Danes and Langobards, the latter living in northern Germany at that point in time. A number of locations mentioned could point in the same direction.

Whatever the historicity, the vivid descriptions of Helgi’s sea journey point to a poet who has journeyed himself. This fits nicely with the British origin of the poem that Bugge argues, based on the occurrence of words of possible Old English origin. In short, we may conclude that the poet was an Icelandic Viking who spent some time in Anglo-Saxon England and may well have had first-hand experience with Viking warfare.

As the poem is much too long to print here in its entirety, I’ve removed close to half of the stanzas, most notably a 14 stanza long flying (quarrel) between Helgi’s and Höðbrodd’s generals Sinfjötli and Guðmund. You can read the complete poem at aethelraed.ddns.net/stories/helgakvidha1.html.

Here starts the lay of Helgi, the slayer of Hunding, and of Höðbrodd.

1. In times of old, / when eagles sounded,
And from Heaven’s heights / fell holy streams;
Then was Helgi, / his heart was brave,
born in Brálund / as Borghild’s son.
2. ‘Twas night in the borough / when the Norns’ came.
There they formed / the fate of the prince.
They bade the boy / to be a hero,
to become famous / and first among kings.
3. The people deemed him / a Dagling² to be.
“Good times / have begun,” they said.
The king himself / came from battle
to bring the boy / a beautiful leek³.
4. He named him Helgi / and handed him
Hringstað⁴
and Sólfjöll, Snæfjöll / and Sigarsvöllu,



A page from the Codex Regius manuscript, which contains the Helgakviða poems.

Hringstöð, Hátún / and Himinvanga,⁵
and a sword shaped / for Sinfjötli’s brother.⁶
10. The king waited / keenly for war;
finally he reached / fifteen winters,
and he slew / the strong Hunding
who had long led / his land and thanes.
11. Of Sigmund’s heir / the sons of Hunding
demanded many / marvellous riches,
because they bade / the king to pay
for the large loot / and the loss of their father.
12. Helgi withheld / Hunding’s sons
compensation; / instead he warned
to await in fear / a fierce storm
of iron spears / and Óðin’s ire.
13. The princes went / to the place of battle
which lay amidst / the Logamounds;
In foe’s lands they broke / Fróði’s⁷ peace;
Viðrir’s wolves⁸ / went over the isle.
14. The king sat down, / having killed them all:
under the eaglestone / laid Eyjólf and Alf,
Hjörvarð and Hávarð, / Hunding’s sons;
the king’s kin / was killed completely.
15. Then shone light / from the Logamountains,
and from this light / lightning struck.
-----⁹
high under helmets / in Heaven’s fields,
they stood in mailcoats / stained with blood,
and from their spears / sparks emerged.

16. In the early dawn / the Dagling asked
the southern maids / amidst the woods
if with the heroes / they’d head home
through the night. / Then knives thun-
dered.¹⁰
17. Off her horse / Högni’s daughter
- the shields now silent - / said to the king:
“Other work / awaits us methinks,
than drinking beer / with the breaker of
rings.¹¹
18. The father of mine / will marry me off
to Granmar’s son, / the grim Höðbrodd.
[...]
19. That king will quickly / come for me
If you don’t take him / to the battle
and take the maid / from that mild man.”
Helgi spoke:
20. “You shouldn’t fear / the slayer of Isung:
unless I’m killed / I’ll combat him.”
21. The king sent / couriers thence
across land and lakes / to levy an army
and richly award / with river’s shine¹²
all the warriors / and their sons.
23. Soon from the shores, / from Stafn’s cape,
sailed the ships, / shielded with gold.
[...]
26. The captain took / the tents¹³ down



“Helgi und Sigrun” (1901) by Johannes Gehrts.

