



I/O VIVAT

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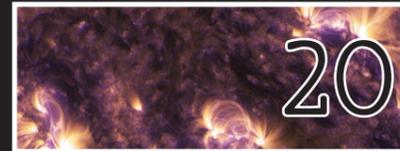
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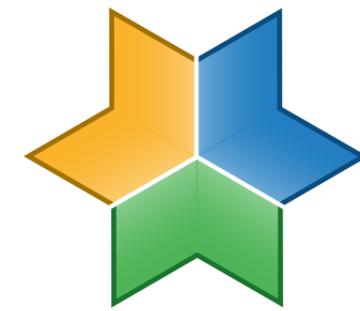
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I/O VIVAT

//Editorial

Dear freshmen (and other readers),

As a new academic year commences, we first take this opportunity to make new (bachelor and master) students aware of our existence. First of all, welcome in Twente, you just began a great journey here in the Netherlands!

So to first of all introduce you, this magazine that landed on your doormat is the I/O Vivat which is the magazine of study association of Inter-Actief. The I/O Vivat first of all publishes articles related to Computer Science (Dwarf Fortress, EU Digital Identity ("eWallets") and human-AI collaboration to name a few).

Additionally, the I/O Vivat publishes articles of life in Twente/at Inter-Actief and, although maybe a bit premature, articles of companies to show you possibilities for later in your career. The I/O Vivat is published regularly and distributed among members of Inter-Actief, as well as to members of ENIAC (the alumni - "old people" -association).

This edition also contains some articles regarding life at Inter-Actief, detailing the different possibilities Inter-Actief gives, such as meeting new people, help with your study and mediate in study-related complaints, (organizing) extracurricular activities and much more.

Thanks to all for opening the I/O Vivat once again. Besides reading this edition we would like to draw your attention to our new digital publication as can be found on <https://ioviv.at>, which we have been busy setting up last months. While you are there, please subscribe to stay up to date and be the first to be notified of new articles.

We thank you for you reading the I/O Vivat!

Jelle Maas
Ruben Groot Roessink
Chief Editors I/O Vivat

Editorial errors:

Front Page (38.1): Chakshy Gupta was misspelled and should have been 'Chakshu Gupta'.

A Giant About Dwarves



By: Sander Teune
Editor I/O Vivat

Most of you will probably have heard of *The Sims* and even played it: a video game franchise that revolves around simulating the lives of virtual characters all with their own personality and background. It is probably one of the most well-known simulation games in existence. Simulating the virtual characters creates a unique world that almost appears to be alive. However, maybe you are someone who is more into simulating the bigger picture and prefers not to deal with the individual: then a game like *SimCity* (or nowadays *City Skylines*) will probably sound familiar to you. In *City Skylines*, everything revolves around designing and governing a city: from policy to infrastructure.

If you want to think even bigger than this, we quickly turn to even more ambitious simulations: for example, the simulation of planets and entire universes. However, each simulation seems to limit itself to its own niche: a city simulator does not look too deeply at the individual citizen, and a life simulator like *The Sims* stays far from city complexity. Despite all this, there appears to be one exception to the rule: *Dwarf Fortress*.

In 2015, it rained bug reports within the *Dwarf Fortress* Community: players of this game kept finding fallen cats in the taverns they had built for their dwarves. After all the enormous influx

of bug reports, Tarn Adams, the game's creator, went digging to find the cause of this problem. After a brief analysis, he had found it: In the taverns, it happened quite often that dwarves spilled their alcoholic beverages; The liquid, of course, ended up on the ground. The cats in the tavern then walked through the liquid, causing the drink to get on their paws. When they then went to lick their paws clean (as a cat tends to do quite often), they suddenly dropped dead, because due to an error, the game grossly overestimated the amount of alcohol on their paws and thus gave them a heart attack due to alcohol poisoning.

Dwarf Fortress, officially launched as "Slaves to Armok: God of Blood Chap-

ter II: *Dwarf Fortress*", is a fantasy simulation game developed by Tarn and Zach Adams, the brothers who make up the independent game studio Bay 12 Games. Development of the game began in 2002, and its first alpha release was released on 8 August 2006. The game has been in development ever since, now totalling around 700.000 lines of code. The project is primarily a passion project of Tarn Adams, who does most of the development and programming, which has resulted in a rich but complex simulation game with an intense learning curve.

The example of the aforementioned perishing tavern cats serves as a bizarre reminder of just how complex the world of *Dwarf Fortress* is: the basic



Figure 1: Even the Steam release's visual information takes some getting used to

principle of the game seems simple, building a dwarf colony, but is so much more complex than that: when one starts a new game in *Dwarf Fortress* in the *Fortress Game* mode, the first question you will be asked is how old you want your world to be. This is certainly not an arbitrary question either: based on your answer ranging from 5 to 500 years, a complete history will be generated. This history is not just a flavour backstory either: all the characters, locations, artefacts and monsters the game pre-generates have influenced how the world looks at the moment you start the game. So at the moment you start your humble dwarven settlement, entire civilisations have emerged, left their mark on the world and possibly collapsed. And the best part of all this? The game even lets you read back all this history, should you find the time and interest.

From here, you get to choose a location to establish your own fortress: each location has its pros and cons: if you start in a haunted biome, a true challenge awaits you. Do you choose a paradise biome? Then it will probably be a smoother start. In any case, bear in mind that war with goblins is often inevitable... And even then: the hordes of goblins you may encounter are probably the least of your troubles. Ancient, forgotten beasts lurk in the depths, strange creatures wander the earth and one might even stumble upon ancient underground vaults, created by the primordial gods of your randomly-generated world. The unfortold treasure they hold does not come without cost however.

Dwarf Fortress plays like a colony Sim and if you were to look at it superficially, you might not even notice what



Figure 1: The original look did not make the learning curve any more attractive

makes it so special, besides its unusually complex world-generation. Looking under the bonnet, however, reveals the most complex world simulation ever made. It is not an overstatement to say that if something can be simulated, there is a good chance it will be simulated. This includes, but is not limited to: The state of every specific body part of every individual dwarf in the fortress, the politics of every state in the world and, of course, how much alcohol cats have on their paws.

All this results in emergent storytelling: every playthrough is different and the game creates its own storylines in this way. Control is often an illusion: the world is a symphony of beautiful chaos, though a consequential chaos nonetheless, dictated by an underlying sea of code. The game will never just spawn a monster in your playing field: rest assured it just happened to wander upon your base.

Only until recently, there was a problem that kept people from playing *Dwarf Fortress*: the graphics of the entire game consisted of pure ASCII, nothing more. Luckily, in 2019, the Adams brothers announced a partnership with Kitfox Games to launch a premium version of *Dwarf Fortress* on Steam and itch.io, with improved graphics and sound. The move was taken to generate additional revenue to support their personal financial needs, including medical expenses.

On 6 December 2022 it finally happened: The Steam release of *Dwarf Fortress*. The game sold like hot cakes and the Adams brothers soon had 7 million Dollars coming in within a short month. At last, *Dwarf Fortress* was available to the wider public and

thus the impetus for this article was born.

Besides the admiration the project deserves in itself, one should not underestimate how much influence *Dwarf Fortress* has had on the modern world of video games. *Minecraft* creator Markus "Notch" Persson has acknowledged that *Dwarf Fortress* was a major influence on his own game. *Minecraft*'s procedurally generated worlds and its focus on building, digging and survival are ideas we also see in *Dwarf Fortress*. It's not just *Minecraft*, though: countless games have taken inspiration from *Dwarf Fortress*, often specifically in terms of a simulation that facilitates emergent storytelling. Think *Rimworld* and *Prison Architect* here, for example. It is quite possible that without *Dwarf Fortress*, the current world of gaming would have looked completely different. All because Tarn Adams had fun while programming and made something he was passionate about.

References

The original version of *Dwarf Fortress* can be found on the following link (for free, newest versions are Windows only):
<https://www.bay12games.com/dwarves/>

Paid versions with better graphics can be found on:

Steam:
https://store.steampowered.com/app/975370/Dwarf_Fortress/

Itch.io:
<https://kitfoxgames.itch.io/dwarf-fortress>



‘De combinatie tussen IT en het menselijke vind ik tof.’



Vanuit de verpleegkunde en de sales stuitte Calvin drie jaar geleden op een traineeship als Test Automation Engineer bij de Belastingdienst; een rol net zo divers als zijn arbeidsverleden. Hij rondde zijn traineeship af en inmiddels floreert hij als scrummaster in zijn team van IT'ers, waar hij helemaal op zijn plek zit.

Hoe ben je bij de Belastingdienst terechtgekomen?

‘Ik heb een heel divers arbeidsverleden. Ik heb een tijdje in de zorg gewerkt, wat ik hartstikke leuk vond. Maar toch miste ik - gek genoeg - het menselijk contact. Soms had ik maar tien minuten met de ene patiënt, vijf minuten met de ander - en dat is niet hoe ik wil werken. Daarna heb ik een tijd in de sales gewerkt, tot ik in aanraking kwam met een praktijkgerichte IT-opleider. Dat vond ik fantastisch; vooral alle technieken waarmee ik in aanraking kwam. In mijn vrije tijd was ik ook al bezig met het uitproberen van

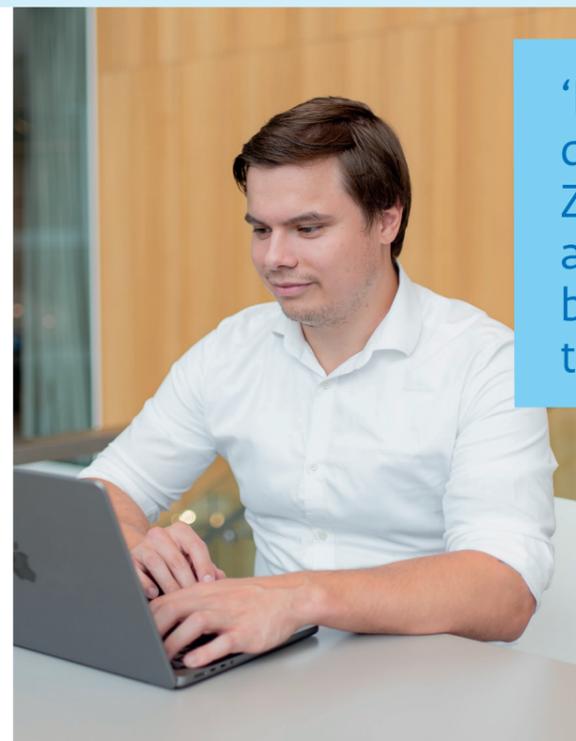
nieuwe dingen op de PC. Zo heb ik mezelf leren programmeren met Python. Toen ik door covid mijn salesbaan verloor, dacht ik: misschien moet ik wat in de IT gaan doen. Door een tip van een kennis ben ik gaan kijken bij de traineeships van de Rijksoverheid en daar zag ik de Belastingdienst tussen staan. En zo geschiedde.’

Wat houdt je functie precies in?

‘Als Test Automation Engineer ben je op dagelijkse basis bezig met het automatiseren van het testproces van applicaties. Dat houdt in dat ik op zoek ga naar nieuwe technieken en nieuwe manieren voor het efficiënter maken van allerlei computerprocessen en die zoveel mogelijk aan elkaar te koppelen. Ik heb heel bewust gekozen voor Test Automation, omdat dit de enige vacature was waarin stond dat het belangrijk was dat je sociale skills had. Ik ben veel in gesprek met mijn team, maar ook met klanten. Die combinatie leek me heel tof; zo ben ik wel met IT bezig, maar kom ik óók met mensen in contact. Uiteraard zitten er dagen tussen dat je heel technisch bezig bent, daar ontkom je niet aan. Maar het wisselt zich mooi af.’

Wat vind je het leukst aan je werk?

‘Dat mijn afdeling veel met maatschappelijke problematiek te maken heeft. Ik werk mee aan dingen die in de samenleving spelen. Zo werkte ik een tijdje geleden aan de applicatie die ondersteunt bij de afhandeling van de toeslagenaffaire. Maar ik vind het ook erg leerzaam om samen met onze klanten in gesprek te gaan, om rond de tafel te gaan zitten en te laten zien: kijk, hier is je applicatie, dit hebben wij gebouwd. Ga maar los en dan horen we het wel als je een probleem hebt. Pas dan kom je erachter hoe verschillend je naar een applicatie kunt kijken en dan vind ik het onwijs interessant om te kijken hoe een applicatie gebruiksvriendelijk voor iedereen kan zijn.’



