

Evaluation anglais

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Explain what your master consists in, and why you have decided to major in SeCReTS. Present your motivations, and your professional project (1 page).

Currently, I am in the last year of my master's degree in computer science with the major SeCReTS (Security of Contents, Networks, Telecommunications and Systems). My master consists in studying the security of information systems. In fact, with the emergence of the new technologies, new security issues were born. These new aspects are what I study this year. So, during this year, we learned the network security with all network aspects which could be dangerous. For example, in a local network Wifi, an attacker can steal the access point's identity and analyze all the traffic. Also, this master taught me the system security which represents the study of the security of systems configurations. In fact, during installations of systems and networks, human mistakes are recurrent. So, I learned lots of manipulations on Linux and Windows to protect a system like firewalls, proxies.

Initially, I was being in my last year of high school when I decided to study for the SeCReTS Master. In fact, I was visiting the university when I attempted a presentation about this Master. That showed the study of cryptography during the first year and the study of cyber security during the second. At that time, I already knew few bases about the cryptography because my major was Mathematics and I had few lessons about this. About the IT Security, I didn't know yet but it sounded interesting. Thereafter, I enrolled in a bachelor's degree in computer science in order to join the SeCReTS Master. So, during this year, I was very happy to study in this Master. In fact, all courses were very interesting. Moreover, it was even more motivating for me because it was the last year of class and we will work for a corporation during our internship. Indeed, I found my internship early. And, I could focus my energy on courses dealing with the subject of my internship.

On my side, I have a professional project maybe too ambitious but if I succeed each step, I think I will be very pleased with my progress.

Firstly, I need to do my internship at Sopra Steria to Montreuil in the field of intrusion detection. During these six months, I will work in a SIEM team (Security Information and Event Management) where the purpose is making tools to improve the detection of IT threats. So, if my internship is interesting, I will choose to stay in Sopra Steria and maybe continue in the same team.

In the other hand, we learned about Forensics during this year, a domain available in a CERT (Computer Emergency Response Team) with an objective to find clues in post-incident and solve problems due to security issues. So, I would like to join a CERT Team at Sopra Steria too because resolving this type of problems in IT security can be very instructive.

My last professional project can be very hard to fulfill. But, maybe, when I will get enough of experience, I would like to create my own services company and offer a SOC team and a CERT team. I am aware that it could be ambitious, especially my last step, but we need to look for the unknown to progress professionally.

Explain the experience you've gained in telecommunications and networks – placement, project in small groups during your education, etc... What have you been assigned to do? Have your experiences been rewarding? (from 1 to 2 pages at the most).

During my education, I made lots of projects which brought many experience for my future professional project. All these projects were made in the context of telecommunications and networks security.

Firstly, during my second year of Bachelor, I made my first security-oriented project. It is called Pretty Good Privacyⁱ (PGP) and consists to send and receive encrypted messages. I have learned two types of cryptography: the symmetric and asymmetric encryption. Put simply, when two people want to send messages, they use the same key for the symmetric cryptography. While the asymmetric cryptography uses two keys per person: the private key to decipher messages and the public key to encrypt messages for you. In this case, when you want to send an encrypted message to your friend, you have to use his public key.

In the case of my project PGP, the user has public keys of his contacts. Then, when he wants to send a message, he creates a symmetric key which uses to encrypt the message. Then, the user enciphers the symmetric key with the public key of his contact. Finally, he sends to the encrypted symmetric key and the encrypted message to the contact.

This project allowed a better understanding of different cryptographic algorithms during my Master.

Moreover, during my third year of Bachelor, with five others students, we made an application of steganography StegXⁱⁱ. This domain is the predecessor of cryptography. Instead of using keys to encrypt data, steganography allows to hide data in other data. Nowadays, with all file formats, there are several techniques to hide data.

In the case of our application, we can hide any data in pictures, sounds and videos of few formats. I was assigned to make algorithms hiding data in BMP and PNG images. The first method is the LSB algorithm and it consists of modifying least significant bits of pixels to hide bits of data. Indeed, human eyes don't notice this difference. The second method takes the advantage of the fact that data is not interpreted by any image-viewing softwares. So, after using the app to hide data in a picture for example, you just have to send this picture. Then, the receiver will have to use the app to extract your message.

Thanks to this project, I could learn low-level computer science. Also, I realized of the usefulness of this domain in Forensics especially.

Furthermore, in this year, I participated with other students to TRACSⁱⁱⁱ (Tournament of Intelligence and Analysis at CentraleSupélec) organized by DGSE (equivalent of NSA in the USA). This tournament (named Capture The Flag) was a one-day project during which we solved IT security problems. These challenges were about cyber security, data science, cryptanalysis and social engineering. I was assigned to solve challenges about forensics and reversing (studying an executable to understand his function) because these fields are my strong points. My team was not rewarded but we came in the top 30 out of 90. I was very proud of my team because it was my first experience in this concept of projects.

Finally, my last project just started for few weeks. This year, we learned Web Security and Social Engineering. Social Engineering consists of finding information about someone on Internet like social networks or Google. Especially, we can make special requests (Google Dorks^{iv}) to discover sensitive information. So, with another student, we are making an application to automate these searches. During this project, I am assigned to collect information about the person to investigate. This project is very interesting because I didn't know Google dorks before studying Social Engineering.

In conclusion, during my school years, I have done many projects but any internship. They brought me lots of experience and I could learn myself lots of aspects that I couldn't learn with classic lessons at school. Unfortunately, I didn't win any awards for this but I am still proud of my projects. Maybe, they will provide solutions for my professional life.