22. Gold.
23. Adams-Bellows: “the awnings spread over the deck to shelter the crews from sun and rain when the ships were at anchor”.
24. Jan de Vries connects this name to the Varini tribe in northern Germany.
25. One of the daughters of the sea-god Ægir. Kolga’s sisters are the waves.
26. Rán: Ægir’s wife.
27. The hill where Granmar has a hall. Possibly Schwerin.
28. One of Granmar’s sons, the commander of Svarinshaug.
29. “Swift” and “Lithe”, horses’ names.

so that the many / men awoke,
- the Daglings saw / the daybreak then -
and within the vast / Varin’s fjord¹⁴
the heroes hoisted / high the sails.
27. Oars splashed, / steel clattered
shields hit shields: / the sailors rowed.
Far from the coast / the king’s fleet
transporting the princes / ploughed
through the waves.
28. So did it sound / when the sisters of Kolga¹⁵
clashed with the keels / of the king’s ships:
as if the surf / smashed on the cliffs.
29. “Hoist the sails,” / Helgi commanded,
when safe harbours / became high waves,
when the dreadful / daughter of Ægir
tried to sink / the sailing fleet.
30. But from above / the brave Sigrun
saved the sailors, / their ships as well;
She fiercely forced / the fleet of Helgi
from the grasp of Rán¹⁶ / at Gnipalund.
31. They anchored at evening / in Unavágar;
the crafty ships / could’ve sailed,
but soldiers from Svarinshaug¹⁷ / spotted
their fleet;
with hostile hearts / they beheld their foe.
32. Then the godborn / Guðmund¹⁸ spoke:
“Who’s the lord / who leads this army
and who sails / his soldiers ashore?”
Here starts the long quarrel between
Guðmund and Helgi’s general Sinfjötli that I’ve
left out. It ends with Guðmund and another
soldier speeding away:
47. They spurred their steeds, / Svipuð and
Sveggjuð¹⁹,
they let them rapidly / run to Sólheim
by bedewed dales / and dark slopes.
Mist’s mare²⁰ / the men made tremble.
48. They met the king / at the courtyard’s gate
and announced the news / of the nearing
army.
[...]
Guðmund spoke:
49.



The Oseberg Ship. Helgi’s fleet will have consisted of ships like this.

“Swift keels / have come to this beach,
mast-ring hearts²¹ / and high spars,
many shields / and smooth oars,
a noble band / of bright Ylfings.
50. Fifteen warbands / went ashore,
though out in Sogn²² / are seven thousand.
Off Gnipalund / lie at anchor
dark drakkars / donned with gold.
By far the most / of the foe is there;
Helgi will start / the sword-ping²³ soon.”
Höðbrodd said:
51. “Make the horses run / to the Reginping:
Sporvitnir / to Sparinsheið,
Méltnir and Mýlnir / to Mirkwood.
Let no man / who knows to wield
a sword still / stay behind!
52. Summon Högni / and Hrings sons,
Atli and Yngvi / and Alf the Old:
they are willing / to wage war.
Let’s give the Völsungs²⁴ / valiant resistance!”
53. Swiftly the soldiers / stormed each other,
spears flashed / at Frekastein;
always was Helg / Hundingsbane
first among / his fighting army,
slow to flee / and fighting hard.
So hard / was the heart of the hero.
54. From heaven came / the helmed maidens,
- the spears clattered - / the king they
protected.
Sigrún called - / the Valkyries flew -
[...]
56. “You, warrior, / have won yourself
red-gold rings²⁵ / and the royal bride.
Your spoils, soldier, / shall be both
Högni’s daughter / and Hringstað,
victory and land! / The fight has ended!” ■

1. The three women that determine fate.
2. Descendant of the legendary king Dag, i.e. a good king.
3. Even though the leek was seen as a medicinal plant, it seems a rather insignificant gift. Bugge therefore argues lauk is a corruption of Old English læc, meaning “gift”, by a scribe not familiar with that language. Although læc is nowhere attested in Old Norse, it would make for the much more attractive translation “beautiful gifts”.
4. Perhaps the historical Ringsted.
5. Respectively Sunmounts, Snowmounts, Sigarsfields, Hring-harbour, High-town and Heaven-fields.
6. Sinfjötli is Helgi’s brother, so Sinfjötli’s brother is Helgi himself.
7. Henry Adams-Bellows: “a traditional king of Denmark, whose peaceful reign was so famous that “Frothi’s peace” became a by-word for peace of any kind.”
8. Viðrir: Odin, a god associated with war and death. His wolves are Freki and Geri.
9. Almost certainly something got lost here. Benjamin Thorpe reconstructs it as following: “then appeared [...] a [...] band of Valkyriur:”
10. The Valkyries don’t take the proposition too kindly!
11. Rings were used as a general currency and were often broken to get a smaller value. A ring-breaker therefore is a generous king.