‘Ik werk mee aan dingen die in de samenleving spelen. Zo werkte ik een tijdje geleden aan de applicatie die ondersteunt bij de afhandeling van de toeslagenaffaire.’

toekomen. Op zulke momenten vervagen ook de lijnen tussen de afdelingen, maar ook tussen de medewerkers en het management. Waar ik de ene keer gezellig met een collega de stad in ga, kan ik ook gerust iets met een afdelingsleider gaan drinken. En natuurlijk zijn de secundaire arbeidsvoorwaarden uniek en erg goed; zo krijg je een IKB-budget die je flexibel kunt inzetten, voor een sportschoolabonnement of door ‘m uit te laten betalen op een moment dat het jou uitkomt. Omdat ik nog geen opleiding in de IT heb afgerond, volg ik een ICT opleiding. Ik krijg één dag in de week betaald de tijd om aan mijn studie te zitten. In de toekomst hoop ik te groeien richting testcoördinator of testadviseur. Maar voordat het zover is, verwacht ik nog heel veel te leren. Voorlopig zit ik hier nog op mijn plek.’

Wat zijn de uitdagingen in je werk?

‘Hoe je zo duurzaam mogelijk een automatisering kan realiseren. Het is natuurlijk fijn als iets automatisch draait, maar dat de volgende dag stopt omdat er iets wijzigt, dan heb je er niks aan. Dan ben je niet meer bezig met handmatig testen, maar wel met het handmatig werken aan de automatisering. En om alles goed te kunnen begrijpen, moet ik als tester van veel verschillende technieken iets weten. De IT beweegt ontzettend snel, dus je moet ook goed op de hoogte blijven. De Belastingdienst werkt met zo'n goo zelfgebouwde applicaties - en dan heb ik nog niet eens de applicaties meegerekend waar we zelf mee werken. Het idee dat de website van de Belastingdienst op dagelijkse basis vier à vijf miljoen bezoekers heeft, vind ik een bizar idee.’

Wat maakt de Belastingdienst een bijzondere werkgever?

‘Toen ik solliciteerde, was ik positief verrast over de informele werksfeer: heel open, relaxed en gezellig. Er wordt ontzettend veel georganiseerd buiten werk om; als je aan alles zou meedoen, zou je niet aan werken

Dát doen wij. [Kijk wat jij kunt doen.](#)



Benieuwd naar jouw mogelijkheden bij de Belastingdienst? Kijk op werken.belastingdienst.nl/ict

EU Digital Identity Wallet

A short introduction into the history of digital identity

European Commission
Commission européenne



By: Koen de Jong
Alumnus

In June 2021, the European Commission made a big announcement: from 2025 each European citizen should have his own European Digital Identity (EDI) wallet. In this article, I will explain to you the why, what and how of the European Digital Identity.

In order to address the first misconception: “European” in this case does not mean identities is issued by the EU itself. Instead each member state should issue or recognise one or more national EDI wallets. These digital wallets, that you can install on your smartphone, can be compared with classic wallets that contain cards (such as ID or bank cards) that you can use to prove something about your identity. For example, your name, age, your bank account,

your diploma, in fact basically anything you can think of. These wallets should be usable throughout the whole of the European Union for access to both online and offline services. This means you should, with your Dutch EDI wallet, be able to interact online with governmental organisations in the EU, collect the diploma of a minor abroad or easily share health data when visiting a hospital abroad. Currently, these kinds of services require a lot of paperwork (which are then scanned and sent through email), require offline attendance or are simply not possible at all.

The development of the EDI is very much in line with Self Sovereign Identity (SSI) thinking, but it has some important differences. So to better understand the EDI, let me first explain

to you about Digital Identities and Self-Sovereign Identity.

The rise of Self-Sovereign Identity

With the rise of the internet, more and more services became available online. Soon, organisations realised that there was a need for access control to these kinds of services. Organisations first tried to solve this themselves: each user would get an account with a username and a password. As the number of online services grew, the number of accounts that you had to maintain became unworkable. This is not only bad from a user-experience perspective, but it is also a major security risk as users would start reusing passwords.

This challenge caused the rise of federated identities. Identity federations exist of one or multiple identity providers and multiple relying parties (also called data using services). A user now only needs one identity provider that he can use to login to all relying services within the identity federation. This makes federated identity more user friendly and secure. The federation includes a trust framework so that relying parties know with certainty that they can rely on the identity provider (at a certain level of assurance, we will talk about that later).

Examples include SURFconnext, which students use to login to services offered by their university (or other universities, although most universities don't allow this last option), DigiD (which allows you to login to governmental services in the Netherlands), but also social logins such as “Login with Google/Facebook/Apple” at any service or webshop. This also discloses the downside of federated identities: there is a major privacy risk as the identity provider sees when and at which service you log in. You may trust SURF or DigiD, but I would certainly not trust Google or Facebook with this data.

This privacy risk triggered the rise of Self-Sovereign Identity (SSI). As the name suggests, SSI puts you in control of your own identity and personal data, with whom you share it and under which conditions. Although there is no formally agreed definition, the 10 principles formulated by Allan in 2016 are considered to be the guiding principles [1], but these ideas go back even before 2016. There were already many different initiatives and organisations striving for better self-determination for individuals regarding their personal data, such as MyData Global.

The SSI role model puts the individual in control by separating the direct connection between the identity provider and the relying party by putting the individual in between. The identity provider now becomes an issuer, who issues a credential (a statement or a piece of information) to the wallet of the individual. The individual can now share this with the relying party. This is done in such a way that the issuer does not see with which relying parties (and when) the individual shares the credentials. Due to the cryptographic properties of

these credentials the relying party can still verify the authenticity of the credentials. This is why we call them verifiable credentials.

There are already many existing SSI wallets. Most of them, including the Dutch wallet Datakeeper use the W3C Verifiable Credentials standard, but there are also other standards such as Idemix used by Yivi (formerly known as IRMA, created by the Dutch professor Bart Jacobs), Solid PODs and some proprietary standards. Although these wallets work technically perfectly well, the adoption is still limited.

The need for EU digital identity wallets

There are multiple reasons for the lack of adoption of these SSI wallets, including a classical chicken or egg situation, a lack of interoperability (currently relying parties only integrate one or two wallets, so often you cannot use the wallet of your choice) and a lack of trust between the different actors in the SSI ecosystem.

On the other hand, the adoption of the first version of the eIDAS regulation, introduced in 2014 to regulate acceptance of national digital identities (eIDs, such as DigiD) between EU member states had not been a great success either. Both the number of member states that had notified an eID as well as the actual cross-border use of eIDs was low. Another downside of eIDAS v1 was that it only regulated the uses of eIDs between government organisations, but that use by private organisations in other member states was not allowed nor regulated.

To realise the true potential of the use of digital identities in the EU, the European Commission announced a revision of the eIDAS regulation. Biggest highlight: a digital identity for each European citizen and the introduction of the European Digital Identity framework.

This revision not only has the ambition to realise the potential of eIDAS, but also has the potential to make SSI wallets work at large scale. I will explain how in the next section.

What will the European Digital Identity look like?

One of the reasons that gives the EDI wallets a better chance of succeeding over existing SSI wallets is that the eIDAS revision includes EU wide legislation and governance.

The EDI wallets should be issued at level of assurance (LoA) High. The EU recognises three different levels of assurance: Low, Substantial, High. The higher the LoA, the better the identification of the individual has been done once issuing the eID and the more effort an attacker should need to compromise the eID. It also means that eIDs with a higher LoA may be used for accessing even the more (privacy) sensitive services. For opening a bank account you need at least Substantial. For accessing your health records you should need an eID with LoA High. As the EDI wallet is issued at LoA High, it means you can use it to access any service.

The number of online services that accept the EDI wallets is also expected to be high. All government services and services from essential sectors are required to accept the wallet for use-cases where strong user authentication is required by law. Any other organisation may decide to accept the EDI

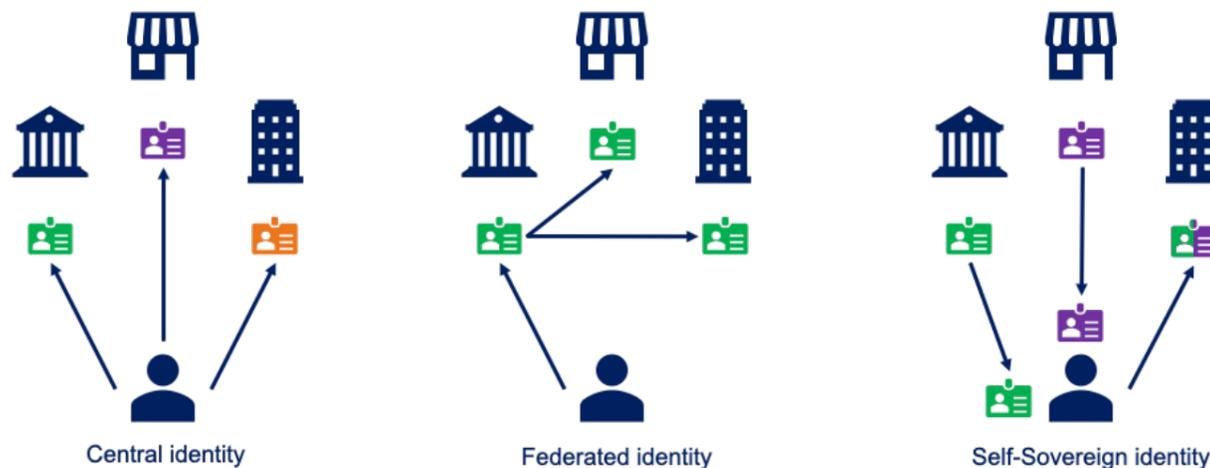


Figure 1: Data model

About Koen de Jong

Koen de Jong is an expert in the field of digital identities and personal data management. He finished his master in the Cyber Security specialisation at the University of Twente in 2019. His interest is in the interaction between technology, legislation, ethics and the impact of technology on the end-user.

At InnoValor Advies he helps governmental and other public organisations to better understand the impact of innovation in his fields of expertise. He also runs the MyData Operator group where wallet providers and other personal data management solutions work together on interoperability and empowering individuals regarding their personal data. If you want to learn more about digital identity or the EDI, you can reach out to him via koen.dejong@innovalor.nl or visit innovalor.nl.

wallets as well. On the other hand there should always be another alternative for an individual if (s)he does not wish to use his EDI wallet for a service. One of the downsides is that this alternative does not need to be the better or easier option. So in practice you might still be 'forced' to use the EDI wallet.

Another reason that gives the EDI wallets a bigger chance of success, is the use of the PID: Personal Identification Data includes your name and date of birth. The PID makes sure that you can be uniquely identified. This does not mean that you will always need to share the PID. Most of the time you will probably only share a part or nothing of your PID at all. The PID is the first thing you need to retrieve to activate your EDI wallet once you downloaded it.

In the Netherlands, you will probably do so by logging in with DigiD and retrieving your PID data from the Basisregistratie Personen (BRP). After you retrieve your PID, you can start collecting other credentials. You do this by showing (part of) your PID. At the moment you share a credential, the relying party can be sure it was issued to the right person. This is a big change compared to the classic SSI wallets where it was quite easy to issue your credential to your friends wallet.

Besides the regulation of the wallet itself, the issuers and wallets are also governed and regulated, which gives more trustworthiness to the whole EDI ecosystem. This makes it easier for all actors in the ecosystem to rely on the EDI wallets and the credentials that you have collected in them.

[How are the developments going and when can I have my EDI wallet?](#)

It was already two years ago that the European Commission announced the EDI. This announcement came with a very ambitious timeline and it was expected that each member state should have an EDI wallet issued or recognised by July 2024.

It now seems that that timeline was too ambitious, but a lot of work has already been done. Both the European Council (member states) and the European Parliament have discussed the proposed

revision of the regulation. Currently the negotiations, the so-called trilogue, between these three institutes have come to an end and a definitive version is expected in the upcoming months.

In the meantime, the European eIDAS expert group has started working on the Architecture and Reference Framework (ARF). The ARF will define actors in the ecosystem, functional and non-functional requirements to both the wallet and the other actors in the ecosystem and potential building blocks. In February 2023, version 1.0.0 of the ARF was released. In the meantime v1.1.0 has been released and new versions are expected soon as well. These first versions already give some interesting insights on how the EDI wallets will work. For example, the wallets will use W3C Verifiable Credentials and mobile Driver Licenses (mDL) specifications. Some other questions still stay open, including how to make sure that relying parties do not ask for more data than they strictly need or are allowed to ask.

