

MACHAZINE

Volume 21 - Issue 3
April 2017

Wiskunde
Informatica
Studeervereniging



'Christiaan
Huygens'

AN INTERVIEW WITH

The New Dean

SYMPOSIUM

The Key to your Privacy

STUDENT INITIATIVE

EWI in Concert

DREAMTEAM

Solar Boat

CONTAINING:

CURRENT AFFAIRS | ASSOCIATION | COMPUTER SCIENCE | MATHEMATICS | MISCELLANEOUS

We push
technology further

to print microchip features
that are finer



to make the
energy use of
a battery more
efficient

to make electric
cars the standard

Do you dream of changing the world of innovation? Do complex technological challenges appeal to your imagination? We are looking for you. ASML always wants to get in touch with eager and curious students.

Join us at [workingatasml.com/students](https://www.asml.com/workingatasml.com/students)

ASML

Be part of progress



MACHAZINE

is a publication of

W.I.S.V. 'Christiaan Huygens'

Chief Editor

Arthur Breurkes, Daphne van Tetering

Editorial staff

Sven van Hal, Rebecca Glans, Laura Jetten,
Maikel Kerkhof, Ghiline van Furth, Angelica
Babel, Marc Corstanje

Art Directors

Floris Verburg, Irene Vooijs, Jamy Mahabier,
Dieuwer Hondelink

Contact address

Mekelweg 4, 2628 CD Delft
E: machazine@ch.tudelft.nl
T: 015-2782532

Concept and design

G20 Kesteren

Publisher

GildePrint drukkerijen

Cover

Night view of The Széchenyi Chain Bridge from
Buda Castle in Budapest, Hungary
June 20, 2013 by The Photographer.

Cooperating on this issue:

Angelica Babel, Beryl Sicam, Daniël Vos,
Daphne van Tetering, David Allaart, Dieuwer
Hondelink, Felix van Doorn, Fred Vermolen,
Hylke Visser, Ilse Bakker, Irene Ravesloot,
Irene Vooijs, Jacqueline Zijdenbos, Jamy
Mahabier, Jeroen Esseveld, Josephine Keim,
K.P. Hart, Leon Overweel, Philip van den Heu-
vel, Rebecca Glans, Ricardo Jongerius, Romi
Kharisnawan, Stefanie Vonk, Thomas Oomens,
Thomas van de Pas

Terms and Conditions

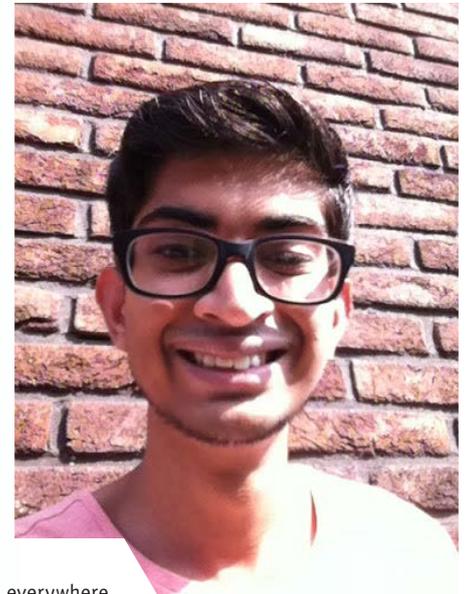
The MaCHazine-committee and the Board
are responsible for the content within this
MaCHazine, in such terms that the opinion
of a writer is not (necessarily) a reflection of
the opinion of the committee or association.
All rights reserved. No part of this publication
may be reproduced, stored in a (retrieval)
system or transmitted in any form or any
means, electronic, mechanical, photocopying,
recording, scanning or otherwise, without the
prior written permission of the committee or
association.

Advertiser index

ASML	Inside Front Cover
ASML	2, 13
Exact	18-19
TNO	32-33

Jamy Mahabier

As I write this, the elections are behind us, and our country's politicians are discussing the formation of the new cabinet. Did you vote? I was never big on politics, but I have to say that it's very interesting to see how the process works and how it's decided who will be our country's guardians for the coming years. Democracy at work! I was also very happy to be at the Lustrum Lecture of our second Lustrum week, where I listened to some thoughts about politics by Ferry Mingelen (a well-known Dutch parliamentary journalist). Who says CH stops at Mathematics and Computer Science?



Voting in the parliamentary elections is not the only first for me: this issue also marks my first editorial since I joined the MaCHazine committee at the start of this year! Some of my most memorable experiences this past while, have been at CH, such as at the Lustrum Challenge (60 Seconds): who knew that crumbs fly everywhere when you try to whistle with half of a Dutch crispbake ("beschuit") in your mouth?!

A lot of activities took place since the last issue, such as the skiing trip, SjaarCie's party, and AreaFiftyLAN. Reading this issue is a great way to reminisce upon those memories! If you weren't able to make it to those activities (or if you just want more), don't fret, as you can also look forward to some awesome upcoming activities in this issue. Problem-solve your way through our neighboring countries at WiFi's Weekend Rally, come feed your brain at the symposium, show off your skills at the hackathon, or travel with us to Budapest during the iCom!

This issue, we have a lot in stock for you. First of all, some big news for the leadership of our faculty: we have a new dean! Read all about him in this issue's interview with him. For those of you interested in joining one of TU Delft's DreamTeams, we have an article by the Solar Boat Team for you. Also in this issue, we have an article by a recent Computer Science graduate and an article by a recent Mathematics graduate. I'm sure everyone can find something to enjoy!

With so many activities and so much news, it's easy to forget what we're all here for: studying. This quarter, I've been using the TU Delft-developed WebLab system again for the CPL (Concepts of Programming Languages) course. Using WebLab is a lot better than having to hand in code on paper, which makes me glad to be a student at TU Delft. In the meantime, I'm also trying to form a team for next quarter's Context Project, which I'm really looking forward to!

Enough about me: it's time to wrap up this editorial, and with that, to let you enjoy this issue's articles for yourself. I hope to see you soon at one of CH's activities! If you'd like to tell us anything after reading this issue, whether it's an idea for a fun article, an area of improvement, or anything else, never hesitate to email us at machazine@ch.tudelft.nl or to speak to one of us in person. We're always glad to hear from you!



**We push
technology further**

**to print microchip
features that are finer**

**to build smarter
solar panels**

**to supply
solar powered
cars**

**to help save
the environment**



Do you dream of changing the world of innovation? Do complex technological challenges appeal to your imagination? We are looking for you. ASML always wants to get in touch with eager and curious students.

Join us at [workingatasmil.com/students](https://www.workingatasmil.com/students)

ASML

Be part of progress



Table of Contents



Current Affairs

From the Board	4
TU Delft News	6
Litter	7
Interview with the Dean	8
Column International Student	10



Association

The key to your privacy: The science behind cyber security	12
Verdiepingssymposium	14
SjaarCie Party	15
iCom goes to: Budapest	16
Lustrum Update	20
Hackathon	22
Skiing Trip 2017	26



Computer Science

Interview Dr. P.G. Kluit	28
Unleashing The Things Network	30
EWI in Concert	34



Mathematics

What is 'Finite'?	36
Fight against financial crime using your data analytical skills?	38
Cryptic Word Puzzle	39

Miscellaneous

De Delftse Bedrijvendagen	42
Science Trends	44
Historical Person: Fermat	45
Dreamteam: Solar Boat Team	46





From the Board

Thomas Oomens

Dear reader,

In the last two issues, you have had the honour of getting to know two of my fellow board members. Since their corresponding function numbers are 1 and 3, it is more than logical that this message 'From the Board' should be from the number 5, also known as the Chief Commissioner of Computer Science Education. Since I fill this function this year in Board 60, I have the honour of providing you with some awesome information about my personal life and my life at W.I.S.V. 'Christiaan Huygens'.

I will start by telling you something about my function as CCCSE, or how I am mainly known, my function as COI. The COI is one of the two Chief Commissioners of Education of CH, who make sure that the first objective of the association, which is to maintain and uphold the quality of the study, is as it should be. Therefore, I have a lot of meetings with different parties within the faculty, like Education & Student business, Marketing & Communication, the directors of study and many of the lecturers at EEMCS. Besides that, I make sure that our exam archive is filled with the latest exams and I lead the different student panels. Together with Iris Kooijman, the Chief Commissioner of Applied Mathematics, we make sure that the opinion of the students is represented, so that these students have the best experience within their chosen study. We work on different booklets that guide students through their study, like the freshmen information booklet and the Minor booklet, in which experiences of different Minor students are stated.

Long before I started doing all these tasks for the study association at the TU Delft, I began as a Freshman at the TU of Eindhoven, where I studied both Mathematics and Computer Science. After the first quarter, however, I discovered that Computer Science would be the way to go. I continued there for the rest of that year, but sadly had to stop because of BSA problems. So I continued my student life in Rotterdam, where I studied Econometrics. There I became a member of SSR, one of the many student associations of Rotterdam. Through one of my fellow dispute mates, I got to work at a website building

company in Berkel en Rodenrijs. There, I discovered that Computer Science was what I should do and after finishing my first year in Rotterdam I signed up for Computer Science once again, but then at the much better TU Delft.

Sadly missing the freshmen weekend and OWee, I started without knowing anyone, nor the study association or any of the cool associations in Delft. I, however, got to know a lot of awesome people and after a few months decided to join the Wispo (skiing holiday) of CH, which probably was one of the best CHoices of my life. There I got to know all the fun members of the association and their way of living. Therefore, I was very happy that I received a mysterious text message a few months later, which followed in being asked for the fabulous FaCie, a committee that makes the freshmen booklet.

After joining the freshmen weekend, I started writing on the booklet and decided to become a member of Proteus, to also have a sportive aspect besides all the fun activities of CH. That year I got asked for the LANcie, in which I had the honour of organizing the second edition of the AreaFiftyLAN, which was one of the most epic experiences in my life. When the LAN started to close in, I decided to accept an offer for a 24-hour position at the company that I was working at, making my life quite busy. Then, however, I got another mysterious text telling me to go to Rotterdam. It was there where I had to cross the Erasmus bridge after a long trip, that I was asked for Board 60 of CH, something that I did not really see coming. Would it even fit in with all that I had already going, the LAN, work, study, etc. Yes it did. It was a lot of hard working, but now looking back on it, saying yes to my function as COI, as member of Board 60, is and probably will be one of the best choices of my life.

Not only have I been able to organize a lot of cool events, but I have also learned a lot about responsibility, planning, and a lot of other useful skills. I can therefore suggest you all to try to go for that leap into the depth and look back on something as simple as an answer on a question, on saying 'yes' to something like a board of a study association.



TU Delft News

Dieuwer Hondelink

The Delft University of Technology is the biggest and oldest Dutch publicly available technical university, established by King Willem II on January 8th, 1842. But what is currently happening in and around the TU Delft? This article will list the most important events of the recent months.

TU Delft organises first anti-drone race

To make sure drones are incorporated in our lives in a good and safe way, we need anti-drone instruments. On the 4th of December the TU Delft Micro Air Vehicle Lab (MAVLab) will host the first ever anti-drone competition. In this competition, named DroneClash, participants will use their own drones to take down as many other drones as they can. It is not just some drone free for all, they also need to avoid anti-drone interventions.

Bart Remes of the MAVLab says he would like to see the drone and anti-drone developments to keep each other in check and as a result drones can be safely and responsibly incorporated in our lives.

On the 4th of December the clash will be held in one of Valkenburg airfield's hangars. Four teams will compete in each round. With their fighter drones they will have to defend their queen drone and avoid the anti-drone machinery.

Powernap at the UB

Tired from all the hard studying all day long and need something better than just a coffee break? Now there is good news for you. You can now take a nap in the UB! In exchange for your college card you get a blanket for half an hour and you can have a wonderful power nap right in the UB. This also improves the learning capacity of your brain and memory. Until the 24th of April you can try it out at the UB, and after that at Sports and Culture until the 12th of May.

Two-dimensional Transistors

For the first time ever researchers have fabricated printed transistors consisting entirely of two-dimensional nanomaterials. This is the result of a collaboration between AMBER and Trinity College in Dublin and the TU Delft. With this research food packaging could possibly be created with a display showing the expiration date, or wine labels alerting you when it's temperature is just right. Two-dimensional transistors have been made before, but the cost of producing them using methods such as chemical vapour was way higher. Right now the material that makes up

the printed electronics consists of many different nanosheets. During printing these sheets are randomly deposited on top of each other. The next step will be to print 2D-structures that are made up of a single nanosheet, which will improve the performance a great deal.



With this technology it will be possible to conduct digital transactions that are guaranteed to be correct, without the intervention of any third-parties. It enables large networks of suppliers and customers to work together more securely and efficiently. The initiators of the coalition expect this to have major impact on areas such as energy supplies, financial services, logistics and healthcare. Right now the primary focus of the agenda is the development of digital identities. These allow people, objects and legal entities to conduct digital transactions as part of a blockchain.

References:

- [1] <http://www.tudelft.nl/en/current/latest-news/>
- [2] <https://www.facebook.com/TUDelft/>
- [3] <http://sc.tudelft.nl/nieuws/>



Litter

Fred Vermolen



When you walk the streets of the Dutch cities, you will see a lot of litter everywhere. Even in the forests, you will see garbage dumped by humans. Litter can even be found in the world's oceans and many fish and whales that have been caught contain elements of litter in their stomachs. Littering annoys many people, but is it always the others who are to be blamed?

Litter has two different meanings in English. It could be *waste, garbage at an unintended location* or *a number of young animals born at a time*. In this column, we will consider litter in the sense of garbage. Garbage, litter, or in other languages 'zwerfvuil', 'skröp', 'Muel', can be seen everywhere in the Netherlands and in many other countries. It is very annoying (at least it annoys me a lot), and it has a negative impact on our well-being and on our perception of surroundings. Some psychological studies, involving mice, have shown that there is a positive correlation between the degree of littering and the intensiveness of aggressive behaviour. Personally, I would not be astonished if similar correlations exist for humans. It is also well observed that litter attracts litter and that if a street is clean, then it is likely to remain clean for a longer period. If you just cleaned up your room, then you will be more careful over a certain period, whereas if your room is already stuffed with garbage then you will be more careless. Litter can be found in parks, in forests, in the ocean, in houses, but also on the internet, in terms of spam messages. It is always irritating. Litter can become a source of bacteria, which can be toxic to humans, animals and plants. If plants, waters and animals are contaminated, it will have (implicit) consequences to humans as well. Hence, litter can be a cause for diseases. Another consequence of littering is fire, as a result of the sun shining on the litter (in particular broken glass can lead to dangerous fires during extensive periods of drought). Other devastating effects can be seen in the stomach of whales, sharks and other fish. It is well-known that litter in the stomachs of whales causes them to disorientate and henceforth to strand on beaches. Lately, on the Norwegian coast, a dying whale was found with thirty plastic bags in its stomach. The animal hardly contained any blubber and fat, which may indicate that the whale eventually died due to malnutrition. Many more examples of wildlife that suffer from litter can be given, in particular, you will find many of them when browsing the internet.

What can we do to reduce waste? Everyone can do something. It is very easy to keep your litter with you until you find a garbage can. Preventing litter is always better than cleaning it up. We can also make our multi-national companies reduce waste by only purchasing products that are made using sustainable principles. Of course, the latter is not always easy.

Additionally, we could re-use, recycle plastics and other synthetic materials. So, there is quite a lot of things that we can do. Cleaning up litter is important in our streets, as well as in the environment, such as forests and oceans. In particular, if we want to harvest from the seas. In the future, this will become even more important, since the human population is growing fast. Cleaning up and reducing littering might be one of the largest challenges that humanity is facing in modern society. This challenge might be larger than globalisation or fighting human-caused global warming. Lately, Boyan Slat, a student in Delft, was in the international news because of a spectacular method to solve the littering problem in the oceans. He proposed to use V-shaped arms (networks) to catch litter, where the sea currents will be used to do so. The idea is still in its infancy, but it is very promising since most waste seems to float at depths of several tens of meters. The idea is simple and elegant. In particular the marine currents, that are modelled, make the waste concentrate on certain positions in the oceans, such as between the Californian coast and Hawaii in the Pacific Ocean and in the arctic region. In fact it is ironic to see that the litter seems to converge predominantly at points that are desolate for humans, but indispensable for marine life. Boyan Slat proposes to collect the waste at those points where the sea currents make the litter converge to.