ⁱ <https://github.com/Heisenberk/ProtectMail>

ⁱⁱ <https://github.com/Heisenberk/StegX>

ⁱⁱⁱ <https://tracs.viarezo.fr/>

^{iv} <https://www.exploit-db.com/google-hacking-database>

Topic 1: Is digital pollution as polluting as it is said to be? Write down an introduction with a thesis issue and a conclusion. If you quote some data or information from a website please use quotation mark and name the source. (from 1 to 3 pages at the most)

Nowadays, actual new technologies concern high-tech sector, modern information and communications technology. All this technology is materialized by our electronic devices. Currently, Earth is in danger because of pollution. In fact, this pollution creates Global Warming. There are several types of pollution and we will study here what is digital pollution.

Digital pollution is defined as pollution produced by our electronic equipments.

Is digital pollution as polluting as it is said to be?

We will define what digital pollution is. Then, we will explain why saying digital pollution can be exaggerated. Finally, we will understand why this pollution can be dangerous for our planet.

Firstly, pollution is the utilization of substances or objects created (or not) by humans which damages environment in the long term. Some studies demonstrated we began to pollute during the first industrial revolutionⁱ. In fact, the invention of the steam engine and mining of coal marks the beginning of a new economic era, bad for our environment.

Nowadays, our actual consumer society has a big ecological impact because people always want to buy the new high trends like cellphones, laptops, game consoles, because of passing fads. They are addicted to these new technologies and this addiction has an impact on the Earth.

Consumer electronics manufacturing requires lots of resources, which means resource depletion. The use of their appliances, like mails or streaming, requires running data centers especially. All these behaviours cause lots of pollution which can be named by Digital Pollutionⁱⁱ.

But, maybe the media overstates this “digital pollution”.

On one hand, with the media coverage of environmentalist movements, studies “demonstrated” Internet is the biggest polluter on the planet. Unfortunately, it is not really true: digital pollution rises shortly by comparison with population increase, unlike car pollution which is more dangerousⁱⁱⁱ.

Moreover, digital pollution is not the first source of pollution. The first source of global warming gases is transports with cars and planes: cars are very used a lot and air travels are so polluting for just one plane. The second source of pollution is industries. So, in our case, digital pollution is marginal compared to other pollutions^{iv} : 4% CO2 emission reflect this form of pollution.

Also, digital pollution was appeared with the emergence of Internet. So, lots of companies emerged and offered their services online. We can mention social networks for example. But, some companies

are trying to reduce their gas emission because of use of servers.

For instance, Facebook^v wanted to only use renewable energies for 2020 with the aim of reducing digital pollution. In fact, use of these renewable energies is democratized.

Even if digital pollution is small compared to others forms of pollution, we will understand the real impact of digital pollution on Earth?

On the other hand, despite the fact that the percentage of digital polluting is small, the figures are alarming. In fact, we are estimated one Google search generates 7 grams of CO₂^{vi}. This can be explained by the fact the user requests Google: This request is sent to Google and goes through few Google servers. So, to respond to the user, servers emit these 7 grams of CO₂. Another shocking figure is the number of 430 million kilos of CO₂ emission per hour during mails transmission. Unfortunately, this digital pollution doesn't emit only greenhouse gases: its uses water and electricity. In fact, data centers gather servers: there servers raise the temperature after heavy use. Therefore, cold water circulates to cool down these servers. For example, annually, 0.2% of water consumed is used because of digital pollution, which represents 3.6 billion of showers^{vii}...

Obviously, electricity consumption is prominent in this problem of pollution. In particular, this energy is used by customers (who want to charge phones for example) and corporations which want to respond to market needs (social networks for instance).

In this case, this digital pollution represents 5.5% of yearly electricity consumption, which is 2.6 times the yearly electricity usage in France.

Currently, we should use more renewable resources like solar panels or wind turbines to product energy. Too few companies use this energy to run their servers...

Finally, with the emergence of 5G in the world, there are increasingly connected objects. In fact, nowadays, all our objects can be remote-controlled (fridge, IT personal assistant...). It is Internet of Things (IoT) which increases fast. We can estimate 48 billion of connected objects^{viii} in 2025. This number can be dangerous because digital pollution will increase too!

From a personal perspective, with regard to the ecological aspect, I think it is too late. In fact, we are in a consumer society where each country wants to grow up. Unfortunately, the economic side is the opposite of the ecological side.

If we stop our activities, pollution will disappear but our society will get through a financial crisis. However, if we continue industries, the Earth will continue to be polluted.

So, we have to find a progressive solution to continue activities and protect our planet, which is in danger.

In conclusion, we have just seen that digital pollution is marginal compared to others pollutions (transports for example). But, if we study the impact on the consumption of water and energy, it is too much for our planet.

We have two choices to protect our environment: being careful about use of our electronic equipments or finding solutions to consume our resources in another way.

A lasting solution consists of using renewable resources to use our data centers, using second-hand or rebuilt IT equipments.

So, we can ask ourselves how our society can do to reduce our environmental impact.

ⁱ <https://www.history.com/topics/natural-disasters-and-environment/water-and-air-pollution>

ⁱⁱ <https://cleanfox.io/blog/pollution-numerique-definition-et-solutions/>

ⁱⁱⁱ <https://youmatter.world/fr/pollution-numerique-internet-ecologie-idees-recues/>

^{iv} <https://www.eea.europa.eu/themes/air/air-pollution-sources-1>

^v <https://sustainability.fb.com/>

^{vi} <https://cleanfox.io/blog/foxyactus-fr/chiffres-effrayants-pollution-digitale/>

^{vii} <https://cleanfox.io/blog/pollution-numerique-definition-et-solutions/>

^{viii} https://www.tourmag.com/Environnement-quel-est-l-impact-reel-du-digital-sur-la-planete_a100845.html