Recently, the first experiments have started to test how the EDI wallets will work in practice. The EU has funded four large scale pilots (LSPs) to validate and learn how the wallet works around different use-cases. In the meantime, the Dutch government is also building its own demo-wallet. This seems to be both to learn how this wallet could work in the Netherlands as well as to influence the EU regarding some values that the government thinks are important. These include open source and privacy-by-design. The Dutch demo-wallet is supposed to be (partially) ready somewhere this year. Current versions of the source code are published via Github [3].

Other developments are still unclear. The timelines initially announced by the European Commission have shifted and it seems that we can expect the EDI wallets to be ready earliest somewhere in 2025, but most likely 2026. In the meantime, we also need to start working on the EDI-NL ecosystem, which regulates EDI wallets, issuers and relying parties within the Netherlands. The governance of this ecosystem might be even more important than building the wallets itself. It will make sure that all the actors will

keep up to the values and rules we find important in the Netherlands such as privacy, prevention of over-asking and voluntary use of the EDI wallet. It is important to understand the importance of this ecosystem. A wallet in itself is useless. It is a means rather than a solution. The actual value for the individual is in the ecosystem in which the wallet operates and the services that can be accessed by it.

If you want to learn more about the EDI or want to contribute to the development of the wallet, the LSPs or the ARF, make sure to visit edi.pleio.nl: A wiki by team of the Dutch Ministry of the Interior working on the implementation of the European Digital Identity in the Netherlands. They also organise monthly meetups and heartbeats.

References

[1] <https://github.com/ChristopherA/self-sovereign-identity/blob/master/ThePathToSelf-Sovereign-identity.md>

[2] <https://www.w3.org/TR/vc-data-model/>

[3] edi.pleio.nl - Wiki of the Dutch Ministry of the Interior

How can we help you?

Education Committee in a Nutshell

By: **Anamaria Ceban**

Chairwoman Educational Committee & Editor I/O Vivat



Hopefully you feel prepared, cause the new academic year is starting. No matter if you're in your first year or approaching the final stretch, embracing support and striving for an enriching academic journey can truly enhance your experience. Whether you are facing challenges or simply seeking to elevate your studies, there is always room for improvement, and seeking help can make the path even more rewarding.

In this article, we introduce the Education Committee of *Inter-Actief* and shed some light on how we can be helpful to you.

First, let us give you some context if you have never heard of us before. If you are reading this article you have already heard of *Inter-Actief*, but maybe not of the numerous committees that it offers. We are one of them. Like our association, we represent both the Technical Computer Science and Business Information Technology studies. Our main focus is to enhance the overall educational experience for all students at the institution. We organize a variety of engaging activities for you to meet some of your teachers or just to break away from your daily routine and have some fun.

Now, to talk about our favorite: the "Week of Education". It is our biggest activity of the year, and we love to keep the individual events of the week a secret until they unfold! We have got some fun activities planned, including a relaxed drink where students can unwind and interact with their teachers in a different kind of setting. But that is not all! Expect more delightful surprises and engaging activities throughout the

week. We promise it will be an unforgettable experience that will make your academic journey even more vibrant and enjoyable!

But that's not all! We have got more fun activities throughout the year, like Kickboxing workshops, Pubquizes and Q&A sessions all with your favorite teachers. Picture this: sweating it out, kicking some stress away with one of your teachers, or asking them questions like what is their favorite video-game or what is their favorite food. Now that is a one-of-a-kind experience, and very different from other universities in (and outside of) the Netherlands!

Apart from all of the fun stuff, we also offer support to our students where we can. We take your feedback seriously, and we are here to listen. We work hand-in-hand with the Officer of Educational Affairs to address and resolve any issues that may arise. So, any complaints or suggestions you have, we're all ears.

And if you're approaching an exam or a project deadline and need some more support, we've got you covered with our Study Evenings. It's a laid-back setting where you can team up with fellow students, exchange insights, conquer those tough study sessions together and even get help from some of your TAs.

On the occasion that those practice exams turn out to not be enough for you, we've got you covered. Introducing our invaluable "Summary wiki" - a treasure trove of past exams that offer the perfect opportunity for additional practice. This extensive collection can be your go-to resource if you're looking to refine your skills and boost your confidence before the big tests. And as we

firmly believe in the power of community collaboration, if you happen to have your own past exams that could benefit your fellow students, we encourage you to contribute them to the "Summary wiki." As a token of appreciation, we've got a sweet incentive for you - "cookie points"!

So, as the new academic year kicks off, remember, we're here to support you every step of the way. Whether you're facing challenges or aiming for greatness, together, we'll make it an unforgettable and rewarding ride.

Get ready to seize the opportunities ahead, to learn, to grow, and to make lasting memories. We're excited to meet all of you. Here's to an incredible academic year!

Education Committee

The Education Committee is a committee consisting of nine members that help the Officer of Educational Affairs in forming a bridge between members of *Inter-Actief* and the studies Technical Computer Science and Business Information Technology.

The Education Committee is involved in handling education-related complaints, manages *Inter-Actief's* Wiki with previous (test) exams and summaries and organizes several education-related activities.

Summary Wiki

<https://summaries.ia.utwente.nl>

How Computers Got Fast



By: Lars van Arkel
Editor I/O Vivat

In April 2022, Epic Games announced the release of its new game engine, Unreal Engine 5. This engine was groundbreaking in how it was able to render ever increasingly realistic worlds with models of millions of polygons and fully dynamic lighting, all in real-time. As impressive as this is from a software perspective, it would never have been possible were it not for the last decades of advances in computer hardware. In the last decades, computer performance has increased exponentially, and although in recent years this curve has flattened, we still see new chips being developed which are more powerful than last year's models.

The first home computer which introduced a graphical user interface, the Apple Macintosh released in 1979, had a clock speed of 6 MHz, 128 KB of RAM, and a cost equivalent of €6300 in today's currency. Compared to a modern computer, you could buy a laptop with 8 GB of RAM and a clock speed in the GHz without spending more than a thousand euros. As you can see, computers have not only become significantly faster but also a lot cheaper.

In this article, we will have a look at how some computers have become more powerful, and how this allowed us to perform much larger tasks. We will look at how computer components have improved, how the architecture of CPUs has allowed us to do more tasks at the same time, and how specialized components

like GPUs allow us to massively increase the performance of certain tasks.

Moore's law and advances in component design

When discussing the increase in performance in modern computers, it is inevitable that the concept of Moore's law is brought up. Moore's law, which is an observation described in 1965 by George Moore who was the co-founder of Intel, states that the number of transistors on an integrated circuit will roughly double each year. In 1975, he changed his prediction such that it doubles every two years, and this prediction has been quite accurate for more than 40 years [1], as shown in Figure 1.

One of the ways in which we have been able to fit more transistors in a chip is that the process of scaling down the size of a transistor has also improved exponentially. In 1971, commercially produced transistors were in the range of 10 micrometres. In 2016, the size of a transistor has been shrunk down to the range of 10 nanometres, a thousand times smaller than the ones produced in 1971.

One of the largest technologies which allow Moore's law to work is the invention of deep ultraviolet (UV) excimer laser photolithography. Invented around the 1980s by Kanti Jain, this technique uses lasers with UV light that etch the pattern of the integrated circuit onto a silicon wafer. With modern techniques

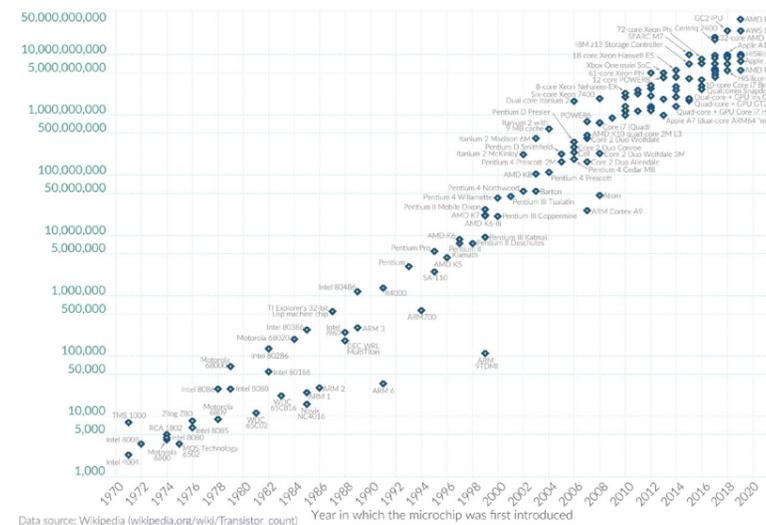


Figure 1: The number of transistors on microchips over time, 'proving' Moore's 'law'.

using UV light with shorter wavelengths, the technique allows us to create smaller patterns, thus resulting in smaller transistors.

Instead of making the components smaller, modern CPUs also gain more performance by increasing the number of cores on each chip. In the early days of computers, the CPU only contained one core on which only a single thread could be executed. By increasing the number of cores on a chip, the CPU can execute multiple tasks at the same time. With modern operating systems, a lot of processes can run concurrently, such as background tasks, internet browsers, etc. Modern Intel processors also contain the ability for a single core to keep track of two threads, which can increase the amount of computing power as well. This process is called hyper-threading and has been implemented for the first time in 2002 on the (Intel) Xeon CPU. When a section of the core is not being used by one of the threads, the other thread can use that section instead, which increases the total performance of the core.

GPUs, Quake and ChatGPT

One important component that was developed in the history of computers was the Graphical Processing Unit (GPU). The Graphical Processing Unit is a component that is designed mainly for computer graphics and image processing. A GPU consists of a large number of small cores that are able to execute code in parallel. As such, any computation task that consists of a large number of parallel computations can be executed on a GPU, although most GPUs are still optimized for computer graphics and video transcoding. Even though the GPU is a separate component in most computers, each CPU contains a small integrated

graphics processor of its own.

Graphics processors in the 20th century were mainly developed for displaying graphics efficiently. In the 1970s, arcade cabinets were already using specialized chips for displaying the screen. Halfway through the 1980s, GPUs were becoming available for PCs which mainly focused on accelerating 2D graphics and allowing for an increased resolution, which was then a maximum of 640x480 pixels.

In the 1990s, when video games started to emulate the 3rd dimension, GPUs allowed games to show an even larger amount of graphical fidelity, as can be seen with the video game Quake (Figure 2) where the resolution could be increased massively, as well as the quality of the images, with the GPU allowing a 16-bit colour resolution instead of an 8-bit one.

As mentioned before, any problem with a large number of parallel computations can be executed efficiently on a GPU. Therefore, GPUs are very popular for mining cryptocurrency and the training of large neural networks or other machine learning techniques. Machine learning libraries such as TensorFlow allow the user to train their model using GPU acceleration. One big example of this is the training of the language model ChatGPT. The underlying model GPT-3, which consists of 175 billion parameters, has been trained using 10,000 GPUs. Not only does this show the immense amount of computing power that modern supercomputers are able to perform, but it also highlights the fact that the amount of parallelisation allows the developers to scale the number of devices, instead of needing to speed up all processors.



Figure 2: Comparison between CPU-based rendering and the 3Dfx GPU for Quake (1996)

A long way from the start

As we have seen, the improvements in technology, manufacturing processes and the design of specialised components have allowed us to create computers which are capable of processing massive amounts of data and performing significant calculations. In the last decades, computers have become exponentially more powerful by the decrease of components' size and the parallelization into different cores. Although Moore's law has been accurate for decades, transistor sizes have been approaching the physical limit. CPU performance is still increasing, but hardly at the same pace as 10 years ago.

Luckily, there are still alternatives to improve the power of computers. Technologies such as the GPU are still improving the ability of computers to perform parallel tasks, and our increased ability to distribute computing powers over a large number of computers, also known as cloud computing, allows us a separate way to scale up our processing power. The previously mentioned training of ChatGPT-3 would have taken over 350 years if it would only be executed on a single computer, according to Lambda Labs [2].

In more than 40 years, we have seen incredible improvements in both the power and costs of computers. Even the phones in our pockets are much faster than computers from 10 years ago. Because of this, and because of the great level of research and optimization into the software and hardware, we have programs with incredible graphical fidelity such as what has been shown by Unreal Engine 5.