Once all the litter has been collected from the seas, then, transportation becomes an issue. Where are we going to store all the waste? In huge containers? Or in the third world, which is done frequently nowadays, where European waste is transported to African countries. I guess that these countries do not want to become Europe's dumping grounds. The only way to deal with this problem seems to be recycling. Plastic bags and electronic waste can be recycled. However, it is sad to see that many devices that we use daily, such as computers, printers, cell-phones, tv's, fridges, etc., seem to be manufactured such that they have a finite lifetime. Of course, this is very beneficial for the manufacturing companies and to the economy, but detrimental to our environment. As individuals, we have to change, we should be more aware of our environment and become less lazy. Industry, as well as the local and (super)national administrations should change this behaviour too. I really hope that Boyan Slat's idea will turn out to be useful in cleaning up the oceans, because the littering problem in the oceans seems to be most harmful. I fully support Boyan. I just realised, while sitting in the train to Utrecht to give finite-element lectures there, that the tone of this column has become more serious than I intended Please, don't think that I am a left-wing environmental freak. I just try to be realistic and to write a column that makes the reader a bit aware.

In case you read the column entirely, I am sorry that I bored you with all this. I am going to drink lots of beers and other alcoholic beverages right now (or probably better after or before (???) the finite-element lectures that I will give soon)!

Cheers – Skål !



Interview with the Dean

David Allaart, Philip van den Heuvel

Room of the dean – 16th of March – 11:07

1. Q: Who is the new dean?

My name is John Schmitz. I have studied chemistry in Nijmegen and I specialized in thermodynamics and electro-chemistry. Hereafter, I gained a lot of experience in the field of integrated circuits and semiconductors at Philips, Genus Inc., Sematech and NXP. During this last position at NXP, I was notified of the position of dean. There were certainly other candidates, but I asked myself: can I contribute to this faculty or this university? I believe I can, but of course the coming years will show whether I was wrong or not. Every time I work in a certain environment I try to look 5 years ahead and I asked myself: is there still something that you can learn in the next 5 years from what you have learned so far? When I was in a big company like NXT or Philips, I went from research to manufacturing to research to national consortia to



intellectual property, but I have always looked where I can get new experience and if I can use the things I have learnt so far in the new position. After 32 years, I have seen a lot in the industry, but I thought: Well, let's try something else. I hope I can help students, teachers and all other people to go to the next level. And Delft is of course a very high profile university, so I was very proud that they chose me.

2. Q: How will your industrial experience help you while you work here?

Let me go back to my experience at NXP. When you want to bring a product to the market, there are a lot of people involved. It starts with talking to consumers and getting some kind of specification, making a design and then creating the product. The point is, the only way you can get a good product is by working together. When you go back to university, of course we do excellent work in the sections, different groups and many faculties. But if we look at the attributes in which we try to contribute to society, like energy, traffic, health, you name it, then I believe we can contribute by making 1+1=3, rather than 2, by working across departments, across faculties and across universities. Therefore, I think it is almost in my DNA and I hope also in my network. I also hope to bring interesting and bigger parties that can contribute more than just the isolated contribution. A pleasant observation I already made is that all professors and teachers are rather well connected to the outside world. We don't work here in isolation. Of course we try to strike balance between fundamental research and applied things, but we certainly have an eye on what

is needed in order to be useful to the outside world. But let's face it, we are not the only one working on urgent problems, so we have to distinguish ourselves at some point in time. When making a product, you want to offer something different, but also as a university, you want to distinguish yourself.

3. Q: What does a dean do on a daily basis?

My children asked the same question! First of all, I have committed to write a weekly blog where I do exactly this. (I have already done two of these blogs.) But in a nutshell: the dean needs to make sure that the faculty can do its job. It could be to get the right/best professors/teachers in; it could be to help with the funding or to map a long-term strategic direction; it could be as simple as getting the right facilities here. It is quite broad, but it is not that much about the content. The content should come from the professors. It is a little bit to make sure the people have the right (financial) facilities to do their jobs. But also, of course, to determine the long term direction: do you engage in power electronics or not, do you want to engage more in IoT things or not? You would do this together with the professors, but overall I would say: making sure the faculty can make the next steps.

4. Q: What was the first thing you changed?

I did not change anything yet, but one thing I certainly want to prevent is (I have a term of four years) that students say after four years: John Schmitz, who is that? I want to be visible and be open for suggestions of the student community. One thing I am considering, depending on whether or not the logistics would allow it, is to have an office hour one hour per week for anyone who wants to walk in. You can just walk in if nobody is in the office and tell me what is on your mind. One condition I will put on that is: if you bring problems, which is perfectly okay, also try to bring a solution. Even if the solution may not be the right one. If you have a problem or there is an issue somewhere, you should also have an idea on how you would improve that, because here is the thing: the people who see the problem often have the solution already in their mind. That is certainly something I would like to change/add at least for a while.

5. Q: How do you feel about the study associations?

I have looked at the websites a little bit: What are you doing? What do you organise? And I see lots of good things, things like study tours. I think Rob also went to several of those, to China and the United States. You guys are in the middle of the student community, you also feel, hear and see what is going on. So yeah, I absolutely support that. When I can support it, if you guys need help, then please come here and ask me whatever you guys need, that's fine. It is a well-balanced addition to the more formal program the faculty has to offer to the students, which is fantastic.



6. Q: What is your long term vision for EEMCS and in particular regarding the building?

I know that discussion is heavily developing at the moment. It is a difficult situation, I do not deny that. The university as a whole has a housing bill that is too high, and the CvB (Executive Board) is looking at how we can solve that. EEMCS is a very expensive building. The plan at the moment is to move Mathematics and Computer Science to the vMB (van Mourik Broekmanweg) building. A discussion we are having at the moment: does it fit? The objective is to continue to offer a really high quality environment so that we can again do what we have to do.

For EE it is less clear now. We have several questions on the table: we're doing an upgrade of our power lab, we have EKL which also needs an upgrade at some point and we have the Kavli lab, which is also a clean room. All of this is not something that can easily be moved. It is quite a puzzle and we're still in the middle of puzzling at the moment on how to do that exactly. Of course, as a dean, my objective is to get a housing which fits our needs and wishes, but there is, of course, also the financial aspect, so we have to see how we balance those.

7. Q: And in regard of keeping the faculty together?

We are beyond that discussion at the moment, that decision has been taken. Am I happy about it? No, but I must say this: where there is a will, there is a way. If I go back to NXP for a moment: we had groups working on projects all over the world 24 hours a day, 7 days a week and they had to work together as well. So if the will is there we can bridge those little physical gaps. Does it help? No, but it will also not impede us to work together wherever we need to do this. By the way, the current building has 24 floors. If you are at floor 20 and the other person is at the third floor, there is also a big distance between the two. So it is not ideal, I would like to see it differently, but that's how it is.

8. Q: How do you feel about the growing student numbers (especially for CS)? Should there be selection/filtering in the admissions?

First of all, I am happy to see this. It means we offer the right program! It is a bit of a luxury problem, but it indeed causes problems. More teachers are needed, you need to have accommodation, stuff like that. There is a group in place to study this and they are figuring out that problem. There are, of course, three categories: bachelor, masters and minor groups. I think we should try to go for a situation where we should not have any cap. However, there are, of course, short term capacity problems, which presents certain quality concerns. Long term, however, I think we should accommodate the additional people. I know from the admission people that there are certain discussions ongoing: do we have sufficient criteria in place? You should not have people starting a Bachelor degree, who you know beforehand will not be successful in the end, that is not right.

9. Q: How do you feel about the internationalisation and the international inflow of students?

Of course, the technology we work on is international and universities are global. Everyone is encountering the same problems: environment, energy, health and others. So that is in itself no surprise: you will see a certain international field here is obvious. However, suppose there would be no Dutch students here, would that be a good situation? Probably not. Would zero international

students be good? Neither, because of the international character of the field we study in. So what is the optimal percentage? I don't know, it is difficult to say. Another interesting question is of course: do we intermingle well? About that I am not sure, I have not been around for long enough to give you a good answer to that, but there are some signs that it could be better. The thing we probably do need to take advantage of is how other cultures approach problems. Western people are very straight to the point, but if you go to China or India, they have different approaches. Maybe we do not take enough advantage of the lessons their cultures can provide us.



10. Q: How do you feel about the teacher appreciation and didactic values versus researcher appreciation? Should there be more appreciation for teachers?

This problem is also known at the CvB, and the CvB has clearly said: we want to appreciate this more. I would say: Yes, 50% of a university is teaching and 50% is doing research, it is an important part of our job. So a good teacher which brings new elements should be rewarded and we are working on ways to put more emphasis on that. It can always be more and better, but in general: it is recognised in each level of the university and I do see this more and more.

11. Q: What do you want to achieve in your term? How do you want people to remember you?

I ask myself the same question! What do you leave behind? I would like to improve on making 1+1 equal to 3. The problems we are trying to solve are becoming more and more complex. You see this already when you look, for instance, at cybersecurity: it's not only just a Computer Science issue, there are also a lot of legal, business, and other issues there. That forces us to work with groups of which the engineers sometimes say: "Oh, these untechnical guys, they're bothersome". You already see, if you look at Computer Science, that in several research domains there is a human aspect there, which forces us to work together with 7 for us relatively unknown fields, which is fantastic! I would say: my hope would be that they would recognise our faculty, in that we can offer complete solutions to the outside world, not just the technical side of it. Like: hey, we looked at all different aspects of the problem, and here is our solution. That's my hope for now, I may come up with other things while time moves on.

Column International Student

Romi Kharisnawan

Hey all!

It has been about 6 months since I first set foot at TU Delft as Master student in Computer Science. It feels like yesterday and time just went by so quickly! I would like to tell you a glimpse of my story being an international student at one of the best technical universities in the world and also how it feels being a foreigner in The Netherlands!

Before taking you with me on my journey, I would like to introduce myself. My name is Romi Kharisnawan and I flew all the way from Indonesia, for more than 14 hours and across more than 11.000 km, to the Netherlands to study a Master degree. I was so excited, since it would be my first experience living in a foreign country for quite a long time.

Studying at TU Delft isn't easy!

After 2 weeks of having fun with the Introduction Program, it was time to get back to business. Coming back to school to study wasn't that easy for me. It requires a lot of effort to resemble all the knowledge that I obtained several years ago in a Bachelor degree and keep up with new study materials from the lectures. But I believe in 'No Pain, No Gain'. At first, I was struggling a bit in adapting to the learning system with the quarter periods, because in my Bachelor I had a semester system, in which I had a longer period to study. Also, learning in an international environment is totally different. As a non-native English speaker, I found out it would be my biggest challenge to understand and to express ideas in a different language than my mother tongue.

I took up too many courses during the first and second quarter, because many of the subjects were interesting. In total, I took subjects that were worth 46 ECTS in two quarters. Consequently, I had to do a lot of assignments and group project, while still the exams being in the back of my head. This experience is totally unforgettable and, gladly, I passed all of the courses.

Live like the Dutch!

It is undeniably important for the people in Holland to ride a bike. I was biking before in Jakarta, but not that intensive because of the temperature and pollution. But over here, I bike every day, because it's so convenient. There is a specific lane for bikes, which makes it really easy to bike without having to worry to get hit by car. I really like to bike around Delft or make a short trip to Den Haag or Rotterdam. The other thing that I need to adjust to is the food. People in Holland really like to eat bread all the time, while I am a huge fan of rice. Fortunately, there are many Asian ingredients sold in Chinese stores in Delft or Den Haag. Also, milk here is like water in my country, because people often drink it for breakfast, lunch and dinner. Now I have become a frequent milk drinker too because it's also relatively cheap.

Despite all nice things in Holland, the thing that I hate the most is the wind. The wind literally can make people fall off their bikes and it also makes the temperature feel like it is lower than it actually is. But, I guess that is also part of the perks of living like the Dutch, right?

Having fun while studying is a must!

I love to travel in my spare time. I use the privilege to visit countries within or near Europe while I study here. I travelled to Norway and Morocco in the break and not forget to mention visiting several cities in Netherlands. I flew to Norway with a Scandinavian group that I met in the Introduction Program to experience my first ski moment. It was definitely an amazing experience because I didn't have any skill before, while my friends have been skiing since they were 2 years old. The funny thing was that my friends forgot how amateur I was and took me directly to the top of the mountain in Hemsedal. I fell down so many times and it took me 2 hours to go down where usually people only take 20 minutes to slide down the hill. Another unforgettable trip was my solo trip to Morocco. This was my first time going to Africa and see the wide desert with my own eyes. Riding a camel and staying in a tent in the middle of the desert were the prominent moments during the trip. Living in Holland definitely gave me more survival skills living in a new place, like when I had to ride the local bus for 12 hours alone from the desert to Fes, with people who do not speak English at all. That was such a once in a lifetime experience.



Last but not least, I also joined Christiaan Huygens' Committee of Master Activities (COMMA) as Commissioner of Communication. Together with other 6 amazing people (2 other international students and 4 Dutch students), we have been working for several months to make fun events for master students of computer science, applied mathematics and embedded system. It has been a great experience to be part of CH and channel stress from study to something fun and useful. As last word of my story, I am excited to see how life in the Netherlands will take me ahead and also I would like to invite all master students of CH to come to COMMA's next event: Carnival, which will be even more fun than previous activities!





The key to your privacy: The science behind cyber security

Jacqueline Zijdenbos

Cyber Security becomes more and more important for modern society.

Increasing amounts of data are stored online, we let computers become continually bigger parts of our lives. However, criminals become more and more competent in undermining the protection of data and systems.

This means that we need to improve the protection the whole time.

On the first of May the symposium committee of W.I.S.V. 'Christiaan Huygens' organises a symposium themed: "The key to your privacy: The science behind cyber security". It will be a day filled with interesting lectures on different aspects of cyber security.

The chairman of the day will be Cynthia Liem, assistant professor at the Multimedia Computing Group of the TU Delft. During the day there are two tracks to make sure everyone can choose the lecture they find most interesting.

The day will start off with a joint lecture by Phil Zimmermann. He is the inventor of PGP (a software package for email encryption) and works at the TU Delft as a crypto teacher. He will give an introduction about the importance of cyber security.

Next there will be two different lectures. One lecture will have a mathematical topic. This lecture is by Wieb Bosma, an associate professor at Radboud Universiteit Nijmegen. Mr. Bosma will talk about the importance of prime numbers for cryptography. The other lecture is more focussed on the computer science aspects. That lecture will be given by Herbert Bos, a full professor at VU University. In his talk he will discuss the new generation of security problems.

For the third lecture of the day, you can again choose between two topics. One lecture by Bart Seghers of Thales about the security monitoring vision and the changes in cybercrime. At the moment of writing the other lecture is not determined yet.

Right before the break some PhD students will give short pitches about the research they are doing. Their researches are all in the field of cyber security. After the pitches it is time for the lunch. Besides enjoying the sandwiches, you can also ask the PhD students some more questions about their pitch.

After the lunch you can choose between the lectures of UL and ING. The lecture of UL is by Gjoko Krstic about the internet of things. The lecture of ING will be about block-chain and encryption.

The last lecture of the day is still a surprise, but the committee will make sure it will be a valuable addition to the day.

We conclude the day with a debate about the ethical side of cyber security. One of the participants of the discussion will be 0xDUDE, a Dutch ethical hacker.

And last but not least it is time for drinks! The perfect possibility to ask all the speakers your last questions and to talk with other attendants about everything you learned during the day.

After this article you probably want to attend this event! You can buy a student ticket for only €5 and when you are an alumni or employer at TU Delft a ticket is €25. For more information and tickets you can take a look at our website: wisv.ch/symposium. 



ASML



Be part of progress

TU Delft student Kevin on being a campus promotor for ASML

Here's your contact with the future

Kevin will be finishing his bachelors this year, and then it's on to the next step: a Masters in Telecommunication, specializing in wireless information transfer. He is an old hand at putting students in touch with potential employers; that's what he did during his Board Year in the Electrotechnical Study Association (ETV). Electricity is all about making the right connections. And if you want to make the right connections at ASML, Kevin is your man.

He first got to know ASML while on the Board of ETV, and immediately realized that this could be a great place to work. How else? For a guy who is so into the cutting edge of technology, there was an instant attraction to this super-high-tech company. ASML develops and manufactures the highly advanced machines used in the fabrication of microchips. So when Menno, the previous ASML campus promotor suggested to Kevin that he should take over his role, he needed no further encouragement. "Menno and I had worked together before, and have quite a lot in common, so I thought I would also be a good fit for the, like he was." It was Kevin's enthusiasm – and possibly also the fact that he is a communicator at heart – that landed him the job.

How Kevin can help you

Kevin: "Basically, together with two of my colleagues, I represent ASML in Delft. We help organize events, arrange field trips and Excursion Days to ASML, assist with the recruitment of students, interview them and give them a hand with the application process, and generally act as the go-between, connecting students and the company.