20. Earth, the “horse” mist rides, according to Adams-Bellows. Bugge however argues for a corruption of the Anglo-Saxon term mistig mōr, “misty moor”, cf. note . In both cases the galloping horses make the ground tremble.
21. Ships.
22. Sogn is in western Norway, so its inclusion here seems rather arbitrary.
23. Ping: meeting. Sword-ping: battle.
24. Yet another legendary family, of which Helgi as the son of Sigmund Völsungsson is a member.
25. Cf. note 11.

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ASSOCIATION I

Open House Day

By: Laurens Kok

On the 26th of February, the Ivaldi Open House Day was organized; an opportunity for parents of first-year students to get an idea of what their children are doing these days. Just two weeks after the registration was opened it had to be closed, since all places were filled. With 132 parents we smashed the old record, standing at 94.

The day started with coffee and cake in the auditorium. We explained the program for the day and afterwards Jorn De Vries, from Volundr, prepared the parents for the soldering workshop that would take place later that day, by telling every single thing they could do wrong. Then the first lecturer arrived. Who better than Bart Smolders can tell the parents about the study?

Subsequently, we walked the parents to Flux, where Peter Baltus was waiting to start his lecture about wireless technology. The parents found this so inspiring that his lecture overran its time by 20 minutes because of the questions asked by the parents. Finally, it was Marion Matters's turn, who, after telling the parents something about her research, put the parents to the test by explaining the first-year course Circuits in about 45 minutes. When she was done the parents were relieved, because they could finally relax for a bit during the lunch.

During lunch, we had a pub quiz prepared to test how much the parents knew about the study, Thor, and Het Walhalla. One of the



questions was: "What is the sum of the number of first-year students, the tuition, the number of members of Thor and the number of stair-steps in Flux?". If you know the actual answer please send an email to openhuisdag@thor.edu, because we have no clue.

After lunch the parents were divided in smaller groups to attend the pipelined (thank you Computation 1) midday events that consisted of three activities.

One of the activities was a tour through Flux. During the whole tour we encouraged the parents to take a peek through the windows, because it looks really impressive even if you don't understand a single thing of what is happening inside. During the tour we showed the parents the beautiful views

over Eindhoven from floor 10 and 9, told them something about the labs on each floor and explained what OGO-rooms are used for.

The second part of the program consisted of a visit to the high-voltage labs, where Guus Pemen had set up a fascinating demonstration. We also took the parents through Gemini to get to the Metaforum to show the student facilities, the library, and the Markthal, and walked back to Flux.

The last part of the program was a soldering workshop, at which the parents were given a PCB and some components, with which they could make a rain sensor. This went way better than expected, since about 60% of the parents were able to create a functional sensor, and only one parent burnt her fingers. All the parents were very enthusiastic about the workshop, and were happy to have learned a new skill. At the end of the day all the parents and helpers were invited for a drink in Het Walhalla to close off the day.

I spoke to my parents afterwards and they told me they had a great time and that the day was very informative and fun. I also spoke to my fellow committee members and we talked about all the things we had learned while organizing this event, because after all, Thor offers the opportunity of the first-year committee with the goal of trying to teach you some new and useful skills.

A special thanks to Bart Smolders, Marion Matters, Peter Baltus, and Guus Pemen for wanting to free up some time in their schedules for the parents, and an extra special thanks to Stefan Molenschot, who assisted us during the organizing this event and made sure nothing would go terribly wrong. ■



Internship in Germany

By: Sjoerd van der Heide

The idea of doing an internship abroad was in my head for quite some time. Of course, I am not the only one with that idea, far from it. Every now and then you hear that someone has done an internship abroad. They always bring amazing inspiring stories back with them to Eindhoven. These stories can also be read in the Connecthor, you are reading one now. These stories made me decide to choose for an internship abroad. Being in Germany for three months now, I see what all the fuzz is about and I do not regret my decision at all.