References

- [1] <https://datatracker.ietf.org/doc/html/rfc1034> & <https://datatracker.ietf.org/doc/html/rfc1035>
- [2] <https://lambdalabs.com/blog/demystifying-gpt-3>

Technolution

Interview with Gerard Rauwerda & Jan Boerman



By: Hanna Gardebroek
& Jelle Maas
Editors I/O Vivat

Dr. Ir. Gerard Rauwerda
Business Developer at Technolution
Jan Boerman



Background and professional journey

Gerard Rauwerda: I graduated from the University of Twente in 2002 with a degree in Electrical Engineering. I then completed a Ph.D. in Computer Science in 2008, specializing in Embedded Systems within the Computer Architecture for Embedded Systems (CAES) group.

During my doctoral research, I co-founded a startup called Recore Systems, based at the University of Twente. We focused on digital signal processing platform chips. I served as the Chief Technology Officer (CTO) of Recore Systems from 2005 until 2018, when part of the aerospace engineering department of Recore Systems merged with Technolution. Since then, I've been working at Technolution, primarily in the field of space development and in an advisory role within the company. Since October 2023, I also have a visiting position at the CAES group. My role at the University of Twente is coordinating research between the UT and Technolution, as well as supervising Ph.D.-candidates.

Core competencies

Technolution was founded in 1987 by four individuals in Gouda. Remarkably, one of the founders is still the current CEO, which highlights his long-standing commitment to the company's growth. Technolution has since evolved from a small startup into a substantial presence within the Netherlands.

Our expertise at Technolution encompasses a wide range of domains, primarily focusing on high-speed electronics, software engineering, embedded hardware, and Field-Programmable Gate Arrays (FPGAs). We specialize in combining these technical capabilities with platform software development, enabling us to provide comprehensive solutions. This versatility allows us to collaborate with various partners and cater to their specific needs, whether it is small-scale design work or complete electronic solutions.

Location and number of employees

Our operations are spread across several locations. In the Netherlands, we have three offices: Our primary office is located in Gouda, with two smaller offices in Deventer and Arnhem. Across these three locations, we have a team of 280 employees. Internationally, Technolution has offices in the USA (San José, Wilmington) and Sweden (Gothenburg).

Within our workforce, more than half are software engineers, highlighting our strong software development capabilities. Additionally, we have a significant number of experts in embedded software and electronics.

Departments within Technolution

Technolution has several distinct departments, with a specific focus and expertise:

Technolution Spark, the Energy department, which includes initiatives related to smart cities and smart grids. To drive improvements in this market, we aim to gain a comprehensive understanding of electricity grids. This involves monitoring the flow of power through cables and predicting any potential cable ruptures. As a result, our Energy department is heavily involved in developments ranging from electronics to embedded systems.

Technolution Prime, the High Assurance Security department specializes in developing hardware VPN solutions. Our primary mission is to ensure the confidentiality of information, particularly for governmental institutions and the defense sector. We have products that have been approved by NATO, allowing Dutch governmental organizations to safeguard their data effectively. The department also involves a considerable amount of work with FPGAs and security techniques, making it a hub for expertise in security-related hardware and technology.

Technolution Move is the Mobility department. Our primary focus is on optimizing the management of traffic and water systems. Our solutions in this domain aim to enhance traffic management, and we have achieved market leadership in the Netherlands. This is partly due to our user-friendly platform, which enables efficient coordination of traffic signals and lights. For instance, during events like soccer mat-

ches or concerts in Amsterdam, road managers can adjust traffic signals with a simple button press to alleviate traffic congestion in the city center. For Technolution Advance and Technolution Perform, the primary focus is on automation, robotization and digitalization of high-tech equipment. For example, we work on solutions to meet precise requirements, such as when a supermarket needs precisely one kilogram of packaged tomatoes. We employ robotic systems and artificial computer vision to automate the process of cutting and packaging tomatoes accurately, ensuring that one-kilogram packages are consistently delivered.

Team structure and work dynamics

Our teams are typically composed of a project manager, project leader, architects, software developers, and electronic developers. The specific roles of these team members may vary depending on the project's size and the extent of collaboration with the client.

In our in-house teams, we follow an agile approach, with daily stand-up meetings to ensure efficient communication and alignment among team members. This agile methodology helps us adapt to changing project requirements and ensures that everyone is on the same page. We also form co-creation teams, where our team collaborates closely with the client's team, either on-premise at the customer or at our offices.

Impact

While you may not directly observe Technolution's presence, the results of our collaborations are often quite noticeable in various aspects of daily life and society. Technolution's work has a tangible impact on the functioning of various systems and services that are integral to daily life and the broader society. For example we worked on the following projects:

Translink and OV-Chipcard: We have had a long-standing collaboration with Translink, the company responsible for the OV-Chipcard used for public transportation in the Netherlands. Our expertise in scripts and automation has significantly improved the efficiency and reliability of the systems we've delivered. These systems are less suscepti-

ble to errors compared to manual input. For instance, we've enabled Translink to use our test scripts for certifying their check-in gates, ensuring smoother and more efficient passenger experiences.

P2000 System: While this may be less apparent to the general public, we have made substantial contributions to the P2000 system, which is used by firefighters throughout the Netherlands. We've developed the base station for this pager system, contributing to the efficiency and reliability of emergency response communications.

Future plans

Looking ahead, we have a forward-thinking approach to our company's future. My role involves exploring the latest projects and advancements globally to identify areas where we need to adapt and grow. Simultaneously, our business development efforts are geared toward providing valuable input to our CTO, allowing us to strategize and strengthen our position in the aerospace sector. In the aerospace field, the primary focus is on enhancing the reliability of electronic systems, and we actively engage in collaborative innovation with partners such as the European Space Agency (ESA) and the University of Twente.

Moreover, in the realm of mobility, we observe a significant trend toward projects that heavily involve artificial intelligence and reinforcement learning. This technology is increasingly applied not only in mobility but also within life sciences. For instance, artificial intelligence plays a crucial role in the detection of unfamiliar tissue in the skin or brain, supporting medical professionals in their diagnoses and tracking of abnormalities. It's important to emphasize that our approach to artificial intelligence is one of assistance, not replacement. We believe that artificial intelligence should complement the work of medical practitioners rather than take over their roles entirely. This human-AI synergy remains a fundamental principle as we chart our course into the future.

Students and Technolution

Jan Boerman: Technolution offers opportunities for students looking to begin their career journey with us. My own journey is a testament to the fact

that opportunities exist for them to contribute to impactful projects, learn, and grow within the company.

I started my studies in computer science at the University of Twente in 2013. It was during the Business days at the UT that I first met colleagues of Technolution. Later on, I graduated from the Formal Methods and Tools (FMT) research group, which has a collaborative relationship with Technolution, although I didn't directly engage in their projects during my studies. It was during this period that I decided to apply to Technolution, which involved two interviews. The initial interview served as an introduction to the company, allowing me to become familiar with its culture and operations. The second interview was more skill-based, where I was tasked with solving computer science related problems.

Currently, I'm involved in the development of software for Rijkswaterstaat, more specifically within the program known as "Beschikbaar Maken Waterdata," which aims to simplify the exchange of data collected by Rijkswaterstaat and standardize data storage practices. Furthermore, the program enables third parties to access this data through API points.

Graduation Projects

Students seeking graduation projects are encouraged to explore our website (<https://www.technolution.com/nl/carriere/stage-en-afstuderen/>), where we have provided example projects, which serve as inspirational starting points. We also maintain collaborations with various departments at the University of Twente. Students who are interested in either graduation projects or internships can also check the University of Twente's internship database for potential opportunities with us.

If students want to express their interest, they can reach us via email at jobs@technolution.nl. We are always open to engaging with enthusiastic students and potential future collaborators, and we encourage them to explore these avenues for connecting with Technolution.

From the Chairman

Don't be scared to be unprepared



By: Twan Weerdenburg
Chairman 45th Board of Inter-Actief

When I started my second year of TCS, I hadn't even thought about becoming a board member, let alone becoming chairman. Yet here I am now, the 45th chairman of Inter-Actief. In this column I will share my experiences on becoming a board member of Inter-Actief, and how we as a board are looking to improve the association.

Deciding to become a board member is a journey different for everyone. Some people know from the start of their study that they will do a board year, others only think about it a week before the enrollment deadline. I myself was part of the latter. But even though the rest of the board was much more prepared for their job, we got along well and we quickly started our journey on becoming a board member. And before I knew it, I was just as involved as the rest of my board.

During the weeks of our candidate board time, we were introduced to what it means to be a part of the Inter-Actief board and what responsibilities you will have during the next year. Not only did this include taking care of the Inter-Actief room and its surroundings, but also attending three meetings a week, meeting fellow candidate boards, and getting oriented on all tasks and responsibilities for next year. All of this sounds very intense and tiring, and quite frankly, it is. Nevertheless, these weeks flew by and before we knew it, the summer holidays started and we had to write our policy plan.

Speaking from my experience, writing a policy is the most difficult task of a

board. Not that we did not have any ideas for our policy. On the contrary, we came up with a whole laundry list of plans and visions for Inter-Actief. Here the difficult task arises: choosing the final points you want to execute. It is at this stage that my task as chairman was fully needed for the first time, and if I am being honest, it did not go well. But the more discussions about our policy we had, the more I learned and the better it went.

It is at that moment you realize have you have grown during your time as a candidate board member. From being unsure about becoming a part of the next board, to being able to confidently make plans about a study association of 1400 members.

Then, after the holidays, the moment is there: the change of the boards. Suddenly, it is your task to lead Inter-Actief. Luckily, there was no time to be stressed out, as the first few weeks of our board year are completely cramped with activities. We organized bowling evenings with the freshmen, a workshop about what it means to be an active member, and the committee market where you can find all committees Inter-Actief has to offer. It is at these moments where you get to meet members, and for them to meet you. And as we all know, knowing your members is one of the most important parts of being board.

After these first intense weeks, the time has come to fully focus on our plans for the upcoming academic year. You might have already seen our "How-to" flyers lying around, which we introduced this year. They are aimed to guide all students, and especially freshmen, during their time at Inter-Actief and the

University of Twente. To further help students along their student journey, we are organizing project group meetings and active member trainings. However, these are not the only events you can participate in. During the year we will host study evenings, sporting activities, LAN parties, a prom, our famous Tuesday afternoon drinks, and much more! Nervous to sign up for such an event? So was I when I signed up to become chairman, yet I am here now with zero regrets. And if I can do it, I am 100% certain you can too!

Finally, if you want to know more about us and the study association, you can always stop by the Inter-Actief room! Here you can meet your fellow students, grab a snack from our cookie corner, work at one of the workstations, or take a moment to relax while playing on our Wii. Do you have any ideas or feedback for us? This too can be left at the association room, or you can send an email to goodidea@inter-actief.net.

See you soon at Inter-Actief!

About Twan

Twan was born 20 years ago, on the 24th of May in Haarlem. Here he graduated from Atheneum College Hageveld, and shortly afterwards moved to Enschede to follow his love for Computer Science. Having studied TCS at the UT for two years now, he has become quite active at Inter-Actief, having organized the international business course to Lissabon, and now he is the chairman of the 45th board. When not busy with being a chairman, you can find him at the Tuesday afternoon drinks, playing hockey at DHC Drienerlo, or enjoying a night out in the city center with friends or housemates.

From the ENIAC Board

Diving into your first job



By: Koen Braham
Secretary ENIAC

Some might fear this for years, others might look forward to it. After a few years of enjoying the University of Twente as a student and all it has to offer next to your courses, it is time to look for your first job. But what should you do? Do you want to go into an advisory role? Craft software with your engineering skills? Or mentor others looking forward to stepping into Technical Computer Science? Options are plenty, allowing you to combine these aspects as you see fit.

Computer Science is such a diverse field with cyber security, data sciences and software technology boosting most of the businesses today. It is important to pick something you enjoy doing, as it is quite the change from waking up at eleven and doing some coursework until late in the evening to catch up again.

Keep in mind that your job is not just the technical skills you have learned, equally important is the human or social factor. How do you transfer knowledge? Are you a team player?

You do not have to win all arguments, but it is good to be able to articulate your ideas based on new insight. That will help a company move forward to apply state-of-the-art technology into their practices. Therefore, as you start, try to have some one-on-one chats with your new colleagues, even if it is just briefly while getting coffee. Learn what keeps them busy, or what could be improved in day to day work. Sometimes these chats and improvements are small things that you can already pick-up in your first weeks on the job, because those are usually dedicated to introduction and training. These opportunities help

you to immediately create a bond with your team and directly get involved with the items you will be working on.