As an ambassador and promotor of ASML, Kevin and his colleagues have "direct hotlines" to the company's Human Resources staff. "If we recommend a promising student to ASML, they take it as an endorsement by us, and will treat the application as a priority. So, being introduced to ASML through a promotor will definitely speed up the process, and you are more likely to get an interview soon."

Kevin went on a two-day training course at ASML in Veldhoven to learn precisely what it is that the company is looking for in potential employees. "It's not just about getting good grades (but it helps of course). It's also about being socially active, doing something extracurricular like a Board Year, and basically being a well-adjusted, balanced human being!"

Kevin raves about ASML

Kevin says the people at ASML are very supportive and helpful, and this applies not only to the HR staff. "In fact, I noticed something that I thought was quite cool about the Customer Support Department at Veldhoven: they're not

just sitting in a call center fielding calls, but when there's an issue, they will sometimes literally assemble a team of experts from R&D to sort out the problem. They even have an aerospace engineer onboard at Customer Support."

Besides the training he underwent at ASML, Kevin has a good feel of what's required. "The more students we put in touch with ASML, the more feedback we receive about the suitability of applicants. So we're forming a pretty good idea of what ASML wants."

He says the company is looking for employees with talent, qualifications and commitment. "The Extreme Ultra-Violet lithography machine that ASML is developing brings a whole new set of challenges. They're working at a much smaller wavelength of light, at incredibly tight tolerances. So everything has to be done with extreme precision."

A cool place to work

About ASML as an employer: "My first impression at Veldhoven was that the company seemed a lot smaller than it really is. That's because it's so informal. It doesn't have this big corporate mindset. Sure, there's a hierarchy, but everyone is treated as equals, each person's opinion is appreciated. I also see a lot of interaction between departments."

About campus life

"Delft is really good on a national level. In my faculty there is a lot of contact between students and lecturers. The professors are very cool, and always willing to help. They even join us sometimes in our pub in the basement of the faculty building."

About being a campus promotor

"I'd like students to see me as a very approachable person. For many students, there is a huge perceived obstacle between them and a potential employer, especially when the company is situated far away. My colleagues and I understand how these aspiring employees feel and we know how to deal with this level of communication. We'll make the process painless."

Connect with Kevin

To chat to Kevin about the opportunities offered at ASML, give him a call on 06 – 448 610 84 or mail asml.delft@gmail.com with Kevin in the subject line.

Advertorial



Verdiepings Symposium

Daniël Vos, Irene Ravesloot, Josephine Keim

On Monday the 13th of February, the annual 'Verdiepings Symposium' was held, where students were introduced to the final Bachelor project. Join us for a look behind the scenes of this amazing event.

The day

It was Monday morning, birds were singing, streets were empty. Callum and Iris arrived at Leo van Vliet, to pick up their order of 130 sandwiches. Instead of coffee they received 2 free sandwiches, nothing could have prepared them better for this day.

While this was going on, the rest of the committee only had CH coffee to wake them up. Everyone but Daniël spent their time setting up tables, pouring drinks, preparing snacks, placing posters and selling the last tickets. He spent his time in the toilet... filling up the percolator with water from the tap, using a coffeepot, one liter at a time.

You might have thought, since teachers tell you not to start work 1 hour before the deadline, that they themselves would not make a similar mistake. You were wrong. Even during the event, 2 weeks after the deadline, teachers were sending in their slide sets. However, we are very grateful for their efforts, all of them voluntarily.

A tsunami of students came rushing into the two lecture halls fighting for the best sandwiches. An interesting observation we made is that mathematics students are much pickier about their lunch than the computer science students. We were unsure whether the awkwardness of the computer science students, or their hunger was to blame.

The rest of the day went really smoothly; all teachers showed up with great presentations.

The day after

To follow up the bachelor event, we organized two separate master events. These events started with a lunch where students could talk to master alumni from their field. This was a good way for them to orient on their master and what to do after. After these lunches, students were updated on the masters in Delft or how they could study abroad.



The bachelor project take-home message

To prepare for your bachelor project you could do the following:

- Think about what courses you liked in your bachelor
- The classic: start orienting in time
- Talk to different teachers, they can probably give you useful advice
- Possibly look outside of TU Delft for interesting projects you can do

For the presentation slides used during the bachelor event and more information, see Bachelorproject course on Blackboard. 



SjaarCie Party

Beryl Sicam

If you have heard about the SjaarCie party and committee, this introduction could be redundant. Let's talk about it anyway. SjaarCie is a committee in our student association. A group of freshmen are supposed to organize a party and a barbecue. Our party was held on the 22nd of February, following the first part of De Delftse Bedrijvendagen (DDB), another event organized for students.

Upper-class students usually see it as a nice completion of the first part of DDB, others see it as another reason to drink and have fun. Each year it's up to the new generation to set up this notorious party and come up with an original theme and stage setting.

Theme

Our idea this year was to give off a wild vibe, to be your crazy self. Therefore, we have chosen for a leopard print with a golden color, preferably with a lot of sparkles. It's flashy, eye-catching and so wrong. Every member was supposed to represent a Wild Cat, and, no, not the one from High School Musical. But a real party animal. Perhaps we agreed on a theme for our committee, but we didn't think of any for the party. Though it didn't take that much time to come up with "Catsino", cat casino, a very SjaarCie-related pun.

From November until present day we gathered (almost) every Friday and discussed what to plan and to do for the then upcoming party. We all had our own function and share of work. The biggest part was arranging the music, location and theme. Luckily our mentors from the board, Beer and Karim, helped us out with fixing the location.

Preparations

It was a lot of work to find a good outfit before the Oud-SjaarCie borrel (networking drink with ex-members). This was very important, because we wanted to prove to them that we were their worthy descendants. That evening was also a moment to get tips for organizing the party and getting to know our predecessors. There were still a couple of preparations undone around this time, we were nearly a month away from the event and we hadn't even started the ticket sale. At that moment, it was still unclear which DJ's were officially going to play. As soon as this was confirmed, we immediately started promoting the party and approached students to inform them about our awesome event (and convince them to come).

A party isn't a party if it's just an empty room with a bar. We also had to think of stage setting. One weekend, some of us went on a trip to buy some decorations. On the day of the party, we agreed on meeting at the location a couple of hours before it started. We had some paintings of dogs and plastered the walls full of cards for some extra theme-atmosphere.

Recap

The event was held at Proteus-Eretes, a student rowing association in Delft. Not only people from CH were invited, but others as well! You were welcome if you had bought a ticket during the sale. We were totally sold out, though, so no tickets at the door! 22:00 o'clock and we were all ready to invite our guests inside. We're talking about students, so around this time it was still quiet. The room still felt spacious and it wasn't really escalating yet. But before we knew it, the flow of guests increased and the room got filled with (perhaps already drunk) students and friends. Some students were dressed in their committee clothes, to show dominance or because it's just fun to wear them. Others were dressed according to theme, either with leopard printed or with casino-related clothing.

We all took turns in the door-shift, so sometimes we were downstairs at the door, checking the tickets and identity cards (aged below 18 means no drinking!). Even during the shift, we could still hear the music from upstairs and just made our own party spin-off downstairs. If you didn't know already, students from Delft know how to put up a good fête. Everybody was having fun, dancing and/or making out. Everything was going great. It went so well, that a few of us don't remember clearly what happened that night. We're lucky that our mentors had guarding-duty all night and were there to watch over us.

What comes next?

Now that the SjaarCie party is over, it's time for us to focus on the barbecue. It will take place in June and will be just as fun as the party. This time, it's less drinking and more food! Keep in mind that less drinking doesn't mean no drinking and we're also planning to include beer and other drinks of course. Setting up the barbecue doesn't need as much of energy and time as setting up the party. But we're still going to gather every Friday and continue having drinking sessions, in Dutch zuipsessies, where alcohol should trigger the creativity in our brains. This time we'll learn from our mistakes and start earlier with promoting the barbecue. I hope all who went to our party enjoyed it, the year is not over yet for us SjaarCie. You'll soon hear from us again. See you at the barbecue!

iCom goes to: Budapest

Irene Vooijs

The iCom is the exchange committee of our study association. Every year

the iCom organizes a trip to a foreign country. Last few years, the iCom

visited Dublin, Krakau and Bologna and this year we will go to Budapest!

From the 13th until the 17th of June, we will travel with a group of

34 CH members and 2 companions to explore the city's university,

companies and culture.

The city

Budapest is the capital of Hungary, which is probably the furthest destination of the iCom so far. It is the city of the inventor of the famous Rubik's cube, mathematician and architect Erno Rubik. Next to that, the city is famous for its thermal baths, and you might know the Sziget Festival which is held on an island in the centre of the city ('Sziget' literally means island). There are multiple great technical universities located in the city, which together have schooled more than 9 Nobel prize winners. No wonder there are many technical companies established in Budapest as well. In the five days that we will discover Budapest, we will visit at least one university and two companies. The time that is left will be used to undertake some cultural activities. Budapest has a long and rich history, which has formed the city into the beautiful 'Pearl of Danube' it is now. Thus, there will more than enough to do to experience five amazing days!

University

To keep the educational mindset in our trip, we will visit at least one university during our visit in Budapest, namely Eötvös Loránd university also called ELTE. This university is the oldest and biggest university of Hungary. At the university we will get an interesting lecture about static analysis and what is achieved within Ericsson using static analysis. We also will get a tour of the campus where we will visit the different faculties. We want to say a special thanks to our contact person Bojana Urumovska, a master student here at EEMCS. She studied at the ELTE in Budapest and helped us arrange the lecture and the tour and also gave us valuable information about the city and all the cool places to go to.

Furthermore we are also in contact with another university. This university is called the Budapest University of Technology and Economics. It is considered the world's oldest Institute of Technology which has university rank and structure, since it was the first institute in Europe to train engineers at university level. It was founded in 1782. The idea is to also attend a lecture here and to visit the campus.



Activities

Besides the company and university visits we are also going to do a lot of fun cultural activities. At the beginning of our trip we will do a walking tour through Budapest to get a perfect impression of Budapest. During this tour you will see multiple famous sites of Budapest, for example the castle hill next to the Danube river, the Danube promenade and the St. Stephen's Basilica. Apart from this tour we will visit the beautiful Parliament building where the crown jewels of the former royal Hungarian family are stored. Because this trip is pretty tiresome we will relax in one of the multiple thermal baths of Budapest. Since the trip is in June, the weather will probably be perfect for an afternoon of swimming outside. Besides the activities we have planned for you, there are multiple fun activities to do on your own or with a little group during the trip. One of the possible activities is to do one of the many escape rooms that Budapest is famous for. This was not an option for us to organize, because you can only do escape rooms with a few people and it takes about an hour for each group. However, we have some free time scheduled for this type of activities, so start searching for mates who want to do an escape room with you.



Did you know that:

- The city's name is derived from the two areas Budapest consists of? The area on the East side of the Danube is called Pest, which is the lively centre of the city. On the other side of the river you will find the rustic district of Buda. Here, on top of the mountains, you have an amazing view over the city.

- The metro network of Budapest is the oldest of the European mainland? The only European city with an older metro network is London.

- One of the biggest photograph of the world is taken in Budapest? In 2010, it was a new record: four days of shooting resulted in 20,000 images, and an additional two days of post-processing produced a single 200 GB file. If printed, the size of the photo would be about two apartment blocks long and ten stories tall!



Interest & Information lunch

We have been busy preparing the trip for a few months already. One event that we have organized already is an interest lunch for all CH members who want to join the trip. They got information about the trip, like what time we will depart from Schiphol airport, which activities we are going to do and how they should behave when we attend a case at the companies. Since we only have limited places, we also explained our selection procedure. After the lunch, the registrations opened. Many of the attendants were enthusiastic and applied immediately!

To conclude, organizing this trip together has been great fun and the trip itself will make it all even more amazing! We hope you will join us and if so, you will definitely enjoy the educative, cultural and social activities we have planned for you. See you in Budapest! 





Code quality is key to a successful company

Exact

For a large company like Exact, it goes without saying that the software that we deliver to customers should be of high quality. Our products need to look great and help customers run their business. The fact that they do, is because of the thousands and thousands of lines of code under the hood. Developers write, change and maintain this code on a daily basis.

Although invisible to the customer, the quality of those lines of code can be just as important as that of the visible part of the software. And thus of the company as a whole.

Make sure to repay your technical debt

As we live in a fast-changing world, software constantly needs to be adapted based on new insights and customer demands. Keeping the code quality on par while making frequent changes in the process, is a challenge all software companies struggle with. As Robert C. Martin, in a foreword to Feather's "Working Effectively with Legacy Code", put it: "software systems almost always degrade into a mess." [1] As long as the software still looks and works great on the outside, this may not seem like much of a problem. It does, however, in the long term, when code becomes so complex that making a change becomes harder and harder. Ward Cunningham explained this in 1992 using the metaphor of technical debt [2]:

"Shipping first time code is like going into debt. A little debt speeds development so long as it is paid back promptly with a rewrite... The danger occurs when the debt is not repaid. Every minute spent on not-quite-right code counts as interest on that debt. Entire engineering organizations can be brought to a stand-still under the debt load of an unconsolidated implementation."



Build-Measure-Learn... applied on code.

Exact adds 1,000 new users to its platform every day, so it is key that everything we build, scales easily. To do so, we are adopting the Build-Measure-Learn cycle, as is used in the lean startup methodology. In short this means that rather than building a complete and finished product – which takes very long to do – we will release a Minimal Viable Product (MVP) first, and measure how customers use it. Through dashboards, the learnings can even be based on real-time data. Based on these learnings, we will be able to develop the MVP into a product that perfectly serves our customers' needs.

Likewise, we figured we could also improve and learn about how we build solutions. We keep improving our engineering knowledge to be able to always incorporate the latest technologies into our products, and avoid technical debt. So we started applying the Build-Measure-Learn cycle on source code as well, measuring important characteristics (e.g., complexity) of our software, learn from it and improving our engineering skills

Improvement by experimentation

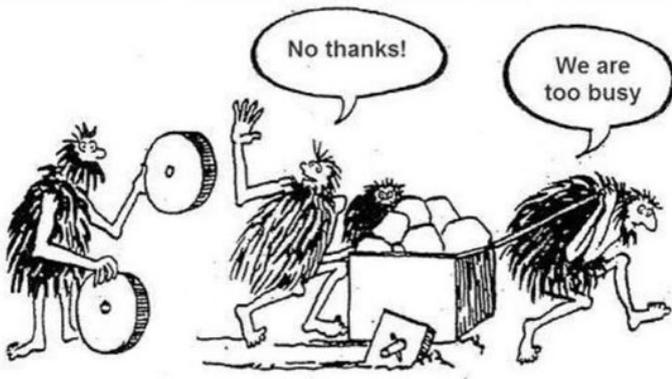
I was a member of the research team that piloted this approach, starting two years ago. Every change to the source code we made, resulted in new statistics in SonarQube, a dashboard for continuously measuring code quality. Engineers use this information to improve their code, to become aware of quality issues, and to deal with potential risks as early as possible. At the end of every development sprint, our team looked at the dashboard together to make sure that all the great things that were implemented in that sprint did not result in a decrease of code quality. More development teams at Exact have adopted this way of working since.

As an experiment, the Research team recently also started sharing their source code in GitHub Enterprise, an on premise version of GitHub. This platform makes it easier to collaborate on code and it stimulates peer review. Peer reviews are not used to 'judge' code. Rather, the team sees it as an excellent tool to share knowledge and to share engineering best practices. It's simply another tool to improve engineering skills and, as a result, to improve the quality of the software that is produced.

Doing code quality the LEAN way

In an organization that experiments with MVP's and such, is it worth the effort to invest in code quality – you might ask. Should you invest time in something you might not end up building after all? The answer, of course, is YES! As an idea takes off, you want to be able to iterate on it straight away. Without a certain level of code quality, that's hard. After learning from an experiment, you want to maybe tweak the MVP, make some adjustments, etcetera. The process is driven by change, rapid change... and from an engineering perspective, clean code is one of the enablers for change [3].

Advertorial



But good quality doesn't mean blind perfection either. In the spirit of lean start-up thinking you might ask: "when is the quality good enough?" That's why our team has started an evaluation with the brand new service Better Code Hub from the Software Improvement Group, a company specialized in code quality audits, which aims to answer that very question.