My story begins on Friday January 1st this year. I took an overnight bus to Munich on New Year's Day. I know it seems a strange moment to leave, but Flixbus had a really good offer. Apparently, nobody takes a bus ride on New Year's Day, so it was both cheap and I had all the space I wanted. I was to start my four-month internship at ADVA Optical Networking on Monday the 4th, so arriving on the Saturday before was just fine. After all, I arranged most of the important things beforehand. I had a place to stay, I knew how to get to the company on Monday and so on.

This first weekend I used to look around a bit and get what I needed for the week, groceries, a public-transport ticket and so on. The city had a fairy-like look to it, in part because of the layer of snow that covered the rooftops of the old buildings in the city center. It had been warm in the Netherlands for some time and I had not seen any snow that winter. And suddenly you are walking in a city with beautiful old buildings covered in snow. This city was to be my home for the next two months. I moved to Meiningen after these two months, but more on that later.

I am very interested in optical communications and everything that has to do with that. I came to ADVA to gain experience in this

field of study. The objective of my internship is building a maximum-likelihood sequence estimator (MLSE) for pulse amplitude modulation (PAM) systems. This is used to decode noisy received signals. I attended a course once where the principles of such an equalizer were explained. However, I must admit, the knowledge I once had on the subject was not as readily available anymore as it once was. I read up on the principle and the implementation and it started to grow on me. I was interested in the assignment from the beginning and my enthusiasm only grew since.

At first I was a bit afraid that the company would be very hierarchical and general manners would be very polite. After all, this is stereotypical for Germans. To my surprise and delight I found out that this was not the case. Everyone in the company is easy going and you can have nice talks with anyone there. Of course it is not that easygoing that nothing gets done, they are German after all, work has to be done. To this day, I find the work and the way of working very pleasant.

The city of Munich is pleasant to be in. The people are nice, the inner city is beautiful and the public transport is excellent. One day I went to Nymphenburg palace. This was a summer palace for the royal family that reigned over Bavaria. When this is just your summer vacation home, imagine what their normal home looked like. Even though it was a cloudy day, it was still quite a sight.

One particular Duke of Bavaria, Wilhelm V, who lived way before the Nymphenburg palace was built, did not like the local beer. Usually he imported beer from other areas because he liked those better. However, at the end of the 16th century, he decided to build his own brewery to save costs, the Hofbräuhaus. This very famous beer hall is one of the largest tourist attractions of Munich. I was lucky enough to be able to see another, less touristy, beer hall as well. Near the end of my stay in Munich, the Starkbierfest began. This is a beer festival with many similarities to Oktoberfest, but with fewer tourists, as I was told. I went to see this with my own eyes together with

one of the guys who stayed in the same apartment as I did. In the Löwenbräukeller, we saw a traditional band, sometimes playing traditional music, at other times ABBA. The place was packed with people who came to enjoy the show, about half of them in traditional clothing. There was traditional food – read: big chunks of meat – and beer was only available in quantities of one liter. As you can imagine, it was a great night.

Munich also has a different side, which they call the dark past. Munich was the birthplace of the Nazi party and many key events took place there. Because of my interest in history, I knew I wanted to know more about this past of the city. Moreover, I think you are morally obligated to learn about this recent history if the opportunity is handed to you. I took a group tour to the concentration camp in Dachau. The tour guide had a lot of knowledge and explains everything in detail. What you get to see there can definitely use additional extensive information. Next to this, I took a walking tour through Munich, which showed where key events played out, such as the (in)famous 'Beer Hall Putsch'. The tour guide was very enthusiastic and shared huge amounts of information. It was a cold, dreary, rainy day, fitting to the subject. The upside was that the group was small and well-motivated to know more. The tour lasted somewhat longer than initially planned because of the interest of the participants. I got to know a lot more about the past and the key role that this city played. I can recommend you to join one of these tours if the opportunity arises.