For myself, the first adventure was consulting for an embedded Linux project. The team size was five members, having four software engineers and one test engineer. Most of the software was written in C++ and that is what the team excelled at, creating applications with Qt. A smaller part was Python, used for secure communication with cryptography modules. As only one team member was familiar with Python and the crypto that was used, it opened opportunities for me to step in this knowledge gap and apply the fundamentals I learned. I bonded quickly with my team members as I could join in on both C++ and Python parts of the project.

Time to orient yourself! Where do you want to start? As an alumni organization, ENIAC organizes events to meet your fellow computer science alumni. As a member of Inter-Actief you are also welcome to join ENIAC activities such as the regional drinks. Feel free to ask around among the alumni and learn about the different work environments, atmospheres and learn about what work they do. And if you are at the end of your studies, maybe you can even get a heads-up about an interesting graduation assignment in their company!

Still looking for inspiration for graduation and your first job afterwards? Twice a year, ENIAC organizes speed-dates to get students directly in touch with companies, and to discuss graduation options. Companies will introduce themselves by talking about their work field, skills they are looking for and options for assignments. In rounds of five

minutes you can chat with them on a technical level to find the ultimate graduation topic to pursue and what would be required to set up such a project.

About ENIAC

The ENSchedese Informatica Alumni Club - ENIAC - is the alumni association for Computer Science (TCS), Business Information Technology (BIT) and related masters at the University of Twente. Membership starts from only € 5,- per year. As a member you will receive all I/O Vivats published during the academic year, usually up to four. You are invited to all organized events. Most of these events are free to join for members. Even more important, it helps you stay connected with your roots and students from your time at the University of Twente!

Activity Calendar

Budget GMM with activity - December 16th 2023

Regional Drink Enschede - City Center - January 26th 2024

Financial GMM 2023 with activity - March 2nd 2024

Regional Drink Utrecht - April 5th 2024

Graduation Speeddate - May 22nd 2024

Regional Drink Leiden - May 31st 2024

family activity - June 22nd 2024



Will AI take over?

The current state of human-AI collaboration



By: Erjan Steenbergen
Editor I/O Vivat

Nowadays, you often hear people say that “Robots will surpass our intelligence” or “We will lose our jobs because of AI”. There is certainly a growing trend towards the importance and potential of artificial intelligence in jobs and daily life, which causes people to conclude the outcome of AI replacing human workers throughout every industry, or even humans in general, to be inevitable. I do agree that these recent technologies will change our ways of working and living, though humanity is not planning to create mechanisms that replace us. Instead, “the technology’s larger impact will be in complementing and augmenting human capabilities, not replacing them” [5]. In this article, we will explore the potencies of ‘human-AI collaboration’ (HAIC): Why do we use it, where is it used, and how will it affect our daily lives?

Humanity is endlessly creating new inventions to increase the productivity and efficiency of our daily lives. Artificial intelligence and machine learning have been main sources of modern technology that is an integral part of new tech and will continue to be so. The stereotypical feature of AI design being a “black box” that can outperform humans in certain tasks limits the capability of humans and machines working together, as it usually provides incorrect explanations of AI’s choices [1]. This is where HAIC takes its place by changing this stereotype and making the collabora-

tion between these two sides plausible.

But what is in it for us? The main aspect to look at is what we as humans excel in, and what AI does better than us. Machines are made to be incredibly good at crunching numbers and humans are amazing at their social and imaginative abilities compared to machines. This symbiosis increases the productivity of employees. A recent survey [5] of approximately 1500 organisations across several industries, found that employees achieve a substantial performance boost when working with AI.

You are most likely a user of HAIC already. Think of ‘virtual assistants’ like Siri or Google Assistant. These bots use cognitive computing to respond to humans, making human-like conver-

sations possible. Cognitive computing refers to the processing of signals and creating behavioural patterns by analysing these signals and acting more human-like.

Another example is self-driving cars. Of course, not everyone drives a Tesla, though it is common for most newer cars to have adaptive cruise control. These advancements make driving more of a job for the AI, though a human can always jump in if the outcome needs to be changed as crashing is not ideal and to ensure a person is legally responsible.

These Teslas are made in a car factory, where robotic arms collaborate with human workers to put together the parts of a car on the conveyor belt. The robotic arms do the boring, dangerous and



Figure 1: Cars parked outside Tesla’s manufacturing plant

repetitive tasks that humans did before, while being more efficient to humans as well: The idle time is reduced by 85% when HAIC is implemented at manufacturing sites [2].

Another industry that has integrated human-AI collaboration is the healthcare sector, where AI algorithms are used to analyse medical data. These analyses are then used to aid doctors in diagnosing diseases more accurately and efficiently than humans alone can do. By having this cooperation, doctors can enhance their decision-making capabilities, leading to improved patient outcomes and overall healthcare quality.

It is not rare to find a conversation about AI nowadays. Typically, the talks are about people being scared their jobs might be taken over by ‘robots.’ According to American research, around 82% of people think that robots and computers will replace most of the work we do right now [3].

Despite concerns about job displacement, studies show that human-AI collaboration can lead to job creation and an overall increase in productivity. According to the World Economic Forum, by 2025, the integration of AI could result in the creation of twelve million new jobs [2,4]. This is because AI technology often complements human capabilities rather than replacing them entirely. By automating repetitive and mundane tasks, AI allows humans to focus on higher-level cognitive activities that require creativity, critical thinking and emotional intelligence.

This is not the first time people have been uncertain about their jobs being displaced by AI/computers. In the computer science field, this has been a recurring hot topic for decades now.

From the first programming languages allegedly taking over the jobs from programmers that were still punching holes in punch cards, to fourth generation languages (4GLs) taking over the jobs from programmers in the 1980s, because ‘everyone could code now’. Although the first programming languages did make punch cards history, 4GLs failed to become mainstream, the outcome was still the same: programming as a job never went away, either because new technology created new jobs, or new technology failed to get applied to society.

In the beginning, I stated that people are scared that AI will take over humans ‘in general.’ What I meant by this, is that a part of society expects a dystopian future, like in the movie Blade Runner, or the Black Mirror tv series. While I do not think this will happen anywhere close soon, how much and what kind of effort will it take for it to be real?

War. An action of prolonged conflict that is usually ‘won’ by the party having the most technological advancements. A clear example would be the war between the Spanish conquistadors and the Aztecs between 1519 and 1521, during the battle of Tenochtitlan, where the Aztecs suffered a loss of more than one hundred times the casualties as the Spanish Empire, as Spain had advancements like nitre and steel, thus being able to make cannons and steel armor, making easy work of the Aztecs.

In our current developed world, we will not find scientific differences as large as what happened in the 16th century, though every nation nowadays still needs to keep up with current research, given they want to have a say in the world. As the potential of AI is immensely high, it is important to note that it

can also be used for militaristic intentions. Think about autonomous weapons systems, like drones, or using predictive algorithms to make identifying threats easier. These deployments of course raise ethical considerations, but in the end, AI works like a machine. It is not inherently good or bad, it ultimately depends on how we use it.

The fear of the inevitable job displacement by AI is overstated for decades now. Paradoxically, studies show that AI will improve the productivity of current jobs and will additionally create more jobs, as it has previously done. What the impact of AI is on our lives is our own decision. AI will not decide the shape of our future, we will decide how AI shapes it. Given we as humans create new things to make ourselves more efficient and grow as a society, it would not make sense if we made ourselves redundant, right?

References

- [1] <https://dl.acm.org/doi/abs/10.1145/3334480.3381069>
- [2] <https://dspace.mit.edu/handle/1721.1/63034>
- [3] <https://www.pewresearch.org/short-reads/2019/04/08/how-americans-see-automation-and-the-workplace-in-7-charts/>
- [4] <https://www.weforum.org/press/2021/01/world-economic-forum-launches-new-global-initiative-to-advance-the-promise-of-responsible-artificial-intelligence>
- [5] <https://hbr.org/2018/07/collaborative-intelligence-humans-and-ai-are-joining-forces>
- [6] <https://arxiv.org/abs/1810.03292>
- [7] https://commons.wikimedia.org/wiki/File:Punch_card_Fortran_Uni_Stuttgart_%283%29.jpg

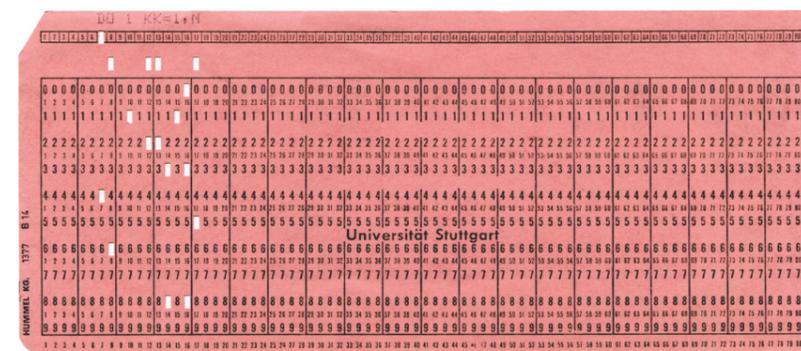


Figure 2: Punch card [7] as used by ‘legacy’ programmers

James Webb Space Telescope



By: Daan Wensink
Editor I/O Vivat

On April 24th 1990, American space agency NASA launched the Hubble space telescope. At the time it was the best telescope possible, and a major achievement. But as 1990 is now more than 30 years ago and Hubble has become slightly outdated, a new telescope called the 'James Webb space telescope' (shortened to JWST) was launched on the 25th of December 2021.

Infrared > Visible light

The difference between the two telescopes is that the capabilities of the Hubble telescope were based mostly on visible light, while the JWST's capabilities are based mostly on infrared. JWST also has spectrograph instruments built in, which allows it to detect which elements are present on distant stars and planets. This allows JWST to make images of (far) more distant stars and galaxies.

As distant galaxies emit visible light towards the Earth, the wavelength increases based on the distance traveled, and the light will become infrared light. This is due to a phenomenon known as red shifting. Red shifting is mostly caused by the Doppler effect. Because the universe is expanding everywhere at the same time, more distant galaxies have more space between the Earth and them, which means they cover more expansion and move away from the Earth

at a higher rate. The light waves from those galaxies are then experienced as having a higher wavelength (infrared). This phenomenon can be experienced in a practical manner on earth: the noise from an ambulance differs depending on whether the ambulance is moving towards or away from the observer.

Another advantage of the JWST because of its use of infrared, is that it has less

interference from dust clouds between it and the object it is trying to photograph. Space is not empty, there are dust clouds, and the further away a target is, the more chance there is that a dust cloud blocks the light. But infrared can travel through dust clouds, and can thus always be detected.

Being able to make images of further away stars and galaxies is important



Figure 1: Image of the 'birth of a star' taken by JWST
Credits: NASA, ESA, CSA, STScI, Klaus Pontoppidan (STScI)

as it can help determine what the universe was like in its earlier stages. The light from a galaxy which is 13 billion light years away from Earth has to travel 13 billion years to get to Earth. If a telescope can then detect this light and make an image, this allows the telescope to make images which are '13 billion years old' which can tell us what galaxies were like when the universe was just starting.

Different Instruments

The JWST uses 4 different instruments to take measurements and images. The first of which is a near infrared camera. This instrument makes images based on the infrared waves with a wavelength between 0.6 and 5 microns (one millionth of a meter). This wavelength is mostly emitted by young stars and galaxies, possibly while in formation. It also comes equipped with a coronagraph, which can take images of an object in orbit around a much brighter object, like an exoplanet around a distant star.

The second instrument is a near infrared spectrograph. A spectrograph can split the light from an object into the light spectrum made of the light's different wavelengths. The JWST near infrared spectrograph operates on the same wavelengths as the near infrared camera, and it will be used to determine physical properties of the objects the JWST is studying. A measurement using this instrument takes hundreds of hours of exposure, so the JWST has a special

microshutter array, which is a hundred tiny shutters which can be controlled using a magnetic field. This allows the JWST to make a hundred spectrograph measurements at the same time.

The other two instruments are mid-infrared versions of the first two instruments. The difference between near infrared and mid-infrared is that mid-infrared has a larger wavelength, near is between 0.6 and 5 microns while mid is between 5 and 28 microns. This allows the mid-infrared instruments to observe and measure different objects like comets, newly forming stars and the earlier discussed red-shifted objects that are very far away (mostly galaxies).