Growth-proof quality for the future

This Better Code Hub analyzes source code on-the-fly, much like SonarQube, but from a different angle. Instead of presenting all quality concerns as issues that need fixing, it simply tells you whether or not the code is still easy enough to maintain. If the quality is subpar, it suggests which areas need improvement, so that the code becomes maintainable enough. The focus is not on making every little detail perfect, but rather to keep (or to get) your code in a maintainable state so it will not impede change. To determine what level of quality is good enough, the Software Improvement Group uses a model that takes the average code quality of the IT industry into account.

The pragmatic nature of the tool, combined with its goal to guarantee growth-proof quality for the future, seems to make it a great fit with the mindset and ambitions of Exact – and a valuable tool next to SonarQube. We look forward to being one of the first enterprises that is going to evaluate the Better Code Hub. We expect it to contribute to our code quality and thus to the future growth and success of Exact. To be continued!

Get in touch!

Erik Ammerlaan [4] has a passion for code quality. In 2014 he received his MSc degree in Computer Science from Delft University of Technology after a research at Exact [5], measuring how refactored source code impacts developer productivity, of which the findings were also presented at SANER2015 (International Conference on Software Analysis, Evolution, and Reengineering). Since then, he's joined Exact's Research team. Want to know more about development at Exact? Want to discuss software architecture? Looking for an inside contact to help you get an internship at this fast growing tech company? Get in touch!

References

- [1] Michael Feathers. Working effectively with legacy code. Prentice Hall Professional, 2004.
- [2] Ward Cunningham. 1992. The WyCash portfolio management system. In Addendum to the proceedings on Object-oriented programming systems, languages, and applications (Addendum) (OOPSLA '92), Jerry L. Archibald and Mark C. Wilkes (Eds.). ACM, New York, NY, USA, 29-30.
- [3] Robert C. Martin. Clean code: a handbook of agile software craftsmanship. Pearson Education, 2008.
- [4] LinkedIn: <https://www.linkedin.com/in/eammerlaan>
- [5] <http://repository.tudelft.nl/islandora/object/uuid:bb857573-ca20-44ee-921a-30e66ee3767c>

Lustrum Update

Felix van Doorn

Having witnessed the festivities of the second lustrum week, some of our readers might think that we will be slowing down for the rest of the year. During our promotional rounds, we hear a lot of our younger members express their amazement for the sheer amount of activities we have already organized this year. In the second lustrum week alone, there were already eight activities in five days! For the poor souls that missed any of these, here is a short recap of this amazing week. You'll have to wait another five years before you can experience one again, go on let that sink in for a while!

The more politically engaged among us came together to join us for a lecture by Ferry Mingelen, veteran of Dutch political journalism for over twenty-eight years! Afterwards, we all enjoyed a number of free drinks and congratulated the board during the official reception of the sixtieth Dies Natalis of our association. The festivities were continued during our Lustrum dinner, held at restaurant 'Het Koningshuys'. On Tuesday, many of you came to our members lunch to treat themselves to a Smoothie. After taking a while to let the food settle down, we made the trip down to Wassenaar to have a swim at the famed Tiki Pool. On Wednesday, it was of course time for the traditional cocktail Wnight. As there is only one lustrum cocktail night every five years, we decided to spice things up a little with more cocktails, a band and much fancier decoration. On Thursday, we organized an Agile Cooking workshop. Here we applied the principles of Agile project management to cooking. To finish the week we gathered at the Flora theatre in Delft for our very own comedy night. Here three comedians, Edo Berger, Neill Robinson and Adam Fields gave us a fitting ending to a wonderful week of Lustrum festivities.

Well dear reader, it deeply satisfies me to say that we have absolutely no intention to slow down whatsoever. Given our profound love of #Trends, you of course know that we will continue #Trending in this direction. The only way is up! (Except for our drinks, these only go down the hatch) There is still so much left to do this year. Of course we will still have our twelfth of the month challenge, in which all of you have faced regular #PlotTwists. Throughout the

year this series has brought out the best or worst in our members. We have seen the most amazing things, from two bottle flips in under three seconds to Applied Mathematics graduates forgetting how they should tie a knot. By now one single freshman, Nick Zwaal, seems to be comfortably cruising to victory. A number of you can still catch him though, which would allow you to spend the most points during our amazing auction at the end of the year!

This is still far away, however, there are still some activities that we must absolutely discuss with you. At the time of writing, we have unfortunately had to change our plan for Kingsday due to some unforeseen circumstances. Keep your eyes peeled for our new plan to make sure that you can join us for this activity.

We highly recommend you to take a look at the piece on HackDelft, you really do not want to miss this activity. This is definitely one of the highlights of the lustrum year.





Then on the second of June, as the summer approaches, it seemed like a very good idea to enjoy a day by the lake after the last mid-term exams of this academic year. As mentioned before, this day is not only about unwinding. It is also an opportunity to spend your hard-earned Lustrum game points in our official auction. Your points act as currency that you can spend on prizes. So the more points you scored during our challenges, the more choice you have in picking your own prize! At the very end of the year, we will end this fantastic lustrum year with an #Ending party on the 23d of June. We have some very exciting artists lined up for you, so keep on the lookout for tickets early!

All of these tickets can be bought online on our website : <https://lustrum.ch/tickets>.

Up until now, the Lustrum committee has been very happy to see you enthusiasm during all of our events. We feel that all activities have been a great success, which is also thanks to your eager participation. We will of course try our utmost best to make the rest of the lustrum activities as much fun as the first part of the year and we know that all of you will do so too. 





Hackathon

Leon Overweel

On May 13th and 14th, W.I.S.V. 'Christiaan Huygens' is organizing HackDelft, TU Delft's first hackathon! A hackathon is often described as an innovation marathon: student "hackers" with backgrounds in computer science, mathematics, design or business form small teams and spend 24 - 48 hours building something cool using the tools provided by the hackathon. The Facebook "Like" button and the popular messaging app GroupMe are examples of products that grew out of hackathon projects.

This first edition of HackDelft is being organized in collaboration with CH's 12th Lustrum, so this year's theme is #trendhacking. We've partnered up with KPMG, Optiver, Aegon and De Volksbank, who are all providing "cases" for the students to "hack" on. Which team will create the best new auditor data visualizer or the most interesting banking risk model? We'll find out at HackDelft 2017: #trendhacking.

So what will this hackathon look like? On Saturday the 13th, the doors open at noon and 100 student hackers from TU Delft and beyond will start to stream in for the first event: an introduction featuring a cool speaker from the tech industry and short pitches for each of the cases. Then, there are two rounds of workshops, during which the hackers pick two cases that they want to learn more about. After a third workshop round on creating and presenting a pitch for your solution there's a team formation session.

At 16:00, hacking starts! During the next 22.5 hours, the teams can use all the tools at their disposal to create the winning project. They'll use skills in programming, modelling, design and business, but above all creativity and innovativeness to come up with amazing solutions to the different cases. But

of course there's also time for breaks: there are sleeping and relaxation areas and at 22:00 we'll have a visit from the Red Bull Wings Team to give the hackers some extra energy (drinks) for the long night ahead.

Hacking continues until 14:30 on Sunday the 14th. By then, the teams will have their projects prepared and demo them to a panel of judges consisting of experts from industry and academics. After hearing everyone's elevator pitch, the jury will select seven finalists. These finalists pitch once more on the main stage and answer the judges' tough questions all in front of all the other hackers. Finally, the jury will present the winners: one winner for each case, as well as an overall Grand Prize winner. HackDelft closes off with networking drinks that last until 19:00.

After attending HackDelft 2017: #trendhacking, we hope students will have had a chance to meet lots of likeminded hackers (the crowd at hackathons is always amazing: everyone is excited to build the future); to create an awesome project; to network with our premium partners; and, of course, to have had a lot of fun!

HackDelft is being organized by the hackathon crew of W.I.S.V. 'Christiaan Huygens'. Wouter Raateland serves as Chairman; Daan Schipper is Secretary; Felix van Doorn is Treasurer; Daniël Vos is in charge of Promotional Affairs; Leon Overweel is Chief Hacker Experience; Erik Wesselius is Head of Logistics; and Marjolein Bouwmeester is Chairwoman of W.I.S.V. 'Christiaan Huygens' and qualitate qua for the hackathon crew.

If you'd like to know more check out the HackDelft website (hackdelft.com), facebook page (facebook.com/hackdelft) or twitter feed (@hackdelft)! 

HackDelft

May 13-14, 2017

Sports & Culture

100 students

24 hours

4 challenges

What will *you* build?

[register now at
hackdelft.com]



optiver 



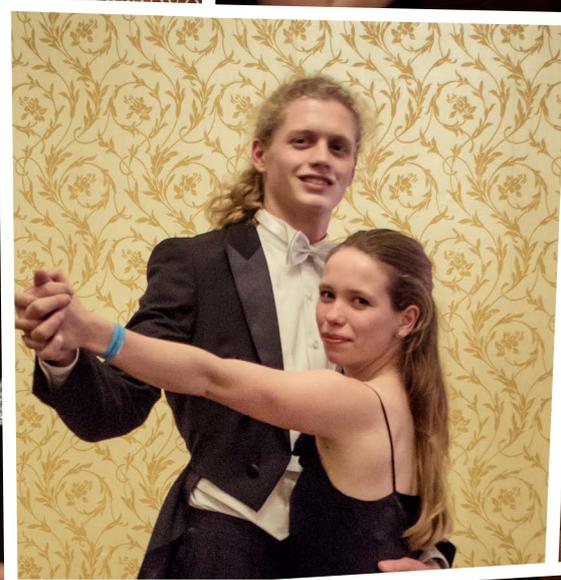
de volksbank

Wiskunde
Informatica
Studievereniging



'Christiaan
Huygens'







Skiing Trip 2017

Thomas van der Pas

Through this article, we would like to introduce ourselves and the WiFi committee, and what it has achieved and what we have in store for the rest of the year.

First of all, we would like to briefly introduce ourselves using the picture from left to right. On the most left hand side, we have Lot, commissioner Escalation, who makes sure that all WiFi activities end up in a good party. Then we have Rik, commissioner Planning, who puts together all the doodles and 'datumprickers' to make sure everyone is able to attend the activities. Next, we have Jurriaan, the Secretary, who writes down everything that's been said during the weekly meetings. In the middle, we have Ilona, Chairwoman, who keeps the sometimes-chaotic group from going off-track. Then we have Thomas, the Treasurer, who makes sure every penny is well spent. On his right, we have Timo, commissioner Promo, who makes the ads of our activities so everyone knows about them. Lastly, we have Thomas (sorry that our parents weren't too creative), the QQ-er, who is the intermediary between us and the board of CH.

Secondly, it has to be made clear that we're not the Wireless Fidelity commission, so please don't come to us for any problems with the Eduroam Wi-Fi. No, we're the commission that organized this year's winter sports and will organize the rally in just a couple of weeks. But then the question remains, why are we called the WiFi commission. The name originates from when our commissions organized three activities: the winter sports, a feest (party) and an "iets" (a "something"). This something could literally be anything, and last year it was a rally to the three-borders point. The rally was so successful that this year CH wants to redo the race and make it even greater. So, this year we did not organize a party, so we would've more budget and time for the rally- but, more about the rally later.

In the first week of February we had the winter sports of CH in which we took 65 mathematics and computer science students skiing. For some this was even the first-time skiing, for one of our WiFi members for example. Luckily for them, there was the opportunity for taking skiing lessons. There were even a couple participants who didn't join the trip for skiing, but just for the fun and the parties around it. They came without a ski pass (or without a ski-jacket) and had fun sledding or staying home with the hungover stragglers. Since there was a party every day, almost everyone eventually had to skip at least one day of skiing to rest from being too hungover. Every night the party had a different theme, so there was something for everyone. We also went out eating with the

whole group one night and lunching with most of the group. Besides, there were two picture moments, so everyone had the chance to be photographed while skiing or take a group picture.

Organizing this trip has taught us a lot. For example, it is hard to work with the travel agency. When they say that something will be done at 3PM, it is most likely finished after 6 (or 11 in our case) and always ask twice if something is fixed, because though they might say something is, it is probably not. The group was divided in ten different rooms, and to make sure no room was left out of any of the activities during the week, we went past each room to tell them the schedule and ask for any problems they've come across. But besides these 'formal' instructions you always sat down with your room to have a beer and hear some of the new rumors. This was a good way to meet CH'ers you didn't know before or getting to know them better.

Lastly, as we told before, we are responsible for organizing the rally of CH. Since the rally was such a success last year, the board wanted to make this year's rally even greater. What we are going to do exactly has to stay a secret, but we can at least explain what to expect with a rally. First off, a rally is not an actual race in which speed is the only factor that counts. It is a race in which you get directions if you solve the given riddles right. But don't be afraid, there is enough back-up implemented for 'screw-ups'. We want to make sure everyone gets to the destination ofcourse. Our rally is going to take up two days: first day to get there by one route, and the next to get back by another.

If you want to join us on this beautiful trip, make sure you put your name on the list, which opens on the 23rd of March. The rally will start on April the 22nd, maybe we will see you there! 



Interview Dr. P.G. Kluit

Rebecca Glans, Daphne van Tetering

If you've ever participated in one of Delft's programming competitions, you might recognise him as one of the judges; Dr. P.G. Kluit. Before leaving on early retirement in 2010, he was a familiar face as he taught first and second year Computer Science subjects and was a member of the Board of Examiners. During this time he was chosen as "Teacher of the Year" in Computer Science several times and became an honorary Member of CH. Interviewing a man who had such a good impact on his students would be very appropriate.

A mathematician teaching Computer Science

We all know that mathematics play an important role in Computer Science (CS), but how does one go from graduating in the former to teaching the latter? During the writing of his thesis, Dr. Kluit wrote programs in Algol (Algorithmic Language) and Basic (Beginners All-purpose Symbolic Instruction Code). Most of us might not even know these programming languages, but the ones we do know are very influenced by Algol. However, these experiences were not the reason for him to eventually teach programming courses. "During my post-graduate studies at the VU (Amsterdam), one of the requirements was teaching." He had already taught at a high school- the same one he attended a few years back-, but it didn't work out too well. To his surprise, he did enjoy teaching first en second year mathematics subjects. In the upcoming years he gained more experience by teaching Algebra at RUCA (Antwerp, Belgium), Calculus at night school Mercurius (Rotterdam) and mathematics to upcoming teachers at the Nutsacademie (Rotterdam). At the night school he eventually taught his first programming subject: Pascal. In '86 the TU Delft needed more CS teachers as the amount of freshmen and graduates were growing. Thus, with his experience in education and a few programming languages, his career at the TU Delft began.

"I would call it a kind of culture shock"

Dr. Kluit taught first and second year courses, including Algorithms and Data Structures, and Software Engineering (Methods). "The thing with mathematics is, it stays the same; I would still be able to teach the subjects I taught back at the Nutsacademie". With CS it's the complete opposite. "I would call it a kind of culture shock when I came to CS". After giving Software Engineering for five years, he would notice the subjects of his lectures becoming limited. "It was time to change it all. I had to check many subjects and narrow it down to only a few to be present in my course. The task of figuring out all the topics that exist and choosing the right ones, became something I did not look forward too." He for instance contemplated on whether he'd include building apps in his course as it was a growing topic. CS is evergrowing: when he first started programming, it was on a stand-alone computer. If you were lucky you'd be connected to the university's network. Nowadays, you're always in a



Figure 1: Dr. P. G. Kluit

network meaning you should be learning about that as well. "I would search software engineering books and every year these books would grow in size; information was always added, not removed".

Studying mathematics = becoming a teacher?

During high school Peter (the doctor's first name) was good at science subjects. While making the decision to study either physics, chemistry or mathematics, it was common knowledge that you were guaranteed a job when graduated in physics or chemistry. Unfortunately for others, by the time he graduated the demand for the other two professions had massively dropped. When telling others he would be studying mathematics, the first question asked would be "Ah, so you're going to become a teacher?". To which his answer was: "No!". But we all know how that turned out.

During his many years in education, he learned that he expected a certain eagerness to learn from his students. He wanted to excite them, give them the challenges they came for. "Something I remember, which I enjoyed very much, is when I had asked my class a question. 'What will happen if you execute this program?' One student answered and said it would produce an error. When I asked if others thought the same, no one raised their hand. He was in it alone, but certain of his answer. It's this kind of things I miss". In those moments he could see he had succeeded in his teachings, and the student had succeeded in learning what he came for and maybe even learned why the subject was so important. Dr. Kluit explained the difference he saw in his students and the students he had in the evenings- at the time the TU Delft offered classes in the evenings for those who worked during the day. "If I asked a room of (daytime) students if they thought CS was important,



they would all raise their hands; it was part of the reason they were there. But trying to explain the problems in programming, was often difficult. Some subjects would seem unimportant as they thought all they needed to know was how to program. Telling the evening group that creating software had its problems, they would all agree. They worked in that field and even had more examples of problems than I did as they experienced them." He also learned why teaching at a high school wasn't that successful for him. "When teaching in elementary- and high school you need to know how to handle children. Not saying you don't need any social skills in higher education, but the more important thing is knowing your field. For me, when I started, teaching was a way of talking about something I enjoyed: mathematics. Doing that with people (students) who knowingly chose that subject worked".