After two months I left Munich. I was back in Eindhoven for a few days before going back to Germany again, this time to Meiningen. Meiningen is a small town in Thuringia close to the Bavarian border. It lies in the middle of Germany and at the same time in the middle of nowhere. Luckily, I have a car available, because the public transport is almost nonexistent here. I stay in a small town next to Meiningen and it takes me about ten minutes to get to ADVA by car.



Nymphenburg palace

The Munich office of ADVA has no lab to test the project in, which is why I had to move to Meiningen. The time in Munich was great, both because of the city and because of the feedback. I worked in the same room as my supervisor, which made asking questions and getting feedback very efficient. I made good progress on the project there. Here in Meiningen I am doing lab work, which is often not as easy as simulations tend to be, but progress is steady.

As scientists, we all know that speed is relative, and I got to experience that here as well. As you will probably know, Germans are a bit

more lenient on speed limits than the Dutch. For example, the speed limit for the road between the town I stay in and Meiningen is 100 km/h. In the Netherlands this would be 80 or even 60, depending on the number of cyclists using the road regularly I guess, as it is a simple two-way one-lane road. At first I found this crazy, especially after dusk for the lack of streetlights. However, within a week I was already annoyed when others did not drive as fast as they are allowed to, but I still find this speed limit ridiculous. Furthermore, I guess there is a reason why I can spot five crosses with flowers laying in front of them next to the road within a particular 3 km

stretch. Fortunately, I am hypocritical enough to make full use of the speed limit myself to make sure I am a minute or two earlier at my destination.

To conclude, an internship abroad is a great experience, both academically and culturally. It is a great opportunity to get out of your usual comfort zone at the university and see things from another perspective. I can recommend it to all. Feel free to ask me about my internship when I am back, which I will probably be at the time of publication. I would gladly tell more over a cup of coffee at Thor or over a beer in Het Walhalla. ■

Tech United wins two prizes at RoboCup

By: Daan de Geus

From March 30th until April 3rd, teams from all over Europe visited Eindhoven for one purpose: the RoboCup European Open 2016, the largest robotics event of the Netherlands. During this event, which took place in the iconic Evoluon, robots competed against each other in several competitions. Besides the Junior leagues and the FIRST Tech Challenge, there were four Senior leagues.

In the Small Size League, small circular shaped robots played soccer against each other with a golf ball. Because the robots in this league move very quickly, and the ball is shot across the pitch like in a pinball machine, this league was very entertaining for the many visitors. Another league that attracted a lot of spectators was the Standard Platform League. Here, little Nao robots played soccer like real humans. This means that they had



to walk around the pitch, find the ball with their eyes, and kick it in the right direction. For some teams this proved to be fairly difficult: the robots tended to fall a lot, when they were finally in a position to kick the ball. Fortunately, they were able to get up by themselves, most of the time.

Of course, our own university was also represented at this event, by Tech United. Their goal was to win both of the leagues they participated in: the @Home League and the Middle Size League. In the @Home League, robots have to perform several everyday tasks, such as person recognition, navigation and object detection. During the competition days Tech United has had quite some competition from the University of Koblenz, but eventually, on the final day, they convinced the judges that their robots were the best in completing the tasks. Congratulations!



Besides the many workshops and demos, during the RoboCup, most of the visitors came for only one event: the final match of the Middle Size League. On beforehand it was already expected that on Sunday this final would be played between Tech United and CAMBADA, and this turned out to be true. In the days leading to the final it had already become clear that the two teams were evenly matched, and therefore many people looked forward to it. When the kick-off was done by PSV player Davy Pröpper, the stands were packed. Over two thousand people watched this thrilling final. After a 0-0 halftime score, it was eventually Tech United that scored two great goals and won the cup. Congratulations!