With all these groundbreaking instruments, the JWST has been able to do a lot of different measurements, and a lot of new discoveries and images have been made. The next few paragraphs will discuss a few of these discoveries or images.

Groundbreaking discoveries

On June 19th 2023, NASA shared a discovery made with measurements from the JWST about an exoplanet named Trappist-1 c. Trappist-1 c is a planet very much like Venus, it has a similar size and receives comparative amounts of radiation from its host star. Therefore, it was assumed to also have a thick carbon dioxide atmosphere like Venus. With JWST measurements of the amount of infrared light (of 15 microns) NASA scientists were able to determine

the temperature of the day side and the night side of Trappist-1 c. These measurements instead indicate that the planet most likely either has no atmosphere, or a very thin CO₂ atmosphere. This indicates that Trappist-1 c formed under conditions with very little water. If the other Trappist-1 planets were formed at around the same time under the same conditions, they will most likely not have much water, and the possibility of habitability will be lower.

On April 24th 2023 NASA posted an article about making images of one of the oldest known galaxy clusters. What makes these pictures so special is that the cluster is very far away, and by determining the red-shift (which relates to the distance) they were able to determine the light received from the galaxy is from 650 million years after the big bang. This means the picture is very 'old'. The cluster is only 7 galaxies in the image, but is expected to grow a lot. The image could be taken by using a different cluster, the Pandora cluster, as a type of lens. As the gravity of a galaxy cluster bends space itself, making objects behind it seem bigger, a phenomenon known as gravitational lensing.

On June 6th 2023, the JWST detected the first instance of a crucial Carbon compound (CH₃+) in space, which is believed to aid the formation of larger Carbon molecules needed for the existence of life. The discovery of this compound gives more information about how the building blocks of life are formed in space, and thus the origins of life itself.

These discoveries are only a few of the discoveries made by the JWST, and the JWST is expected to continue to produce many more discoveries which will be crucial for understanding the universe around us. The telescope will also continue the search for evidence of life on other planets. The NASA website regularly posts updates and images, which are definitely worth a look.

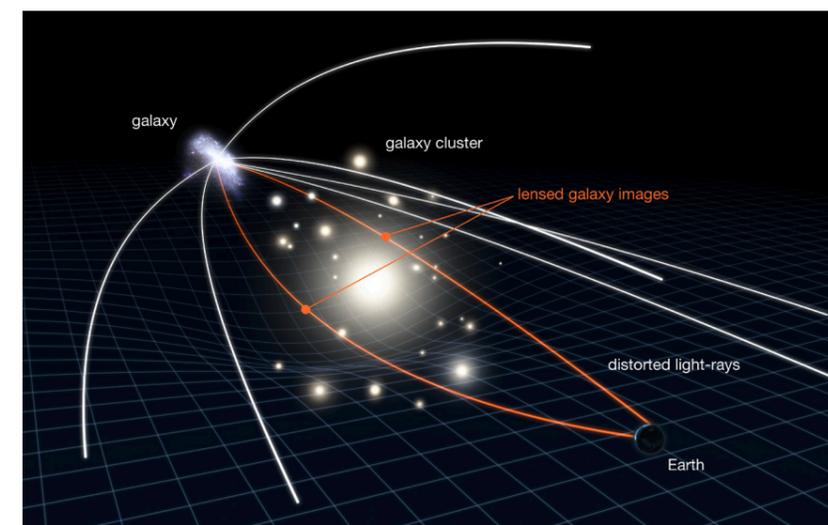


Figure 2: Gravitational Lensing
Credit: NASA, ESA & L. Calçada

References

- [1] <https://www.nasa.gov/feature/goddard/2023/webb-celebrates-first-year-of-science-with-new-image>
- [2] <https://esahubble.org/images/heic1106c/>

Beyond books and lectures

What Inter-Actief can do for your educational career



By: Daniel Jonker
Officer of Educational Affairs Inter-Actief Board

During the upcoming academic year, there are many paths open to you, such as pursuing a career, experiencing student life, and, above all, studying. With that in mind, Inter-Actief is here to give you the study assistance you need. In this piece, I'll tell you about some of the things Inter-Actief can do for you, as well as what we do for the study. I will also explain what I do as an educational affairs officer on a daily basis and how we may assist you.

To start with, let me explain what we have to offer to you as a student. As a study association, you would at least expect us to provide some sort of discount on books and you would be correct because you can get your study books through us for a lower price than if you would have bought them yourself. However, we offer so much more than just study books! In addition to study materials, we offer various forms of aid, such as a tutoring network with tutors who can assist you. This is also advantageous if you want to become a tutor yourself. If you are looking for extra practice alongside tutoring, you can obtain extra practice by visiting our exam database, which contains a large number of exams. You can even deliver your exam to us and receive cookie corner credit in return.

We are directly involved with the faculties of Business & Information Technology (BIT) and Technical Computer Science (TCS). If you have a problem with your course and have previously spoken with a teacher but are still dissatisfied, you can make a complaint on our website (inter-actief.utwente.nl). Because we have direct contact with the

faculty, we can determine how to deal with a complaint and communicate with the appropriate persons. Furthermore, we invite faculty members to our activities and create arrangements that allow students to interact directly with them in a different setting.

In addition to assisting students with the resources we provide, I am involved in numerous meetings with staff and students. This enables me and the association to better understand the studies' current situation and ensure that we have a voice in how the studies are carried out. This is significant since there are advancements concerning Inter-Actief from both the university and the students' perspectives. I participate in consultative committees within the university, such as the programme committees of BIT and TCS, as well as meetings dedicated to solely the bachelor programmes of TCS and BIT. Relevant topics concerning the current state of education and the future of the courses are considered in these committees, such as how some modules are going forward and future advancements that are relevant study-wide. Another of these committees is the CEEP, which is an independent committee, in contrast to the aforementioned ones. This committee handles the evaluation of courses where students can give feedback and a report is produced.

In addition to meeting with university-focused consultative committees, I also meet with student-only committees. This is made up of our own Education Committee as well as the CEO, which is a gathering of all educational affairs officers from all study associations. We discuss university-wide issues, such as changes in the field of education in ge-

neral, and it also serves as a consultative body for the university, with the CEO providing important feedback.

I hope this article provided you with significant insight into what Inter-Actief can do for you, as well as the numerous things that are done solely to improve your educational career. Remember that we are here to help you achieve your academic goals and make the most of your university experience as you embark on this exciting chapter of your life. Accept the help, embrace the opportunities, and allow Inter-Actief to lead you beyond books and lectures on a joyful educational journey.

About Daniel

Daniel Jonker was raised in Hilversum, the city that produces all national television. He is currently 19 years old, but this could change from time to time.

Daniel began his career at Inter-Actief as a member of the Christmas committee. Eventually, he moved on to organising the RIAlly and joining more committees. In addition to that, he is the leader of a scouting organisation at home. But most importantly, he is also the officer in charge of educational issues, so his official title is 'Officer of Educational Affairs'. This implies he is involved with everything related to education at Inter-Actief. He is up to date on current events and has connections within the university to improve education. If you have any questions, thoughts, or suggestions for him, please contact him by email at education@inter-actief.net.

Inter-Activities: Turing's Tower



By: Hanna Gardebroek
Secretary TakeshCie committee

Around two years ago, a small group of active members came up with the idea to create an event based on Takeshi's Castle, a Japanese show that originally aired on the Tokyo Broadcasting System (TBS) from 1986-1990. The show featured a count named Takeshi who owned a castle and set up difficult physical challenges for players to get to him. The most famous of which was a maze in which Takeshi's henchmen hunted down the players dressed in scary costumes. Despite the show ending many years ago, its cultural impact can still be felt today. The show has many international adaptations and reruns of the original are still on the air in some countries. Its format has also inspired many other famous shows, such as American Ninja Warrior and Wipeout.

Of course, it was impossible to do everything Takeshi's Castle did, as the show had a very large budget and absolutely no regard for human safety. Contestants were often physically hurt in the

challenges, much to the amusement of count Takeshi. So, a few adjustments had to be made in order to have a similar event here on campus. Working out which challenges were possible and which were not was a large part of the committee's job, the challenges in the event were all based on challenges seen in the show, but only ones deemed safe enough for contestants. Another big part of adapting the show was picking a name for the event. The committee eventually decided to go with Turing's Tower, based on the famous mathematician Alan Turing.

On June 3rd, the day of the event, people dressed in all sorts of strange outfits were lining up in the burning heat at the Kampeerveld to face six challenges. After a quick warm up by the committee, dressed in kimonos and sweatbands, the participants were off! The first challenge they had to face was called "Skit-tles", a game where participants acted as living bowling pins that could be struck down by a giant inflatable ball that was thrown off of an inflatable hill. If they survived, they could go on to "Blue-

berry hill": a red light/green light or "annamaria koekkoek" like game where they had to walk over a slip-and-slide and if they moved at the red light got shot at with paintballs. After this was "Pie or die", a game of chance where you might get a pie thrown in your face. Followed quickly by the star of the show: the "Square maze"! Much like in the original Takeshi's castle there was an actual maze with people in costumes hunting the participants that were trying to make it to the other side. After this the participants had to put on horse costumes and skate to the other side of a street in "Rollerderby run" and finally in "On your bike" they had to ride mini bikes and play a game of Tug of war with an object they could not see, ranging from a teddy bear to an actual truck.

The ten participants that survived all six of these challenges moved on to the final, each of them got a target strapped to their chest and two large skelters rolled up to the Hogekampplein. These skelters could seat 10 people each, and the surviving participants had to face off in an epic water gun fight against the committee! In the end, after a long fight which may or may not have almost wrecked one of the skelters, the participants defeated the committee and the battle was finally over.

Interested?

Check out pictures taken of the event at the Inter-Actief website! There were also video recordings made of the event which will be turned into an epic episode of Turing's Tower!



Domain Name System (failure)

Ancient Technology Ruling the Internet



By: Wouter Kobes
Alumnus

During my studies at the University of Twente, I developed a fascination for the Domain Name System (DNS). How could a thirty-five-year-old, insecure-by-design, barely standardized system still be among the most widely used technologies today? Even with the additions of various security and performance improvements in the past decades, the DNS remains a quirky part of the Internet. During my graduation research on domain name management, I took ample time to get to know the dark, funny and sometimes scary properties of the DNS. In this article, I will guide you through some of these facts that may raise your eyebrows.

History and basics

The purpose of the DNS is to resolve domain names. 'utwente.nl' is an example of such a domain name, consisting of two labels 'utwente' and 'nl'. Typing 'utwente.nl' in your browser does not tell your computer where the UT servers are. Therefore, it queries the DNS for its corresponding IP address. This works in a hierarchical way: starting at the root, you are redirected to the server for 'nl', which in turn redirects you to the server that knows the IP address for 'utwente.nl'. A fully qualified domain name is supposed to end with a dot, indicating the root (empty) label at the end.

The DNS is a distributed system and in

1985 replaced the single shared 'hosts.txt' file that was used for this purpose until then. Its 'formal' specification was captured in standards RFC 1034 and 1035 [1], although plenty of choices are left for actual implementation. So far, it appears as a simple process, with a straightforward goal and a suitable solution. *Let's get to it.*

Insecure-by-design

A mere five years after its conception, major security design flaws are found in DNS [2]. Basically, the distributed system did not provide for any trust anchors, with which you could confirm that a DNS response was genuine. Instead, anyone could reply to your DNS query and redirect you to an IP address controlled by them. *Not good!*

Several improvements were made to mitigate this type of vulnerability, yet

the 'full fix', being the DNS Security Extensions (DNSSEC), is far from being fully adopted. That means that the majority of the DNS infrastructure, in theory, remains vulnerable to this thirty-year-old security issue. *Nice going!*

The secret of the trailing dot

As mentioned earlier, domain names *should* end with a trailing dot. Yet, in our daily use of domain names when navigating to websites, this is not used... Right?! Well, citing RFC 1034: "[...] a multi-label relative name is often one where the trailing dot has been omitted to save typing."

This means that for DNS, 'utwente.nl' is the same domain name as 'utwente.nl.'. This is where it gets grim. While the DNS might see them as equals, in the eyes of browsers, these are two different domain names. This means cookies,

sessions and the like, are not shared between these two. To make matters worse, since both variants are valid values for the 'Host' header of the HTTP protocol, web servers can differentiate between them as well. We observe this in practice at our own University, as the UT domain name with a trailing dot currently gives a 404 error, instead of the UT website (Figure 1).