Teacher of the Year

As mentioned before, dr. Kluit was CS Teacher of the Year several times. He tells us that during his time at the VU, where he learned a lot, he met studies coordinator Riekus Kok. From this man he learned to always handle students with integrity. "When introducing a new course or project I made sure to clarify what is expected from the student at the end". When asked if this motto was the reason for his many nominations, he doesn't know. He does mention that he always enjoyed his profession and that's what works. "A student of the Nutsacademie, who is now teaching there, once told how he enjoyed the way we taught our subjects- wherein he mentioned my name".

Programming Competitions

For those of us who aren't staff at the TU Delft or aren't taking an exceptionally long time at graduating, might know dr. Kluit from the various programming competitions. "In '91 the chairman of CH, David Koh, wanted to participate in programming competitions. In this year the first programming competition of Delft was organised and CH's first CHpicie was set up". To have some form of impartiality in the jury, they wanted a teacher as one of the judges. Dr. Kluit was asked for this role and accepted. After some editions of the programming competition had passed, dr. Kluit wondered if he could write a problem for the competition. He did and kept contributing problems.

In '95 the "Informatica Olympiade" was being held in Eindhoven. Every university was asked to send someone to act as judge. Being the obvious choice, dr. Kluit was the TU Delft representative. In '99 the ACM-ICPC finals were outside of the USA for the first time: in our own Eindhoven. Its regional preliminary rounds, the Northwestern Europe Regional Contest (NWERC), had been hosted in Delft a few times. During the "Informatica Olympiade" dr. Kluit met Tom Verhoef, who then called him a year in advance regarding the NWERC finals."He said he was the local contest director and wanted to fill up positions with familiar people as much as he could. 'Do you want to take place in the jury?'he asked and I said yes". Not only did dr. Kluit act as a judge, he also handed in problems for the contestants. It was a noteworthy experience. "Afterwards one of the judges said they would be in Florida next year and asked if I would join again. I kindly accepted the invitation". He judged at a few other NWERC finals, keeps coming back for Delft's Programming Competition and is part of the jury of the National Programming competition (BAPC). The latter being all over the Netherlands.

How's life now?

When planning this interview, we couldn't schedule an earlier time as dr. Kluit would be attending a yoga lesson. Knowing of this activity, we asked what else he did during his (early) retirement. "I started following drawing classes. For a few years my wife and I did model drawing. Before we drew portraits for a year and a half, to which I've gone back to". Singing and "5-rhythms-dancing" are also among his hobbies. Now and then he travels with his wife to locations with a more pleasant weather or enjoys the occasional warm Dutch weather in his garden. Last year (like our iCom trip) they went to Dublin for three weeks. This was his second trip to this "beautiful country". The first time they drove there with their own car. The second time they decided to fly and rent a car in Ireland. "I figured it would be easier if the steering wheel would be on the 'right' side, but it made it even more confusing. The clutch is on the other side, everytime I saw an oncoming vehicle I would fear for the car next to me- but ofcourse there was no car. And if I wanted to drive more along the side, my wife would begin to yell as I would come too close to a wall. Estimating the size of the car became difficult as I was sitting on the other side". Unfortunately he didn't fully get used to riding in such a car, resulting in exciting road trips each time.

And that brings us to end of our interview. Thank you dr. Kluit! For the interview and that you keep coming back every year to take your place as judge in our programming competitions. We wish you all the best. 



Figure 2: One of Dr. Kluit's drawn portraits

Unleashing The Things Network

Hylke Visser

Imagine the possibilities when millions of sensors are connected to the Internet. Your car can tell you where to find a free parking spot in the city, because smart parking spaces can detect if there's a car, and send this information to the internet. Smart streetlights save energy by dimming when there are no people around, and work together to light up your path as you approach. And when the light breaks, the municipality is alerted and they can send someone to fix it right away.

These kind of solutions are made possible by Internet of Things (IoT) technology. In recent years, we've seen a major growth in IoT technologies. Traditional machine-to-machine (M2M) technologies have evolved to work over longer ranges while using less energy. So next to building smart homes where devices have easy access to an energy source and to a network, we can now build smart neighborhoods, smart cities and smart regions.

The idea excited me, so I decided that I was going to do something with IoT. I found a nice thesis internship in Toulouse related to IoT data processing – I was living in France at the time – and was just about to sign the contract when I came across some item on Hacker News. The article was about a group of people in Amsterdam who had the idea of “building a global, open, crowdsourced IoT network that is owned and operated by its users”. This network would allow anyone to build cool IoT stuff without having to pay for data subscriptions with a telecom provider. The users would have full control over the availability and quality of the network. I immediately knew that I had to be a part of this, so I thanked the company in Toulouse, canceled the rent of my little room in Rennes and moved to Amsterdam.

I was going to get a Master's degree in Cloud Infrastructures, so it would be my job to build cloud systems that are responsible for routing sensor data from the device to the right application and back. This wouldn't be as simple as hooking up a WiFi router, because the devices don't use WiFi or Bluetooth. In fact, they don't even implement the Internet Protocol: IP. Instead, these devices use the LoRa radio technology and implement the LoRaWAN[1] protocol. In order to get data from a device to an application, we first need so-called *gateways*

to pick up radio signals from the device and forward them to the Internet. At this point, these messages still do not make much sense, and have to be processed by a *network server*.

LoRa and LoRaWAN

As mentioned before, the devices we're connecting speak the LoRa PHY-layer protocol and the LoRaWAN MAC-layer protocol. You could compare LoRa a bit to WiFi. Like WiFi, LoRa operates in unlicensed (ISM) radio spectrum, allowing anyone to set up LoRa devices. These devices can transmit at different speeds, but unlike WiFi, these speeds are measured in hundreds of bits per second. That's more than 10,000,000 times slower than an average WiFi connection. On the other hand, this communication has a long range, while consuming only little power. One gateway can cover several kilometers whereas I already call my WiFi router's signal “terrible” when I'm 20 meters away. A device can operate for months on a battery whereas my iPhone's battery is empty by the end of the day.

These low data rates mean that LoRa transmissions take a lot more time than WiFi or Bluetooth transmissions. In order to still comply with radio spectrum regulations, the transmitted messages have to be as small as possible. LoRaWAN allows for messages with a maximum size of 51 to 222 bytes (depending on the exact data rate) so it was designed to have as little overhead as possible. Only 13 bytes are needed to contain the device address, frame counter, port number, some signaling and a cryptographic signature of the message. This is many times smaller than the 64 bytes needed for the WiFi, IPv4 and TCP headers combined. A number of tradeoffs had to be made, putting the routing logic into the network server instead of the protocol. I won't go into details here, but I'm sure you can imagine the challenges of routing messages that have non-unique addresses (of only the device) and only partial frame counters.

Another interesting aspect of LoRaWAN is how devices send messages (we call this uplink) and receive responses (downlink). Sending a message is done in a way similar to the ALOHA[2] protocol: just send whenever you want. Although this is not the most efficient approach in terms of avoiding collisions, it is very energy efficient. The device only has to switch on its radio for the time it is transmitting, and can go back to low-power mode immediately after. There are two so-called *receive windows* for possible responses from the network (the application). One exactly one second after the transmission finished, and one another second later. As a response is not required, there are now three possibilities, shown in Figure 2: no response at all, a response in the first window, or a response in the second window.

Computer Science

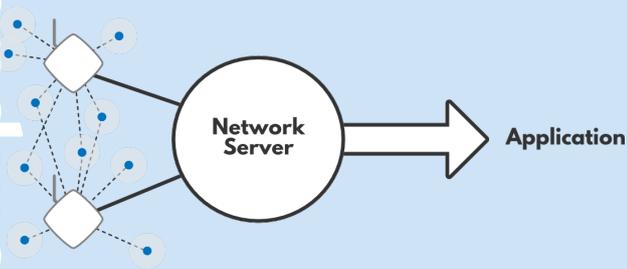


Figure 1: Gateways, Network Server and Application

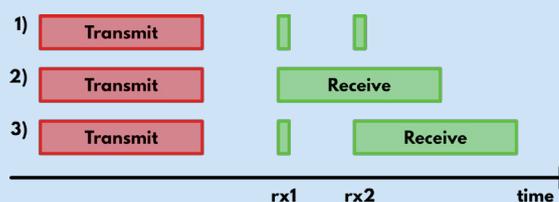


Figure 2: Downlink Receive Windows



The Backend

Now that I had an idea about what exactly I was dealing with, I could start building the backend that would be responsible for routing messages from IoT devices to application servers and back. We had come up with an architecture that would split the routing logic over multiple components to allow for the best scalability and decentralization possible within the constraints of the (extremely centralized) LoRaWAN protocol. Figure 3 shows this architecture.

Gateways connect to Routers, which are responsible for handling all gateway-related logic: keeping track of scheduling, handling the regulations of the gateway's specific region and taking care of the logic for the gateway's specific channel plan. After doing this, it would distribute the messages further into the network. Based on some kind of prefix routing[3] mechanism, the Router forwards each message to zero or more Brokers.

The Broker component, together with a “database” we call the NetworkServer, is responsible for all device-related routing logic as well as handling MAC-layer functionality. As we're dealing with a connectionless broadcast protocol, a transmission of a device can be received by more than one gateway. This means the Broker first has to de-duplicate the messages in order to prevent that the message is delivered to the application more than once. In this deduplication process, we also determine the best option for sending a potential downlink response to the message. To do so, we look at the number of potential conflicts reported by the Router and the signal strength reported by each gateway.

In the meantime, we also have to determine which specific device sent the message. The address in the message is not guaranteed to be unique, so we have to look at the frame counter and cryptographic signature of the message in order to determine the actual device. To do so, we make a list of candidates (devices with this address) and sort it such that the device with the closest known frame counter is first. Then, we try to match the key of this device with the message. If this check passes, we know that this device indeed sent the message. Each device maps to exactly one application, which in turn is registered to a Handler. So the device state is updated in the database and the message is forwarded to this Handler.

The Handler component exists for one specific reason: end-to-end encryption. All routing until now was done while the data payload of the message was encrypted. The Handler component is responsible for decryption and processing of the data. End-to-end encryption is achieved by running this component

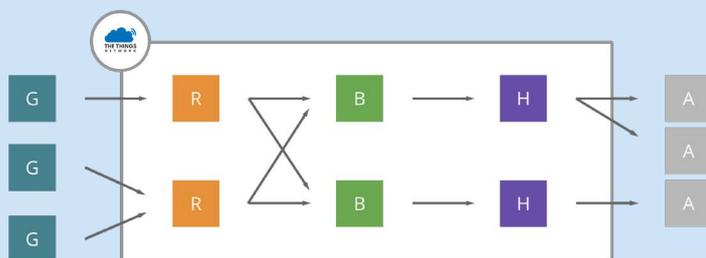


Figure 3: Backend Architecture

separate from the rest of the network, in the domain of the application. After decrypting the binary payload of the message, the Handler can “convert” it into something that can be used by applications. In most cases that means converting sensor data to JSON that can be interpreted by the application.

Implementation

We decided to implement the backend in Go (*golang.org*). Go is a fast, statically typed, compiled language with garbage collection and powerful concurrency features. Perfect if you need very low latency (when was the last time you saw “Request completed in 181.687µs” in your server logs? – yes, that’s *microseconds*). We use gRPC (*grpc.io*) for communication between components. gRPC sends protocol buffers over HTTP/2 framing. Protocol buffers are binary representations of data structures, many times smaller than XML or JSON, saving us a lot of bandwidth. The HTTP/2 transport used in gRPC features bi-directional streaming of messages over multiplexed connections. This means we can have thousands of concurrent streams over the same socket.

The code for this backend is open source and available on Github: github.com/TheThingsNetwork/ttn. Everyone can compile it, download pre-built binaries or even complete Docker images that are ready for deployment. This makes it really easy to set up a (private) network yourself, but the real power of The Things Network is in its communities.

Communities

Due to the fact that LoRaWAN operates in unlicensed radio spectrum, everyone is allowed to set up both gateways and devices. As a result, we don't need telecom operators to build a network, require everyone to buy a SIM card and have them pay monthly fees for using their network. Instead, users can build their own network, just like they can set up their own WiFi network.

The Things Network does this by forming communities: groups of people in a specific area that collectively build, own and operate the network. In 2015 the city of Amsterdam was covered in only six weeks. Now, about one and a half year later, The Things Network counts 12,403 people in 385 communities across the world. Together they are the network, building this thing together.

Want to know more?

If you want to know more about The Things Network, you should definitely check out thethingsnetwork.org or talk to our local initiator at TU Delft: Fernando Kuipers (EEMCS HB 13.250). If you want to criticize my code, have a look at our Github. And finally, if you're looking for a Bachelor internship or Master thesis position, shoot me an email at hylkev@ch.tudelft.nl and I'll try to put in a good word for you. 

References

- [1] LoRa Alliance. LoRaWAN specification 1.0.0, 2016.
- [2] Norman Abramson. The ALOHA system: another alternative for computer communications. In *Proceedings of the November 17-19, 1970, fall joint computer conference*, pages 281–285. ACM, 1970.
- [3] Bakker, Erwin M., Jan van Leeuwen, and Richard B. Tan. Prefix routing schemes in dynamic networks. In *Computer Networks and ISDN Systems 26.4*, pages 403–421, 1993.



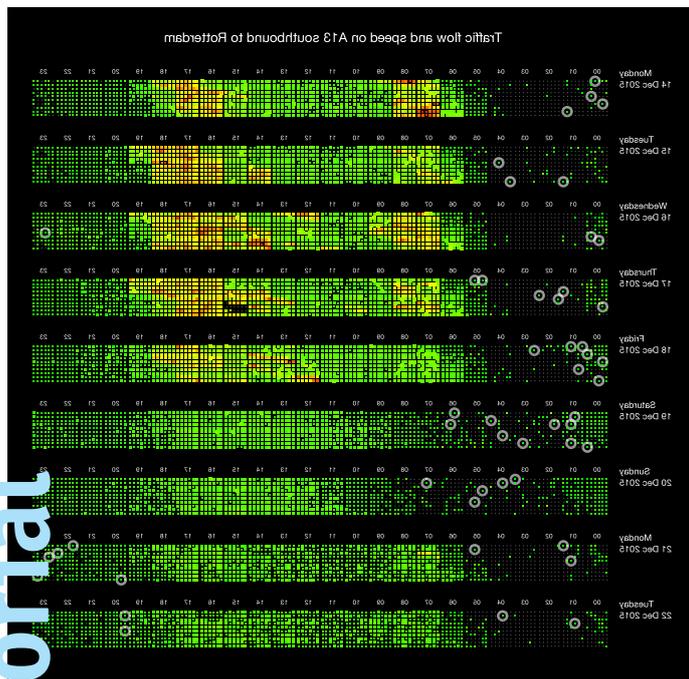
Ah, now I see! The power of data visualization

Erik Boertjes, TNO

Data visualization is the process of transforming data (numbers, text, music) into a graphical representation (colors, shapes, movement).

Why would you do that? Well, to make optimal use of the human eye.

We as humans have an incredibly powerful visual system that can read and process anything visual at enormous speeds (as compared to other modalities like sound, smell, and touch). "Ah, now I see!" is the exclamation any data visualization engineer is hoping to hear when showing their work to a client, colleague, or even family member.

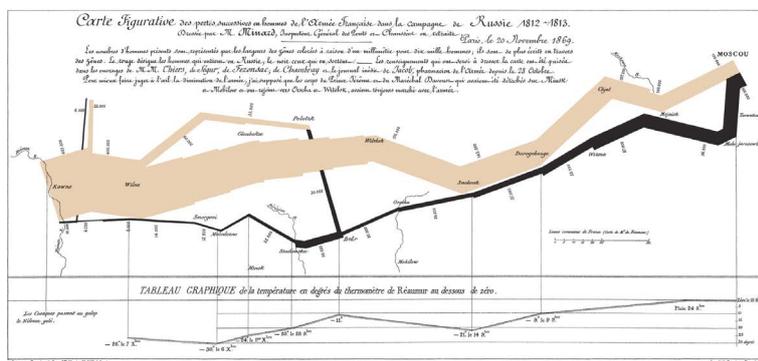


Visualization of 9 days of traffic on the A13. Each square represents one minute of traffic data registered by one sensor in the road. The size of the square is relative to the amount of cars passing the sensor. The color indicates the speed of the cars, ranging from red (slow) to green (fast). Every bar is one day of the week, and within each bar, time is depicted horizontally from left to right, the numbers indicating the hours of the day. Part of the Social Glass framework at TU Delft.