Especially with two prizes for Tech United, we can look back at a great event. We want to thank everyone involved, and we hope to see you again in the near future! ■

Puzzle

1					1		0		0			1	
			0		0		0				0		
	0					0		0	0				0
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			0	0		0	1						

Objective / Rules

Each binary puzzle should be solved according to the following rules:

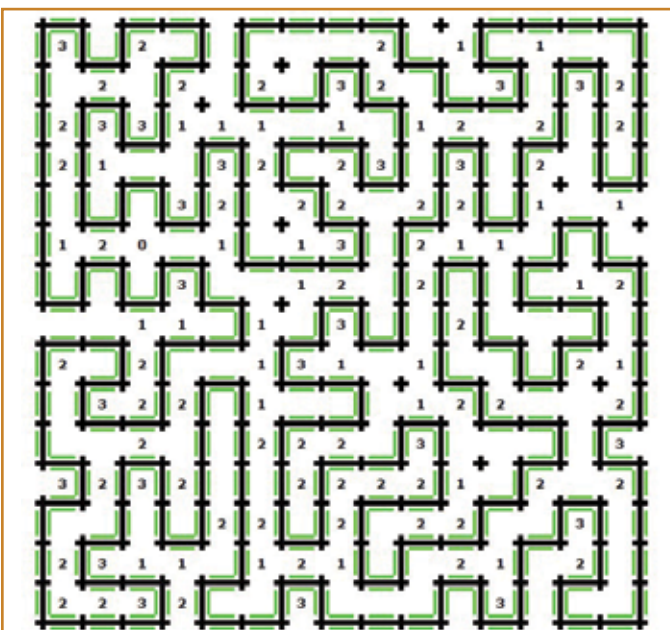
1. Each box should contain a zero or a one.
2. No more than two similar numbers next to or below each other are allowed.
3. Each row and each column should contain an equal number of zeros and ones.
4. Each row is unique and each column is unique.

Please send your answer to connecthor@thor.edu before 22 July.



Winner previous puzzle

The winner of the previous puzzle is Yuk Hang Yuen. The picture is unfortunately lost, so this is a picture of the previous time he won.



Puzzle solution March edition (Connecthor 33)



A honorable mention to Tom van Nunen for sending a solution half way around the world, trusting that snail mail would be in time for delivery.

Kill complaints, embrace solutions

By: Tom van Nunen

What if someone did something really bad, something you would totally disagree with? What would you do? Would you yell at that person as hard as you can, and tell everybody around you how bad that person is? Or would you try to convince that person to change his behavior?

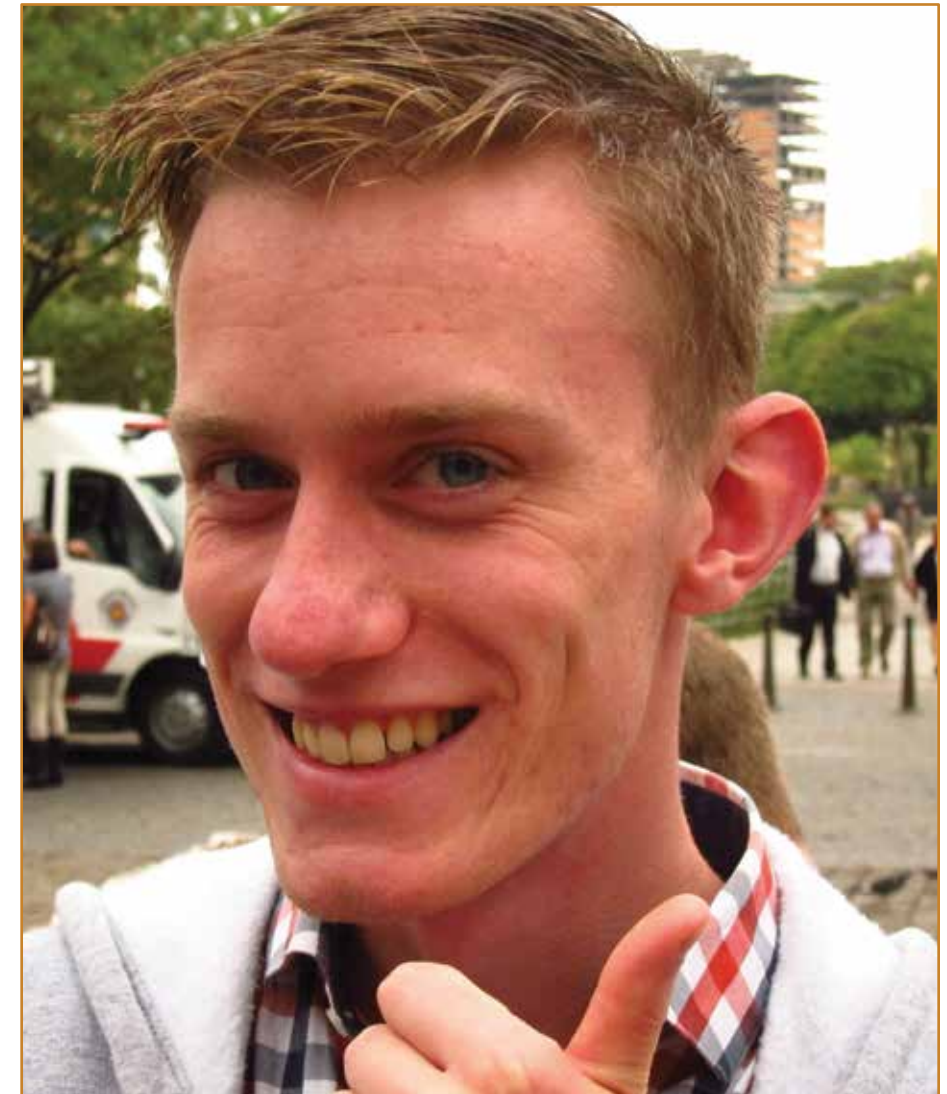
A little while ago, the Career Expo took place on the TU/e campus. Over 140 companies presented themselves, giving students a nice idea of what their future could look like. It's great that this opportunity is given to the students, truly a valuable addition to their already valuable education.