The obscure specification of DNS might have saved us from writing one extra dot all the time, yet has given us two ambiguous domain names with unpredictable behavior in return. Fair trade, or a bad idea?

Internationalized Domain Names

Not too long after the emergence of DNS, people realized that restricting domain names to Latin/ASCII characters only would not really contribute to the concept of "one world, one Internet". Yet, any programmer knows that handling foreign scripts can be a real pain. For so-called Internationalized Domain Names (IDNs), the solution was found in using Punycode, a representation of Unicode using only ASCII characters [3]. I won't dive into the details here, but all IDNs start with 'xn--', followed by the representation in ASCII. For example, münchen.com would translate to xn--mnich-kva.com. Since regular domain names may not contain two hyphens in a row, this unambiguously indicates an IDN. This way, local scripts can be used in domain names, while barely impacting the technical implementation of DNS. So far so good!

The *bad* thing about Unicode in the context of IDNs is that it contains so many characters. Many scripts use characters that are identical to an ASCII letter, yet are different characters in

Unicode. Unicode also contains emojis, many of which are hard to distinguish from each other. You can see the problem here, unrestricted use of Unicode in IDNs is a recipe for disaster.

While being a bit late at the party, the Internet community saw this problem too and restricted IDNs by means of the IDNA2003 protocol, later superseded by the IDNA2008 protocol [4]. Among others, IDNA restricts the usage of emoji and the use of multiple scripts in a single domain label. Sadly, these protocols came too late to prevent the registration of some troublesome IDNs, for instance xn--n3h.com (the snowman emoji WITH snow, the one without is not registered, Figure 2).

Even with IDNA, dubious domain names can still be registered. In 2017, a security researcher registered the IDN xn--80ak6aa92e.com. These days, you will most likely get a security warning from your browser, but this IDN uses Cyrillic characters that look identical to the word 'apple'. Thus, while using a single script in the domain name label, a company name in the Latin script has been successfully imitated.

Forever unencrypted?

Another classical issue with DNS is that in its original design, the protocol is not encrypted. While our actual website traffic is mostly encrypted these days through the use of HTTPS instead of HTTP, encrypted variants of DNS are slacking behind. In July 2023, less than a quarter of all DNS queries from the Netherlands were encrypted [5]. This results in a potential leak of all domain names that you have visited (or at least resolved).

Interestingly enough, two quite suitable



xn--n3h.com is registered



xn--58h.com is not registered

Figure 2: Some emoji-based DNS hostnames were registered before the IDNA protocols

solutions exist for DNS encryption already. DNS-over-TLS (DoT) uses a TLS encryption scheme, similar to HTTPS. DNS-over-HTTPS, in contrast, encapsulates the DNS request inside an HTTPS request, making it barely distinguishable from regular website traffic. As far as I can see, the question should not be if we want to encrypt all our DNS traffic, but rather by which means.

Internet governance

Finally, I wanted to spend a few words on how the DNS is governed and how you could contribute to it. As explained, the technical foundations are outlined in RFCs. These documents are monitored by the IETF, yet anyone in the Internet community can contribute to them. If this article raised your interest in the technical foundations of DNS, be sure to get involved in related mailing lists. Perhaps, you can prevent the next 'epic fail' that would have been added to this article.

Policy on domain names, top-level domains and the like, in contrast, are set by ICANN. This non-profit organization is operating by a multi-stakeholder governance model in which individuals, organizations, industry, and governments collaborate. The discussions here can be of technical nature, yet you can expect quite some politics as well. If this sparks your interest, be sure to check out the introductory programs they offer specifically for students [6]!

References

[1] <https://datatracker.ietf.org/doc/html/rfc1034> & <https://datatracker.ietf.org/doc/html/rfc1035>

[2] https://www.usenix.org/legacy/publications/library/proceedings/security95/full_papers/bellovin.pdf

[3] <https://en.wikipedia.org/wiki/Punycode>

[4] <https://datatracker.ietf.org/doc/html/rfc5891>

[5] <https://stats.labs.apnic.net/edns/NL>

[6] <https://www.icann.org/public-responsibility-support/nextgen>

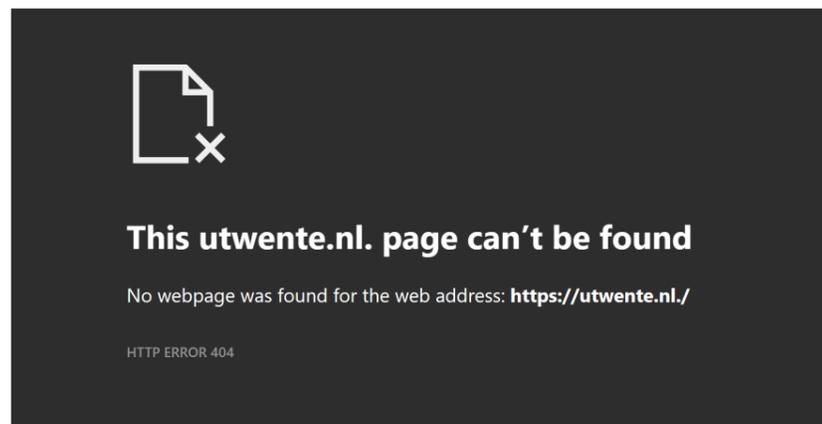


Figure 1: utwente.nl. is not recognized by UT's web server

Instant Insanity

Activism

What you can do next to your studies?

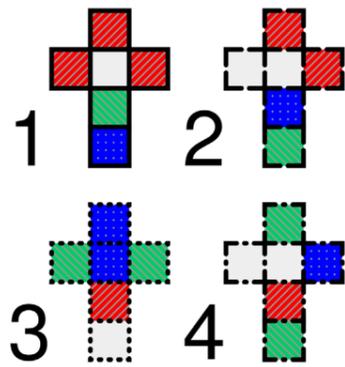


By: Filip Karkalasev
Editor I/O Vivat



By: Mathijs Vogelezang
Officer of Internal Affairs Inter-Actief Board

In this section I would like to try something different in proposing a puzzle to you all. In the game of Instant Insanity, where 4 cubes are used, each side of a cube is painted one of the colours red, green, white or blue. For example in the following way:



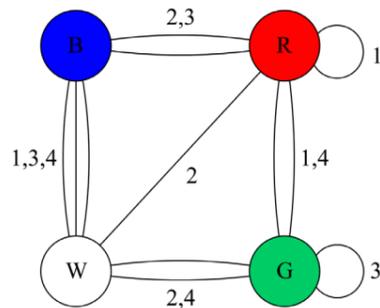
Depending on how the cubes are coloured, there may or may not exist a solution. A solution being that the cubes are placed in a column (or row) of four such that all four (different) colours appear on each of the four sides of the column. This is an example solution:



One observation, which is useful in solving the puzzle, is that with three pairs

of opposite faces there will be at most three ways to place cube 1 (and any other cube). This is because it makes no difference whether we place the green face on the table or the opposite red face on the table: the middle layer will stay the same.

We can represent this information in a graph, where each colour is a node and an edge is drawn between two colours if they appear on opposite sides of any of cubes 1-4. In addition, the edge is labelled with the number of the cube on which these opposite colour sides appear. For our initial colouring, this gives the following graph:



Suppose we had an arrangement of cubes that was a solution. Then, from each cube, pick the edge representing the colours facing front and back on that cube. These four edges are a subgraph of our original graph. Furthermore, to form a solution to instant insanity, each colour appears once on the front face and once on the back (there is another subgraph for the left and right faces of the column). This means that for our subgraph, each vertex has degree two.

We can get another subgraph satisfying these two properties for the left and right faces of the pillar. Furthermore,

these two subgraphs cannot have any edges in common.

So, to find a solution to instant insanity, we must find a pair of subgraphs S1, S2 such that:
- Each subgraph has one edge with each label 1,2,3,4

- Every vertex of a subgraph has degree 2

- No edge of the original graph is used in both S1 and S2

Can you find an arrangement of cubes 1,2,3,4 such that the example solution is satisfied?

Participating

Solutions can be sent to ioivat@inter-actief.net. We will give away two cinema vouchers to those who did send in a correct solution.

We will publish the solution to this puzzle next edition.

While you were enjoying the Kick-In you have probably seen that there is a lot to do at the University and in Enschede. You have probably also seen the numerous associations the University has.

I would highly recommend joining one (or more) of these associations, whether it is a sport, culture, study, or student association, it does not matter, you will definitely have lots of fun at one of these associations. Next to having fun, you can also become an active member of such an association. As an active member, you will organize activities and/or help out at activities or behind the scenes. Doing this is a really enjoyable way to spend some of your free time and it lets you develop yourself in ways that are different from your studies and you will get experiences you would never have thought of! You will develop your social skills and improve your teamwork skills, and along the way you will make some good friends!

At Inter-Actief we also have a lot of active members in different committees. Almost all of our activities are organized by a committee, this can be as small as a game night or as big as the Kick-IT



camp, you name it! The camp itself was organized by a committee, and many other committees have helped during the camp, either by organizing an activity or by helping behind the scenes like the EROes and bartenders. These activities all exist thanks to the effort of all our amazing active members. If after reading this you think that this is something for you, or if you have any questions, don't hesitate to talk to the officer of Internal affairs (or any other board member), you can find us in the Inter-Actief room or you can send an email to internal@inter-actief.net!

Next to the camp, there are lots of other (recurring) activities organized by Inter-Actief. For example, every Tuesday there is a drink where you can hang out with your friends and fellow students while enjoying a nice beverage and maybe some games. Another activity that is organized every half a year is the LAN party. The LAN party is a weekend-long event where you will play games the entire weekend. There is always a competition with games based around a theme where you can even win some prizes. We hope to see you at one of the many activities Inter-Actief has during the year, maybe one organized by you!

Internal Affairs

The Officer of Internal Affairs is the first point of contact if you want to become active at an association. This board function best relates to an HR manager in companies. The Officer of Internal Affairs focuses on the wellbeing of the association and its members. If members are not happy, this affects not only the current year, but years to come as these members most likely will not become active in the future. The Officer of Internal Affairs is also the one that can help you guide you through your activism path throughout an association. If you want to know more, keep an eye out for the committee markets or visit the Inter-Actief room.

Associations

Enschede has many sport associations ranging from 'normal' sports like football and field hockey to special sports like under water hockey and Quidditch. Several student associations exist, including 4 large ones in the Pakkerij in the city centre. Culture associations include associations for specific countries (Indian, Pakistani, etc.) and associations related to arts like cabaret and dance associations. Last, but not least, every study has an associated study association that can help to address study-related issues, gives discount on study books (the discount in the first year is often more than the total amount of membership that is to be paid throughout your time in Enschede) and help you in connecting with other students that follow the same study as you.

Resistance to Change



By: Ewout van der Wal
Editor I/O Vivat

In 2023, Artificial Intelligence will be the topic that defines the year. Proponents of the technology argue that it will change our lives radically, and if we believe all of the hype and hope it will bring about a revolution to rival the original industrial revolution that kick-started our explosive technological and societal improvements. Elsewhere in this issue, Erjan has written a more nuanced commentary on the efficacy and implications of this technology outlining the truths and myths of what AI can do.

The introduction of this new technology also exposes an issue that everyone is likely to run into at some point in their professional careers: people tend to resist change. As engineers, we are always looking for ways to optimize the world that we see around us. It can be tempting to dive headlong into picking apart each and every process in an organization in a desperate bid to unlock the full potential of the resources available to the organization. However, sooner or later you will find yourself burnt out with no progress to show for your enthusiasm and hubris. It almost seems as if the more you try to convince the people around you to change, the more you find they refuse to budge. *You are Sisyphus, and they are your rock.*

It is simple to put the blame on the people that are resisting the change. To say that they are unwilling or unable to change with the times. Even in the sci-

entific literature concerning change management, we considered the resistance to change an “irrational and dysfunctional response” [1] for a long time. However, more recent research has shown that resistance to change is much more than a one-sided unwillingness to cooperate and instead is something that is influenced heavily by the actions of the change initiator as much as the actions of the change recipient.