The image above shows a visualization of traffic data on the A13 from Rotterdam to The Hague during 7 consecutive days. It is part of the Social Glass framework at TU Delft. This framework helps to analyze data from urban environments and data visualization is one of its tools. Without even exactly knowing yet what we are looking at, we see patterns in the image: red areas that occur everyday at the same time (traffic jams) but not during the last couple of days shown (start of the Christmas vacation). Then during the nights all these circles: people speeding over 150 km/h. And when looking closer at the data on Thursday: a gap between 3 and 4 PM. No traffic? A malfunctioning sensor is more likely. Data visualizations allow for visual data analysis, spotting trends, anomalies, and patterns. It allows for data inspection: how much data do we have? What kind of data? Do we miss data? And data visualization can help communicate a message, for instance "The effect of the opening of the A4 on the traffic on the A13 has been substantial".

It is nothing new...

Maps have been around for ages. And because those are graphical depictions of data (location of cities, mountains, oceans), you could say that data visualization has been around at least for 14000 years, since that is the oldest map scientist have found [1]. Visualizations of more abstract data, i.e. without inherent spatial aspects, have been around quite some time as well. It was in the 18th century that the Scottish engineer and economist William Playfair [2] introduced the first line chart (accompanied by several pages of explanatory text describing how to read this strange new thing) and later bar charts, pie charts, and basically any other basic chart that can be found in Microsoft Excel. Even more complicated and more ecstatically pleasing graphs were introduced long ago, one of them being Minard's depiction of the Napoleon's March that can be found in all texts about data visualization, this one being no exception:



Visualization by Charles Minard of Napoleon's disastrous Russian campaign in 1812. It shows the immense loss of men, shown by the diminishing width of the band during the march to Moscow (in brown) and the retreat (in black). The line graph shows the temperature and time in relation to the position of the army. Source: commons.wikimedia.org.

Adaptorial



...and yet it is...

Despite the fact that data visualization has been around for a while, it gained momentum since two decades or so. One of the reasons is obviously the fact that our computers have powerful graphical possibilities. We all have retina screens powered by fast GPU's, allowing for fast interaction with tons of data. In addition, more and more data has become available, often in the form of open data. The traffic data visualization shown above is based on open data from the Nationale Databank Weggegevens (ndw.nu), that provide data from 27000 sensors every single minute. So there is more need / urge to 'do something' with all that data and visualization is an effective way to analyze and communicate the message hidden in those data sources. The introduction of tools and libraries like the D3 JavaScript library, not only made it easier to produce visualizations but also to distribute them over the web. Nowadays many newspaper websites feature full-fledged interactive data visualizations.

It is not only hardcore statisticians and computer scientist that perform the art of data visualization it is spreading towards other areas like journalism, psychology and art. Topics like interactive data story telling and data-driven art are a common part of education in journalism and art schools. Topics like cognitive perception, that study how people perceive color, movement, shapes, are part of psychology studies. Data visualization is more and more multi disciplinary, which makes it more and more interesting and challenging at the same time.

...and it will be.

The field of data visualization is still under development, driven by the fact that datasets become larger, new types of devices become available, and more and more is known about how humans perceive and process information. One example of a new development in data visualization concerns the availability of new types of devices, like Apple Watch, Oculus Rift, Sony Hololens, Ultra-High resolution screens, and 3D printers. These devices allow new ways of interaction (touch, gestures) and new ways of displaying data (VR, AR, physical). This gives rise to questions like: how can we effectively display a lot of data on a very small screen? How can we display millions of data points on a large screen, while still allowing fluent interaction? Which types of visualizations are suitable for augmented and virtual reality? What does 3D-printed data look like (see image below) and what advantages does it give? And what about using sound and smell and other modalities to represent data? So fortunately, there are a lot of interesting challenges to be tackled.

DIY

By now, you are undoubtedly eager to go and start visualizing data yourself. Great! Let's start with the data. Google 'open data' plus the topic you are interested in, and most likely you will find an interesting data set. Good starting points are opendatanederland.org, data.knmi.nl (weather data), data.amsterdam.nl (including the location of every garbage bin in Amsterdam) and openov.nl (real-time public transport data).

Before designing a visualization, it is good practice to get an idea of the data itself. How much data is there, over which period, between which range (min and max values), are there errors or missing values, etc. I typically use the tool R (rstudio.com) for that. That tool is also very suitable to clean and restructure your data so it fits your purpose better and makes the data easier to visualize.

Imagine you would like to show traffic data not per minute, but per hour. Then you could use R to aggregate the raw data to one-hour time bins containing average values for speed and number of cars.

Before building the actual visualization, it is good practice to make sketches of the end result, using pen and paper, Adobe Illustrator, PowerPoint, Excel or R. Show them to others to get feedback, before creating the actual visualization, so you don't spend time building a visualization that does not convey any message. To learn about the principles of data visualization, and be inspired by amazing examples, you could start reading [3], [4], or [5], listen to the Data Stories podcast (datastori.es), or browse through the well-documented examples at [6].

The final, most rewarding step is to create the visualization and see the data come alive. There are many tools to accomplish this. Which one is most suitable depends, amongst others, on whether you would like your visualization to be static or dynamic. Another consideration is whether your visualization consists of standard elements like line graphs and bar charts, or that it consists of elements that you have to create from scratch (like the traffic visualization at the start of this article). At one of the spectrum there are tools like Tableau and Excel that do not require a lot of programming knowledge and are able to produce nicely looking standard visualizations. At the other end of the spectrum are Processing and JavaScript libraries like D3, Leaflet, and Sigma. Those require programming but allow you to realize any fancy interactive visualization you can think of.

References

- [1] <http://www.dailymail.co.uk/sciencetech/article-1204539/Oldest-map-western-Europe-engraved-14-000-year-old-chunk-rock.html>
- [2] <http://www.datavis.ca/papers/hbook.pdf>
- [3] Scott Murray, Interactive Data Visualization for the web
- [4] Andy Kirk, Data Visualisation: a Handbook for Data Driven Design
- [5] Alberto Cairo, The Truthful Art: Data, Charts and Maps for Communication
- [6] D3 Gallery, <https://github.com/d3/d3/wiki/Gallery>

Erik Boertjes studied Computer Science at Twente University and holds a degree in Design from the Royal Academy of Arts in The Hague. He creates data visualizations for the Data Science department at TNO and for the Web Information Systems group at TU Delft. Please contact him at erik@bloomingdata.com for any questions you have about this article.

TNO innovation
for life

TU Delft

Advertorial

EWI IN CONCERT

WHEN THE NIGHT FALLS.

EWI in Concert

Ilse Bakker

On the 7th of June, when the night falls, EWI in Concert will perform a spectacular show at the International Festival of Technology. An interactive performance filled with music and light projections will take over the evening. In this interview, initiator of EWI in Concert and Applied mathematics student Ilse Bakker explains what EWI in Concert is exactly, how it all started, and if you can still join.

Tell me, what is EWI in Concert?

EWI in Concert is a group of enthusiastic students and teachers with a mission: create an unforgettable musical performance. All musicians study or work at the most beautiful faculty of the TU Delft campus, EWI! The theme of the show will be: 007-wij maken het Bond! (007 – we make it Bond). Bond stands for action, Bond stands for technology. We will take you into our Bond creation, by playing energetic music, surprising you with exciting light projections and, most importantly, the audience will get a big role to play!

A great example of this: at the moment we're giving some love and care to the huge Nintendo Controller from ETV, so we can literally play this Bond piece together on the 7th of June!

Where do all these ideas come from?

Every month we have a brainstorm session with the whole group to think of new acts. We try to implement everybody's creative input. Every style of music is represented in our group. That makes these brainstorms very interesting. A varied set of acts arises. Every other week we rehearse on the group acts at 'Sports and Culture'. These rehearsals are full of fun, but we are also very keen on the quality. After the rehearsal we eat and drink together at 'the Hub'. It's funny to see that most ideas arise when people relax and eat pizza!

I hear you are performing on the International Festival of Technology this summer. Could you tell some more about it?

On the 7th, 8th and 9th of June the International Festival of Technology, IFoT will be held on the TU Delft Campus. This is a festival with an unexpected mix of technology, music and art. After a first meeting with the festival organiza-

tion we found out we had a good match with great potential. IFoT for example inspires EWI in Concert with ideas for more technological acts. In turn, the festival is interested in our light projections that make a great match with the theme of the festival this year: Boost your senses!

On Wednesday evening, the 7th of June, we start the show at our 'Bond square' on the festival. We are still designing the 'Bond square', but one thing is sure: It will be an exciting place suited for a wonderful experience.

How did you get the idea to start EWI in Concert?

Haha, I think I have Beyonce to 'blame'.... Before studying mathematics, I studied at the conservatory. When I watched this inspiring interview with Beyonce, I realized I wanted to pick up music again. I get most of the fun out of organizing, preparing and conducting musical events. So I thought: 'Let's organize a concert with musicians from EWI!' I posted an invitation in the Facebook group CH chat, but as I didn't get so many responses I expected a small group. But then all of a sudden 20 musicians turned up at the first brainstorm!

How do you feel about EWI in Concert?

This is one of the most beautiful projects I've ever worked on. I'm happily surprised by the varied musical talent all musicians have and the atmosphere in the group is great. I'm extremely happy with the committee. They do a lot of work for the concert, and put all the creative ideas into an achievable plan.

Can people still join EWI in Concert?

Yes! First of all, by visiting our show you will already join. We will need you for some live gaming, jumping around and making a lot of noise on the right moment. If you like to join as a musician, or if you have more artistic input, you're very welcome. Send us an email: ewiconcert@gmail.com. You can also check our website: ewiconcert.nl.

More information about the International Festival of Technology? Check: <http://ifot-delft.com>.

We hope to see you all the 7th of June at our EWI in Concert!! 



What is 'Finite'?

K.P. Hart

When you search the website of the Dutch Science Agenda

(<https://vragen.wetenschapsagenda.nl/>) for the keywords 'oneindig' and 'oneindigheid' (infinite and infinity) you will get more hits than for 'eindig' and 'eindigheid' (finite and finiteness): 25 against 6.

Apparently people find the notion of the infinite more difficult, interesting, fascinating, ..., than that of the finite.

Mathematically the difference need not be so large: 'infinite' is 'not finite' and 'finite' is 'not infinite', so if you know one you know the other. The question then is: "What is 'finite'?" Once we have an answer to that question we also know what 'infinite' is: just put 'not' in front of that answer. Unfortunately (or maybe fortunately) it is not quite that simple; it will turn out that what we want from both notions makes it difficult, at first, to make them simply each others negations.

The dictionary

It is always interesting to look in a dictionary for the 'normal' meaning of a mathematical term; often that will also give an idea why students find it hard to get to grips with a concept: that 'normal' meaning quite often has no bearing on what mathematics wants to say.

I use *The Chambers Dictionary* ([1]) when doing crosswords, so I looked there for definitions of 'finite' and 'infinite'.

finite *adj* having an end or limit; subject to limitations or conditions, opp to *infinite*. [L. *finitus*, pap of *finire* to limit]

infinite *adj* without end or limit; greater than any quantity that can be assigned [*maths*]; extending to infinity; vast; in vast numbers; inexhaustible; infinitated (*logic*)

infinitate *vt* to make infinite; to turn into a negative term (*logic*).

So, the first definitions of 'finite' and 'infinite' are each other's negations but then there is a slight divergence. 'Finite' is the opposite of 'infinite', but not vice versa; also, 'infinite' has more variety than finite. I included the verb 'infinitate' because I had not seen it before and because it has a nice logical constant as well.

There is one noteworthy bit among the definitions of 'infinite': the phrase "greater than any quantity that can be assigned" comes more or less straight out of Euclid's *Elements*:

Book IX, Proposition 20. The primes are more than any assigned multitude of prime numbers.

Nowadays we formulate this as: "There are infinitely many prime numbers."

Mathematics

The problem with dictionary definitions is that they use words that have their own definition and quite often looking up those definitions will lead you to others and, ..., after a while you find yourself going round in circles. The definition of 'infinite' that goes back to Euclid contains 'greater', 'quantity', and 'assigned'. We need to give meaning to these when we want to make the definition unambiguous.

What we will do is define 'finite' in such a way that 'infinite', as its negation, will let Euclid's formulation make sense.

Before we do that first an aside: in Analysis you sometimes read about 'finite intervals'; those are simply intervals with real numbers as limits. For example $[0, 1]$ and $(2, 10^{220})$ are finite intervals, but not $(0, \rightarrow)$. This corresponds to the dictionary definition of 'finite' but we will not discuss this type of finiteness because it does not occur that often and because these intervals do have an infinite number of elements.

Finite sets

So what is the definition of 'finite set'? A bit anticlimactic maybe, but a set X is *finite* if there are a natural number n and a bijection $f : n \rightarrow X$. Before anyone panics, "a bijection between a set and natural number?": in Set Theory we define \mathbb{N} in such a way that $n = \{i \in \mathbb{N} : i < n\}$. This is because we want to keep things as simple as possible and this is indeed the simplest possible way to define natural numbers *set-theoretically*, see [5]. So, for example: $0 = \emptyset$, $1 = \{0\}$, $2 = \{0, 1\}$, ..., $7 = \{0, 1, 2, 3, 4, 5, 6\}$, ...; in general: $n + 1 = n \cup \{n\}$.

It is a good exercise to show that there is at most one such n .

Exercise. Prove, for every n , that there is no bijection between n and $n + 1$.

The consequence is now that we can *define* for finite sets what the *number of elements* is: the unique n for which the desired bijection exists.

Infinite sets

Now we also know what an infinite set is: one for which no n as in the definition of 'finite set' can be found. That is quite negative; in fact you are basically empty-handed when your set is infinite: you have no n and no bijection.

What you do have is lots of injections: if a set X is infinite then you can prove, by induction, that for every $n \in \mathbb{N}$ there is an injection from n into X . This may seem completely self-evident — "just pick some points" — but it takes a bit of work to turn those words into a proper proof, and we will see later why this might need some work.

For now we note that Euclid's proof of his theorem, that you can look up on-line, see [3], shows indeed that the set P of prime numbers is infinite according to our definition: it shows that for every n no injection $f : n \rightarrow P$ is surjective.

Alfred Tarski

In [6] the Polish mathematician Alfred Tarski made a thorough investigation of the notion of a finite set. One thing he asked himself was whether you could define finiteness without referring directly to natural numbers.

The answer was "yes, that is possible". Nowadays we call a set X *Tarski-finite* is the following holds: every nonempty family \mathcal{A} of subsets of X has a *maximal element*. Note: 'maximal' means that there is no larger element (and



Figure 1: Alfred Tarski



Figure 2: Richard Dedekind

that is not the same as being the largest element). For example in the family $\{\{x\} : x \in X\}$ every member is maximal, but there is no maximum (if X has more than one element).

Exercise. Prove, by induction, that every natural number is Tarski-finite (and hence that every finite set is Tarski-finite).

Once you have done this exercise you should, of course, do the following one too.

Exercise. Prove that every Tarski-finite set is finite.

Here is a hint: let \mathcal{A} be the family of all finite subsets of X . It is non-empty because $\emptyset \in \mathcal{A}$. Next prove that a maximal element of \mathcal{A} must be a *maximum* and indeed that it must be X itself.

This characterization of finiteness, which we might also call *The Maximality Principle*, is very useful in mathematics, especially in Combinatorics.

Richard Dedekind

One of the first mathematicians who sought to define finite and infinite sets was Richard Dedekind. His most famous definition is from [2]. It even made it into the dictionary:

infinite set *n* (maths) a set that can be put into one-one correspondence with part of itself

In terms of maps: a set X is *Dedekind-infinite* if there is an injective map $f : X \rightarrow X$ that is *not* surjective. This property has two nice equivalences,

especially number 2 is something that we would like to be true about infinite sets.

Exercise. Prove that the following three statements are equivalent.

1. X is Dedekind-infinite
2. there is an injective map $f : \mathbb{N} \rightarrow X$
3. there is a bijection $f : X \rightarrow X \cup \{p\}$ for (some) p not in X

Now, by definition, a set X is *Dedekind-finite* if every injective map $f : X \rightarrow X$ is surjective.