Amongst the companies present was Shell, by some considered controversial. One of our female Industrial Design students clearly didn't agree, both on Shell being present at such an event and on the company in general. She positioned herself near the Shell stand and held a sign up, saying 'Shell kills'. Fortunately, the Shell employees didn't notice, TU/e security removed her within moments and we all had a good laugh.

This made me wonder: what on earth did she think she would accomplish with her actions? What were her goals? Did she think that her cardboard sign would suddenly trigger the engineers and HR-people to step up to the big boss, or to quit their jobs? Did she think that all students would scratch the back of their heads, join her and boycott Shell? I don't think so. I don't think that she thought this whole thing through whatsoever.

Maybe she thought Shell would just stop. Imagine what would happen if all petrochemical companies would cease to be, as I guess most of those closed-minded activists would prefer. Imagine the scale of the disaster it would lead to: no more oil, gasoline, natural gas, and a great reduction in plastics and cosmetic products, just to name a few. At the rate we're consuming oil and natural gas, simply stopping production is not a viable option.

What bothers me is not the fact that she has problems with Shell. On the contrary: I think it's a good thing that people are concerned about the environment and the future of our planet Earth, everyone should be. What bothers me is the way she tackled the situation. She doesn't agree on the business of



Shell and Shell being present, and says that in public, period, end of the story. This is in no way the scientific or academic approach.

As well-educated people, we should know better. Instead of just pointing out the problem, we should mainly be concerned with providing possible solutions to solve the problem. Nobody benefits from complaints, yet everybody could possibly benefit from solutions that make the world a better place. The thing is, it's not hard to complain, but it takes a well-educated mind to come up with a decent solution.

Suppose the person standing there would have been me, instead of our activist-girl. What should I have done better? My hypothetical ultimate goal of a

petrochemical-company-free world is not hard to achieve. Instead of telling everybody how bad the companies are, the only thing I need to do is to make the companies superfluous. Instead of complaining, I have to invent new ways of producing plastics and cosmetics, convince everybody into driving electric cars and make sure nobody relies on fossil fuels anymore for their daily energy needs. Nobody will need oil and natural gas anymore and voilà.

Okay, of course it's not as easy as depicted here, but I truly hope you get my point. We know better than to think complaining is the best way of tackling problems. We're fortunate to study and work in the supportive environment the TU/e has created, let's put that to good use. ■

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