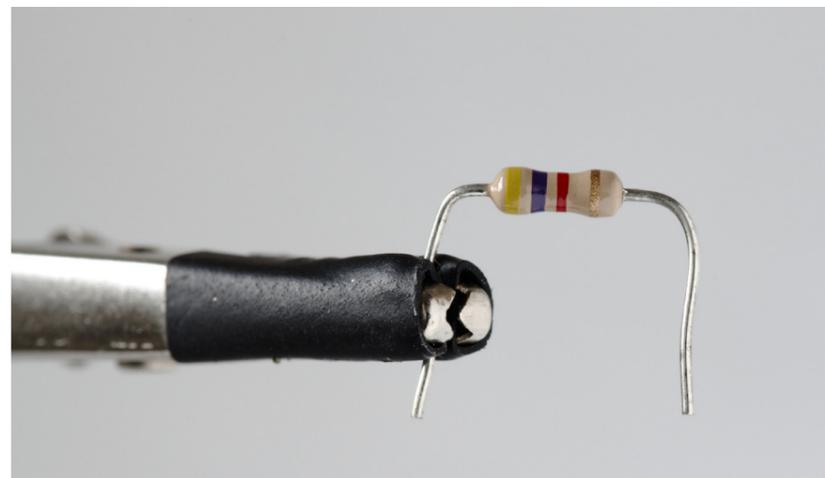
Let’s dive deeper into the factors that govern resistance to change and perhaps discover how we can foster cooperation rather than confrontation.

Expectations matter

We have established that the classic understanding of resistance to change is flawed. While it is easier to blame only the recipient of change, it is important

to understand our role as change initiators. A review of decades of scientific research into change found that managing expectations, providing strong reasoning, and preserving the agency of change recipients were critical factors in the success of a change process [1]. In other words, people tend not to like feeling misled or without control over their situation. Other researchers have found that the idea of losing power, status, money or comfort due to a change is what causes us to cling to the status quo [2].

Another factor that we have glossed over so far in this article is the name of the phenomenon we are describing. Perhaps the biggest contributor to resistance is the expectation that we will meet resistance. Resistance to change may be an example of a self-fulfilling prophecy that we are perpetuating



by framing our thinking of the phenomenon in light of resistance. Naturally, where we expect resistance we will act in such a way that we can protect ourselves and our ideas from this resistance. In turn, by becoming protective of our ideas we invite resistance by seeming unwilling to consider alternative options or opinions.

Finally, previous resistance will drive new resistance. When previous attempts at change have failed due to communications breaking down over mismanaged expectations or an attempt to push through a change that violated the agency of the recipient, new changes will be met with more scepticism and are less likely to succeed. This can lead to a cycle of resistance that can only be broken through conscious effort.

Resistance as a driving force

Luckily for us, resistance to change is not all doom and gloom. In fact, there is evidence that resistance is beneficial to the process of change overall.

One positive aspect of resistance is engagement with an idea. By generating more discussions focused on the change, more people will be exposed to the idea more often. These discussions can be leveraged to understand the reasons why resistance exists in the first place. The same people that will resist a chan-

“All changes, even the most longed for, have their melancholy; for what we leave behind us is a part of ourselves; we must die to one life before we can enter another” - Anatole France, 2016

ge are often the ones that will advocate a change once they understand and support the initiative.

Also, like how previous resistance to change will prevent a new change, a change that has been challenged and consequently accepted is more resistant to reversal. The inoculation against change that comes from resistance also cements a change in an organization in the cases that they succeed.

Dealing with resistance

Now that we have established that resistance can be a constructive tool in the change process, how do we use it as such?

First, we need to understand that resistance often does not stem from an unwillingness to change. Instead, factors such as previous experiences, misunderstanding the change, missing agency or fearing loss are likely to drive resistance. Instead of trying to prevent resistance, use the resistance to drive discussions and expose the plan to new ideas that you may not have considered.

Most change management techniques focus on the reduction of resistance by adversarial techniques. The idea is

that we can create understanding and therefore acceptance in change recipients by means of “information ‘battering’” [3]. Instead, we may find more success with a more open-ended

approach such as a Q&A session with the change recipients. So far, there is no clear-cut best practice for engaging people in such an open-ended conversation. In reality you will often have to carve your own path and find what works best for the situation at hand.

Conclusion

In short, resistance to change is a phenomenon that suffers from a poorly chosen name and unfair expectations. In theory, we would expect a positive change to be accepted with open arms. However, reality is messy and people are emotional beings. Resistance is a given that we can use to our advantage to test our ideas, find people who are invested in the change, and ensure that the change sticks once implemented.

Resistance is inevitable, do not fear the resistance.

References

[1] <https://doi.org/10.5465/AMR.2008.31193235>

[2] <https://doi.org/10.1177/0021886399351003>

[3] <https://doi.org/10.1108/00251749810232628>



Interview with Laurens, Maarten & Carmen



By: Hanna Gardebroek
& Wout Velthuis
Editors I/O Vivat



Chipsoft is a medical software company that specializes in software for hospitals. Our most famous product is the EPD (electronic patient record). The EPD is the core business of Chipsoft, which we continually update with new features.

Chipsoft was founded by Gerrit Mulder and his son Hans Mulder. Gerrit Mulder himself was a vascular surgeon in Amsterdam and in the late 1980s Hans had an idea: He saw the benefits automation could bring to the way invoices were handled. So Gerrit and Hans started to build a software product together and this product grew more and more. Because of Gerrit's colleagues and the demand for the product, it grew into what we know today as EPD.

Market Focus

The biggest difference with the competition in the Netherlands and abroad is that we specialize in the (Dutch) healthcare sector and its financial system. Additionally, our business model is that we offer a single, standard software solution, we do not make hospital-specific content or software. A hospital simply connects to our product.

We are still growing and also expanded into Belgium. Of course, in order to appease the Belgian market, we had to make adjustments specific for that market. But because our system is quite

flexible, we can switch more easily to other sectors. We are now also working step by step to expand our system to other countries.

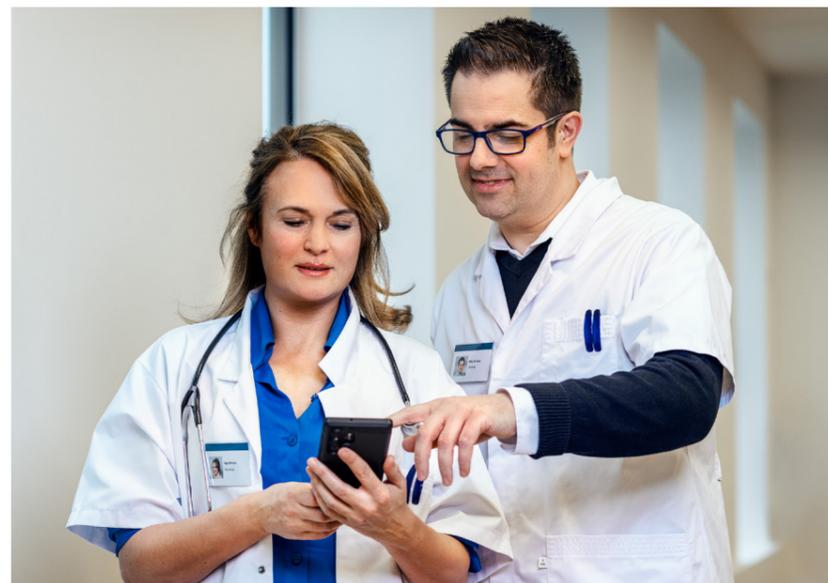
HIX

The updated version of EPD is called HIX, which actually comprises a large group of multiple modules. This allows our customers to choose different additional modules. As these modules complement our standard package, all our customers still buy our standard solution in order to join our offering. Then they can simply add these modules from their HIX account. Improving HIX is a continuous process with invaluable input from our customers. As part of HIX we provide an innova-

tion platform, allowing all customers to mention how we can help them better.

Most hospitals in the Netherlands are interconnected through HIX, allowing them to communicate with each other about patient data, improving care for their patients as well as improving our system. Of course, we have to put a big emphasis on the GDPR (AVG) and other (privacy) legislation.

Currently, we try to improve our offering by building new modules to use AI. Examples of these modules include those that involve drug prescriptions, possible complications after surgery, or predicting how many beds are needed at a certain moment in time.



With many additions within HIX, more people no longer need to go to the hospital but can stay at home and this saves both time and money for patients as well as on hospital staff. Keep in mind that these examples are only part of a much larger offering in HIX.

Challenges

Within Chipsoft, of course, there are some challenges that we have to face on a daily basis. One of the biggest challenges is GDPR (AVG), because while we want to be able to share patient data with other hospitals to improve overall care for patients, this has to be done in a secure manner of course. The endless debate between security and usability. Additionally, while we would like to develop as many new features as possible, we have to keep in mind that our customers cannot always keep our product up-to-date, due to it running on outdated hardware all throughout a hospital or other legacy limitations from the past.

Another challenge is that we ourselves are not a hospital and therefore it is not always easy to interface directly with end users that use our software on a daily basis. Also, due to security restrictions, we do not always have full system access, allowing us to debug a certain problem. Fortunately we do have our innovation platform where we can ask the customers what they would like to see. Our innovation platform allows us to combine medical knowledge from the end users with our software development knowledge, allowing us to continuously add features and improve our offering.



When we get a new client at HIX we immediately start planning, because it takes a lot of work to convert all the systems in a hospital to our system and it is our goal to limit the impact on the hospital as much as possible. In fact, we allocate only seven days for implementation on site, excluding preparation and testing days. At the end of these seven days we have a big launch day and celebrate together with the customer. Additionally, as a customer often has a wide range of people in different roles with different levels of tech-savviness, it is a challenge to get everyone well informed about our product and how it works. That is why we also give courses that we give to the customers of HIX, with intended audiences ranging from server administration to the billing department. We strive towards good explanations of each individual HIX module and everything that comes with it.

Another nice challenge we have actually starts with Chipsoft's market share. We currently serve about 60% of the entire market and even though we have such a large share we still try to move with the market. We improve constantly by using new technologies, as this is expected by the customer due to our market share. A paying customer expects a reliable and good product and also the updates that are needed to keep up with the times.

Students

Chipsoft has a lot to offer students, during their studies as well as afterwards. University (of applied sciences) students often start working here as a part-time job during their studies, or as graduation interns. Many people who

graduate here also stick with Chipsoft because of our primary as well as secondary working conditions.

We offer all students working for us a platform so that they can talk to each other, share ideas and help each other. These moments allow them to discuss their projects and how others would solve them.

Most student projects actually add something to Chipsoft's products and do not simply end up in a drawer. This attracts a lot of students, who can usually choose from assignments we have lying around. However if they have an idea of their own, we certainly want to think along with the student. But if you want to find out more about graduating or working at Chipsoft the best thing you can do is come to one of the fairs Chipsoft frequents or visit our website where we list open applications. Do not hesitate to reach out!

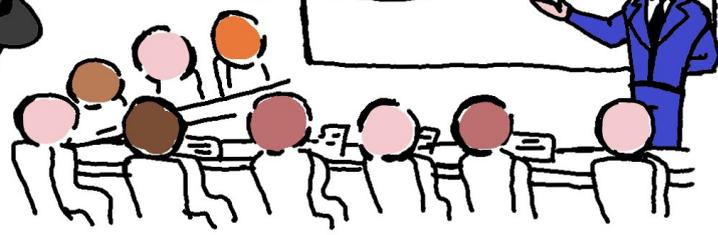
Why Chipsoft?

Carmen: The thing I like most about Chipsoft is the social impact I can make on the healthcare sector. It really feels like I was able to support hospital employees during difficult times like Corona and that feels extremely rewarding. Besides this, there is always a challenge within Chipsoft, because there is always something to do that you can pick up together with your colleagues. And besides that, besides being colleagues that I can work with very well, we are all good friends.

Laurens: I have been working here for eight years, working in different departments and I have had the pleasure of experiencing many different things here. As a bonus, if you come up with a good idea and story, anything is possible within Chipsoft. The workload is well distributed and your personal circumstances are well considered, so you feel very comfortable here. Besides our work, Chipsoft organizes a lot of activities to socialize with our coworkers. This allows us to build beautiful products with our friends!

CYBER TRAINING

Welcome to this cyber security training. Our main topic today will be 'Social engineering'



After a while...



... in short, don't be fooled by:



plumbers
mechanics
WiFi Engineers
Auditors
Family members
Sales
Insp
elec
etc.



Later...

CENTRUK

Hi, I'm a consultant. I am here to perform a penetration test



Let's see...

- plumbers
- mechanics
- WiFi Engineers
- Auditors
- Family members
- Salesmen
- Inspectors
- electricians

Come right in!