Exercise. Prove, by induction, that every natural number is Dedekind-finite (and hence that every finite set is Dedekind-finite).

We now have a problem; our notion of ‘finite’ is very practical: a finite set comes with an enumeration $f : \mathbb{N} \rightarrow X$ and we can use that in our proofs. Similarly a Dedekind-infinite set comes with an injective map $f : \mathbb{N} \rightarrow X$, also quite handy to have.

Unfortunately, ‘(in)finite’ is not the same as ‘Dedekind-(in)finite’.

It seems easy to prove that every infinite set is Dedekind-infinite: pick a point x_0 , the set is infinite so there is another point x_1 , there is another point x_2, \dots , and so on. The map that send n to x_n is injective.

Well, ..., no; there is no way to turn the “..., and so on” into a formal set-theoretic proof that involves only finitely many steps. By ‘formal proof’ I mean a proof as described in the course Logic (TW3520) that you can take every year (recommended).

To give a proof in finitely many steps you need an extra assumption, the Axiom of Choice ([7]).

Cyclic permutations

In the foreword to the second edition of [2] Dedekind mentioned another definition of ‘finite’: a set X is Dedekind*-finite if there is a map $f : X \rightarrow X$ such that if $A \subseteq X$ is such that $f[A] \subseteq A$ then $A = \emptyset$ or $A = X$.

It is not hard to show that natural numbers are Dedekind*-finite: think of cyclic permutations.

On the other hand: if X is Dedekind*-finite then X is in fact finite, and the map f is indeed a cyclic permutation.

Exercise. Prove this. *Hint:* take some $x \in X$ and prove that $x = f^n(x)$ for some $n \geq 1$.

So, Dedekind had two definitions of ‘finite’ (and of ‘infinite’) and he tried quite hard to prove that they were equivalent but did not succeed. If you want to know why then you should study [4].

References

- [1] *The Chambers Dictionary*, Revised 13th Edition, (2014). Chambers Harrap Publishers Ltd, Edinburgh.
- [2] Richard Dedekind, *Was sind und was sollen die Zahlen?*, (1888). Vieweg & Sohn, Braunschweig.
- [3] D. E. Joyce, *Euclid's Elements*. <http://aleph0.clarku.edu/~djoyce/java/elements/>.
- [4] Thomas J. Jech, *The axiom of choice*, Studies in Logic and the Foundations of Mathematics, Vol. 75. (1973) North-Holland Publishing Co., Amsterdam.
- [5] K. Kunen, *Set theory. An introduction to independence proofs*, Studies in Logic and the Foundations of Mathematics 102. (1980) North-Holland Publishing Co., Amsterdam.
- [6] Alfred Tarski, *Sur les ensembles finis*. *Fundamenta Mathematicae* 6.1 (1924): 45-95. <http://eudml.org/doc/214289>.
- [7] Aad Vijn, *Het Keuzeaxiom: Een studie naar de geschiedenis van het keuzeaxioma, de gevolgen, equivalente uitspraken en de onbewijsbaarheid*. Bachelorscriptie, 2012. <http://resolver.tudelft.nl/uuid:f7641d50-4c21-4aae-a879-154093427007>



Fight against financial crime using your data analytical skills?

Stefanie Vonk

From 2010 to 2016 I studied Applied Mathematics and was an enthusiastic and active member of the study association. During these years I was a board member too and very involved in the study, always trying to help students making the best decision on what study, minor or master to choose. When making choices in my study, I did what I thought was most fun and the best fit for me. I hope by giving you some insights on how I chose my job, I can help you find your best fit.

So many companies to choose from

As a high school student, I visited an open day of Applied Mathematics at the EEMCS faculty. During this open day, I asked a student what I could become after graduating from AM. He gave me an answer that I would later also give to a lot of other people: 'You can work for various companies, ranging from research institutes to consultancy firms and from small companies to large multinationals'.

After studying mathematics for 5 years, I still did not know what to do after graduating, something a lot of other mathematics students will probably recognize. To get a better view on what I could do with my mathematical background, I decided to do my internship at a technical consultant and my graduation at the R&D department of a big company. Through these experiences I had the opportunity to see two completely different worlds: research on the one side and consulting on the other. I felt that my interest lied mainly in the consulting field, but I also wanted to use my analytical (and mathematical) skills within a job. This made me realise that I did not want a job in either of these two world, but something in between. I did some research on what other alumni had chosen to do after graduating from Applied Mathematics and got in contact with someone from Deloitte. Her job description said: Financial Crime Analytics Consultant, which made me very curious. She invited me over at the Edge, one of the big offices of Deloitte, to explain me something more about her job. Later I realized, this was the start of my new career!

What is Financial Crime Analytics?

To understand what you do as a consultant within the Financial Crime Analytics team, it is good to know that FCA is part of Forensic, which in their turn is part of a large service line within Deloitte, namely Risk Services. Within Risk Services, professionals with diverse backgrounds are active, such as data analysts, forensic researchers, IT auditors, internal auditors, financial risk consultants and security specialists. Because each professional is specialized in his own field, they complement each other perfectly and teams are regularly compiled from the various competencies.

The Forensics team consists of approximately 50 employees and has the ambition to grow strongly throughout the coming year. Our Forensic team conducts forensic investigations and advises on how to prevent and detect financial crime. This can range from small investigations when corruption or fraud is suspected, to large scale projects in which we help clients to prevent financial crimes as money laundering and terrorist financing. Financial Crime Analytics is part of this fast growing Forensic team and uses their data analytic skills to support the investigations and doing various projects. The team of FCA is as diverse as Risk Services and has people with backgrounds varying from psychology, electrical engineering, law, business analytics and mathematics. Especially this diversity makes the team really nice to work in and able to reach its goals.

My first three months

In the short period that I have worked as a consultant FCA, I already did three different projects, each with a different goal, approach and team. My first project was already in my first week at Deloitte and I had to team up with a manager. The project focused on anti-money laundering and terrorist financing. The second project was a small project on paid search advertising (Google and Microsoft Bing, amongst others) and my third and current project is a real data analytics project together with a lot of colleagues from Deloitte (team of approximately 20) and will last another few months.

Deloitte and you

From day one you will be part of the team, get responsibilities and advise your clients how leading advanced data analysis techniques can help in the fight against financial crime and controlling risks. You will assist clients with the design and construction of this data analysis and report to your clients. You will be working in a fast growing team, with plenty of opportunities to develop yourself.

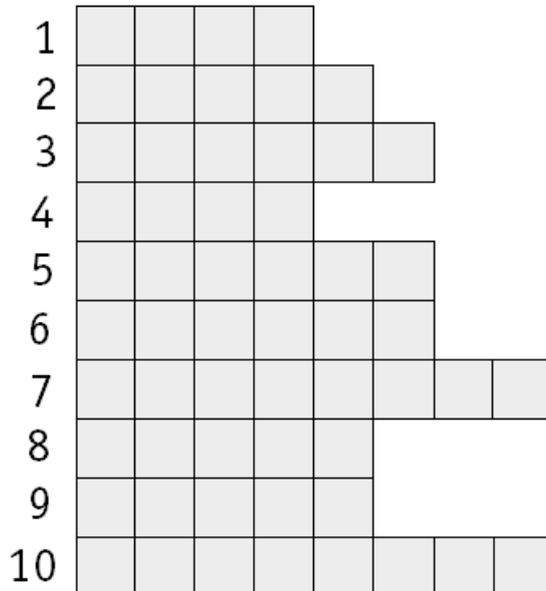
Would you like to know more about Deloitte, FCA or one of my projects, just let me know (stefanie.vonk@deloitte.nl) and I will answer all of your questions over a cup of coffee (or tea ;))! 



Cryptic Word Puzzle

This time the MaChazine has a Cryptic Word Puzzle. With some 'logic' thinking you should be able to solve this riddles. An example: *One lewdly desiring some bicycle chains (4)*. Answer: Some of "bicycle chains" is LECH - one lewdly desiring.

1. Diamonds seen by the rivir in partial darkness (4)
2. Poets start drinking in pubs (5)
3. Flag seen when queen is captured by bishop and rook (6)
4. Regretted sounding coarse (4)
5. A soft-fruit show (6)
6. Find a prophet or a clever person (6)
7. Romance story involves someone from the past (8)
8. Acquire knowledge with poker end of the day (5)
9. Walk in step for a month (5)
10. Broken in there for more than the eighth time (5)





De Delftse Bedrijvendagen

Ricardo Jongerius

‘De Delftse Bedrijvendagen’ is a recurring career event organised by W.I.S.V. ‘Christiaan Huygens’ together with four other study associations of the TU Delft. Each year, it provides over 3000 students with application trainings, CV checks, in-house days, and, of course, the career fair itself; where over 130 companies get a chance to present themselves and convene with the students.

‘De Delftse Bedrijvendagen’, DDB for short, is the largest technical career event for jobs, internships and graduation projects in the Benelux. It is organised by five study associations: W.I.S.V. ‘Christiaan Huygens’, VSV ‘Leonardo da Vinci’, Gezelschap Leeghwater, Technologisch Gezelschap and the Vereniging voor Technische Physica. Each of these associations puts forth one of their board members, who collectively organise the whole event. This year our Nelleke Scheijen was lucky enough to be part of the organisation. There is also a committee, comprised of a member of each association, which supports the five board members: the ‘Bedrijven Informatie Team’, or BIT. This year I was given the opportunity to fill this role.

I hugely enjoyed helping with the organisation! DDB itself consists of four main events: Application Trainings, the Presentation Days, In-house Days and the Interview Days. Especially the first two events is where we, BIT, experienced our time to shine.

The Application Trainings are three days where roughly 5 companies come to the Aula and give an interactive presentation or crash course in how to apply. It is interesting to see how different companies approach this; some preferred smaller groups of 12 to 15 students, while other presented in front of almost 120. The focus of the presentations also varied, from how to apply at a business in a specific sector, to teaching international students about Dutch norms and customs in the application process.

The Presentation Days is where the magic happens. This is the main event of DDB, a huge fair spanning two days where over 130 companies put up their stand to present themselves to almost 3000 students. If you are looking for a job, internship or simply want to orient yourself, this is the place to be. Hundreds of recruiters who cannot wait to get to know you and answer any questions you might have are present. Each day also ends with a good old-fashioned Dutch ‘borrel’ with free drinks, where you can integrate with the recruiters in a more casual setting. This year we also had a Startup Area for the first time,

where each day seven Startups got the opportunity to present and introduce themselves. As they usually don’t get the chance to be at such large events, this was an exciting experience for both parties.

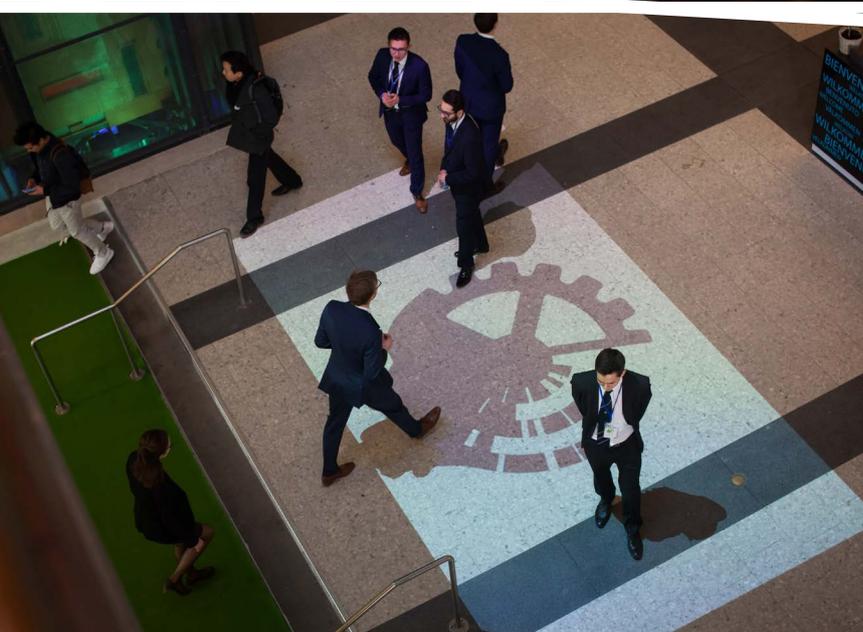
In-house Days are days where the companies can select some of the students who indicated interest and invite them to come along for a day. Here they get a chance to acquaint themselves with the general vibe and atmosphere of the company and get a better understanding of what it is they do exactly.

Interview Days offer intensive and personal contact with companies. During these days students get the chance to speak one-to-one with recruiters, which can directly lead to a job, internship or graduation project.

While DDB is mostly focussed on third year students and up, don’t feel discouraged to check it out before! It is a great opportunity to orientate yourself in relevant sectors and could also help you choose your ideal Master.

All in all, I intensely enjoyed being part of the organisation of this fantastic event. This year was a great success with a couple of considerable milestones. We finally reached 3000 registrations after three years of just missing it. The rate of check-ins also broke all records, largely because of this year’s beautiful DDB backpack, andnd, of course, the brand new coffee cups which will be filling TU Delft’s coffee machines for the coming few years. However, perhaps the biggest component which made it such a delight to set up was the fact that you’re doing it together with eight other people who you have most likely never met before. You start off as strangers and end up as a team of friends who put together a (hopefully) hugely successful event which helped hundreds of students. This is why I want to thank the rest of BIT and of course, the board of DDB!

Finally, don’t hesitate to contact me or Nelleke if you have any further questions. Thanks for reading and hopefully see you next year at DDB 2018! 





Science Trends

Rebecca Glans

On this page you will find some brief info on recent scientific breakthroughs or interesting news. Whether they're big or small, if we think they might interest you, we will mention them here! Do you miss a certain trend or want to inform your fellow readers of an interesting innovation? Feel free to contact us.

Eye-tracking and choice making

To determine how our choices are affected when given a certain amount of information, engineers from Trinity College Dublin are studying people's eye movement. Using an infra-red beam placed at the bottom of a screen, they record how much time one spends viewing information on the screen and in what order. This produces a graphical representation in the form of a scan path or heat map as in figure 1. "A huge number of factors can – and do – influence decision-making, so it is really important that we better understand what motivates people, and why. (...)" says Associate Professor in Civil Engineering at leader of this work, Brian Caulfield. One of the current researches is how people study energy labels that promote sustainable choices. It is found that people do consider eco-labels, but spend less time reviewing information they aren't that familiar with. With this technology researchers can determine which information does not play a role in decisions made by users – if they don't look at certain information, we can assume they won't consider it – and how they can make sure it does. Redesigning the way information is provided, for instance, either way, this is the next step in understanding human behaviour. [4]

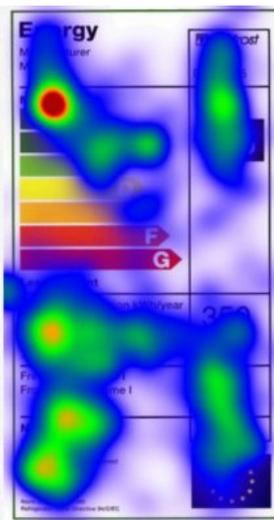


Figure 1: Heat map showing which information caught the most attention [4]

Bird is the word!

In 2015, researcher in machine listening at Queen Mary University of London Dr. Dan Stowell, released Warblr. With this smartphone app you can record birdsong and receive a list of possible species this sound could belong too. Dr. Stowell now wishes to expand his research by studying what kind of messages are communicated and who is dominating in a conversation. By using modern machine-learning methods they can measure different sounds and determine, for instance, if the probability of one bird calling increases or decrease after another bird calls. Eventually his work can be used in deciphering the dawn chorus or how (other) animal groups are socially organised. Warblr has not only

led to thousands of recordings of birdsong, but also of people imitating birds. The latter are used to teach computers the difference between authentic and imitated birdsong and how to extinguish birdsong from other kinds of sounds in general. "There are people creating projects right now where they have unattended microphone systems in a forest, that are recording and trying to identify which birds occur where. In order to be able to do that in any sort of scaleable way we're going to need algorithms that can say 'yes that is a bird' or 'no that is just a tree creaking in the wind.'"[3]

Seeds and data till the end of time

On a remote island in the Arctic Ocean the Svalbard Global Seed Vault resides underground. It was built in 2008 to store world's most important crop seeds. This 152 meters deep freezer holds almost a million seed samples. The assumption that the vault exists to aid humanity after a major crisis, isn't entirely true. It exists as backup for other seed vaults over the world and keep certain traits of crops from going extinct. This way scientists will always be able to continue research in enhancing our crops – disease and weather resistances – without worrying about extinction. This march another vault opened on the same island: the Arctic World Archive. It will act as a digital data safe, with data ranging from meteorological observations to manufacturing plans to classical literature. In contrast to its high-tech security the data will be stored analogous, therefore being invulnerable to remote attacks. Digital data is written onto photosensitive film, technology developed by Piql. This company originally converted film from digital to analog. They claim their films can preserve up to a thousand years. As of writing, Brazil and Mexico have sent data to be stored.[1], [2]

Understanding one another

Researchers from Leiden and Leipzig have found that we aren't able to feel empathy till the age of four. The cause lies in the connection between two brain regions which matures between the ages three and four. The first region being at the back of the temporal lobe for (adult) thinking about others and their thoughts and the second being in the frontal lobe. The latter helps us understand what the real world is and what the thoughts of others are (abstraction). Connecting the two gives us the ability to predict or feel what others (would) do in a certain situation. 

References

- [1] Bradford, A. (2016, September 23). Facts About the Global Seed Vault. Retrieved April 3, 2017, from <http://www.livescience.com/56247-global-seed-vault.html>
- [2] Dreamer, K. (2017, April 1). 'Doomsday' Library Joins Seed Vault in Arctic Norway. Retrieved April 3, 2017, from <http://www.livescience.com/58497-second-doomsday-vault-opPiens-for-data.html>
- [3] Research teaches machines to decipher birdsong. (2017, March 24). Retrieved April 03, 2017, from <http://www.technology.org/2017/03/24/research-teaches-machines-to-decipher-birdsong/>
- [4] Researchers use new eye-tracking technology to ask what drives human choice. Retrieved February 23, 2017, from <http://www.technology.org/2017/02/23/researchers-use-new-eye-tracking-technology-to-ask-what-drives-human-choice/>
- [5] Universiteit Leiden. (2017, March 27). The importance of relating to others: Why we only learn to understand other people after the age of four. ScienceDaily. Retrieved April 3, 2017 from <https://www.sciencedaily.com/releases/2017/03/170327083433.htm>



Historical Person: Fermat

Angelica Babel

All the Mathematics students who finished their first year, or only the course Algebra 1, know the 'Fermat's Little Theorem', a theorem about prime numbers and the modular arithmetic.

Pierre Fermat is his full name and he was born around 1607 in Beaumont-de-Lomagne in France. His father's name was Dominique Fermat and his mother's name was Francois Cazenove. After his mother died, he remarried and his new wife was Claire de Long. He had one brother and two sisters and was almost certainly brought up in his birth town.

Fermat got his bachelor in civil law in 1626, before he moved to Bordeaux. Fermat was a lawyer (!). Next to his job as a lawyer, he did some mathematical research in Bordeaux. He was a lawyer by day and a mathematician by night, i.e. in his spare time. Although his focus was not just on mathematics, he sure did some good research that we now know as the classic differential Calculus. Additionally, we know him from the Algebraic side of mathematics, with his most famous theorem 'Fermat's Little Theorem'.

In his spare time, Fermat restored the 'De Lovis Planis' written by Appolonius and gave the papers to one of the mathematicians there. In Bordeaux he also did some work on maxima and minima, which he shared with 'Etienne d'Espagnet. In 1632 he bought an office of a councillor at the Parlement de Toulouse, where he stayed for the rest of his life. In the following months he didn't do lots of work as a mathematician and he focused on his job in Toulouse. Even though he was a lawyer, he did some great works, and made some huge contributions on modern analytic geometry, probability, number theory and calculus.

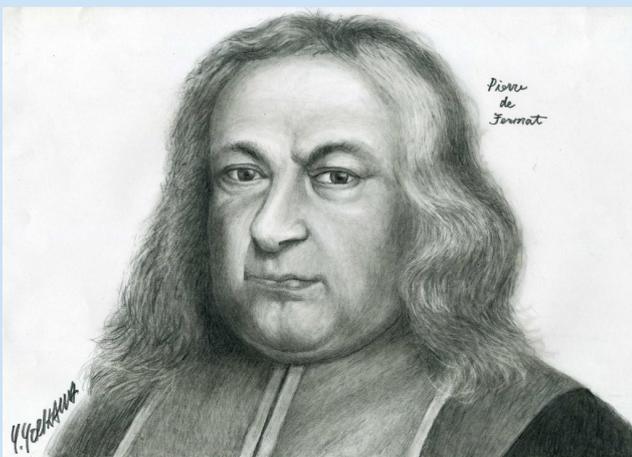


Figure 1: Pierre Fermat

In his life, he wrote some manuscripts, which are used in the modern differential calculus. The mathematicians of our association know some of the following theorem's he found:

- Fermat Numbers
- Fermat's Little Theorem
- Fermat's Factorization Method
- Fermat's Right Triangle Theorem
- Two-squared Theorem
- Polygonal Number Theorem and many more

As stated before, we all know him because of 'Fermat's Little Theorem', which is the following: If p is a prime number, then for any integer a , the number $a^p - a$ is an integer multiple of p . In the notation of modular arithmetic:

$$a^p \equiv a \pmod{p},$$

For example: if $a = 2$ and $p = 7$, $2^7 = 128$ and $128 - 2 = 7 \cdot 18$; 18 is an integer multiple of 7. Fermat stated the theorem in a letter in 1640 and Euler published the proof in 1736. Fermat claimed he had proved all his arithmetic theorems, but only a few of them survived. Gauss doubted several of his theorems, because of the difficulty of the problems, but they are used nowadays. His *Last Theorem* was discovered by his son, but the proof was never found. His last found Theorem was:

$$x^n + y^n = z^n$$

doesn't hold for $n \geq 3$. For $n = 1$ the equation above is proved and for $n = 2$ as well (Pythagoras' Theorem). Many many years, and many many mathematicians were dedicated to find the proof of this theorem, but many failed. Euler proved that the equation indeed doesn't hold for $n = 4$ and $n = 6$, but not for all $n \geq 3$. In 1993 the proof was finally finished by Andrew Wiles, a British mathematician working at Princeton in the USA. He proved some elements needed to finish the proof of Fermat's Last Theorem as a colly in a lecture. But this proof still had some holes. Finally after working for months, he found the proof.

Even though Fermat didn't proof his last theorem, people worked on it for many years and finally found the proof, he claimed years ago.

References

- [1] <http://mathworld.wolfram.com/FermatsLastTheorem.html>
- [2] http://www-groups.dcs.st-and.ac.uk/history/HistTopics/Fermat's_last_theorem.html

Dreamteam: Solar Boat Team

Jeroen Esseveld

Hello my name is Jeroen Esseveld, I am a BSc student Computer Science.

This academic year, I joined the TU Delft Solar Boat Team. This dream team is a great opportunity for me to learn more. The coolest part of the Solar Boat Team is that you get to work on an actual product, which is going to compete in a race with other strong players. The Dream hall has many dream teams like the Solar Boat Team: all with their own project, their own dream.

We are making a Solar Boat!

The Solar Boat Team is creating a boat which is fully powered by solar energy. We want the boat to cruise through the water as efficiently as possible, because we want to keep the energy consumption low. A way to do this is to reduce the water drag. For this, we use a technique to sail on hydrofoils (underwater wings) which are capable of elevating the hull from the water given the boat has enough speed. We do everything to keep the boat light as a feather, well almost. We use materials like carbon fibre as core material for the hull, which is light but it is also able to maintain in rough sea water. The boat will have a weight of about 115 kgs.

Unfortunately, it's not possible to collect more energy than we consume. The boat is designed to have a big surface area to fit a tiny solar park on top. The solar panels we use are very efficient in providing fresh juice to the lime green batteries in the energy box. Much of the energy box is custom made or hand-picked to meet the specific requirements. Previous energy boxes were always water sealed, this year we will have an open energy box for air ventilation. May Kraken have mercy on our boat.

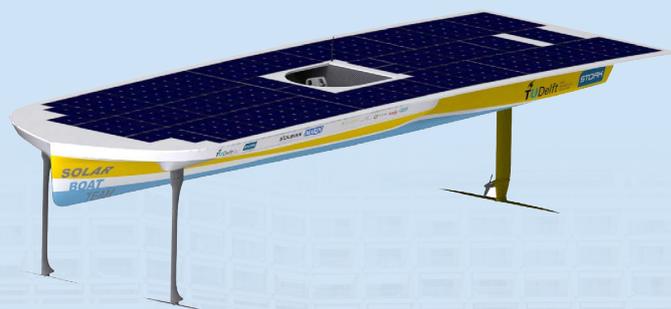
The race

Our boat will eventually compete in the Solar Boat race in the port of Monaco. The race in Monaco consists of several parts on which we try to score better than competing teams. We'll now give you an impression of the race: First we will do a drag race, it's about speed. The top speed of our boat will be around 50km/h. After that, we have to do an endurance race, which means that we need to cross a long distance but save our energy while doing so. Sailing this long will drain the batteries but fortunately our greatest friend will also be present in Monaco, the Sun. The tired Solar Boat will get a break to recover from the endurance race. Next up is a parkour race, where our boat has to show off its manoeuvrability.

After the Monaco race, on a sunny day, we are going to cross the English Channel. Our goal is to set a new Guinness World Record. The crossing will take us about two hours. It's not going to be a joy ride as there will be high waves, strong winds and wicked currents. On top of that, we don't have the English Channel for ourselves. Once again the Solar Boat will have to prove its manoeuvrability as it needs to dodge the cargo ships that are passing by. Frogger is nothing compared to this.

Design in a nutshell

The two renders give an impression of what the boat is going to look like. For the first time we have a three-strut design for better stability, great for rough seas. At a speed of about 20 km/h we can generate enough lift with the hydrofoils to lift the hull from the water and sail entirely on the hydrofoils. We call this flying. The hydrofoils are actively controlled to maintain stability and control the lift. There is room for only one pilot. For the best performance the pilot will be as light as possible.



My job in the team

In this team I take care of programming the height control system. I have to read datasheets and hardware specifications to be able to implement correct hardware drivers. It's my job to deal with different sensors which have their own communication protocol; they all speak their own binary language. The boat consists of microcontrollers which are perfectly suited for reading sensors. It's also my job to implement the drivers for the DC motors which can change the angle of the hydrofoils.

Aside from programming the hardware, I also design the height control system. This system is responsible for making the boat fly at the correct height and balancing the boat, so it doesn't fall over. To do this, we use a PID controller, short for proportional-integral-derivative controller. That is a control loop feedback mechanism which determines the next action to be taken based on the current state of the boat. Using this technique, the boat will be able to smoothly ascend from the water to the desired height. And more importantly, maintain that height. Although this is a huge task for a simple programmer like me, I shall keep the Solar Boat away from Davey Jones' locker.



Why I joined the team

I joined the Solar Boat Team because I thought it would be an interesting occupation aside of my study. Everything I do in the team perfectly fits my interests. I'm free to plan the work the way I want. I decide what interesting topics to research. When I am stuck on some problem, I can discuss my problem with the team or with last year's team members and turn my problem into a challenge. Especially talking to previous year's team members is very helpful, because they have been through the whole process last year and know how to tackle issues. Professors are also willing to help out and provide knowledge and ideas. I learned a lot during my time at the Solar Boat Team already and we are just getting started.

The team

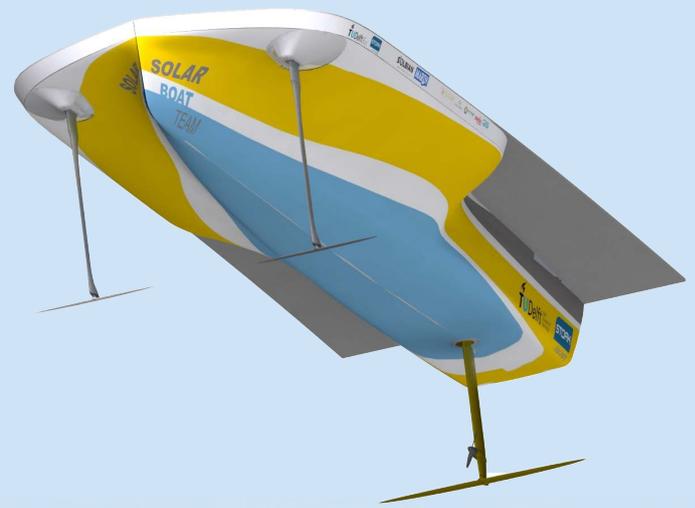
The Solar Boat Team consists of 29 students from different faculties of the TU Delft. Making a boat from scratch requires a lot of time and effort. We have four different departments which specialize in their own field: Stability-and-Dynamics, Electronics, Drivetrain and Hull-and-Body department. I will briefly explain what each department is responsible for. Stability-and-Dynamics designs the struts and hydrofoils. The Electronics department designs the energy box and Energy Management System. Drivetrain takes care of thrust. The Hull-and-Body department designs the hull and keeps the boat afloat.

Aside from these departments we have a press and publicity team and of course a management team, consisting of 5 members. There is lots of flexibility in work time as I can determine for myself when I come to work at the office. Most team members are part-timers, some are full-timers. I combine the Solar Boat Team with my study, so I am a part-timer as well.

It is really fun to work in a team that is so dedicated. But of course it's not all about work, we have lots of fun: we organize dinner together, we plan Solar Boat weekends and every Tuesday we gather at lunch time where we present our progress to the rest of the team. We also get invited by sponsoring companies to get guided tours, which is very interesting. Not only the Solar Boat Team but any other team at the Dream hall will be fun and a great experience.

Other teams

Currently, the Dream hall has 12 teams: Dare, Hyperloop, Eco-Runner, Formula Student Team, Forze, Human Power Team, Nova Electric Racing, Nuon Solar Team, Project March, Rise, Wasub and of course the Solar Boat Team. All these teams are very cool and almost as awesome as the Solar Boat Team. For the sake of the length of this article I do not go into depth of these teams so if you want to know more about them, just go to the Dream hall and say hi! Visit our website <http://www.solarboatteam.nl/> if you want to know more about us. Solar Boat Team 2017, making dreams come true. 



Parents' Day

Event will be in Dutch

Let your parents experience
your study for a day!

20th of May

Entrance: €7,50

Location: EWI

More info & tickets: wisv.ch/ouderdag

09:00 - 18:00

- Educational
- Career
- Social



Calendar



April is a less busy month than the previous ones. Board 60 will be on holiday and when they are away, 59 will take over CH again! When everything is back to normal again and the Board has returned, we will finish the month with the WiFi rally and the celebration of King's Day on a boat in Leiden!

Hack Delft

The first of May will be fully in the theme of our symposium about Cyber Security! The day will be filled with lectures and debates by professionals and researchers from different companies. Besides activities as T.U.E.S.Day lectures and the yearbook drink, another large event will be held in May: HackDelft, our first own hackathon!



Already one of the last months of the academic year, June will be all about the last lustrum activities and the iCom. At the 2nd of June we will go to the Delftse Hout for a nice day at the lake, and we will end the lustrum festivities with the Lustrum Party!

April

- 4 T.U.E.S.Day Lecture with Drinks by ING
- 5 CH Vision Music Festival
- 15 Good Friday
- 8-15 Board 60 on Holiday, 59 takes over
- 16-17 Easter
- 18-21 Exams
- 17 Birthday Prof. Aarts
- 22-23 WiFi Rally
- 25 T.U.E.S.Day Lecture by ASML
- 26 MeisCie High Tea
- 27 King's Day

May

- 1 Cyber Security Symposium: The Key to your Privacy
- 2 Birthday Cor Kraaikamp
- 3 ComMA Master Fair
- 5 Liberation Day
- 9 T.U.E.S.Day Lecture Sogeti
Birthday Peter Kluit
- 10 MatCH ZiCH ZaCH
- 11 Career College 4.1
- 13-14 HackDelft Hackathon
- 16 T.U.E.S.Day Lecture Computer Science
- 17 General Assembly
Yearbook drink
- 18 CoH IT in the Digital Age
- 19 Start-up Event
- 20 Parents' Day
- 23 Members' Lunch
- 25 Ascension Day
- 29-31 Exams

June

- 1-2 Exams
- 2 LuCie Day at the Lake
- 4-5 Pentecost
- 7 SjaarCie BBQ
- 8 Career College 4.2
- 9-11 EIWEIW
- 12 Teacher of the Year Awards
- 13 T.U.E.S.Day Lecture Pointlogic
- 13-17 iCom Trip to Budapest
- 19 Committee Thank-you Bye
- 20 T.U.E.S.Day Lecture Applied Mathematics
Career College 4.3
- 23 Brother/Sister activity
End-of-Lustrum Party
- 27 T.U.E.S.Day Lecture bol.com

