Netflix, an investigation from different perspectives

Emil Dahlgren & André Frisk (B4b)
Faculty of Engineering, LTH
em0123da-s@student.lu.se an8218fr-s@student.lu.se

***Abstract*—Since the start of streaming services, Netflix has been one of the biggest platforms contributing with content and now also producing their own content while contributing with several open source software projects. Netflix has a stable position in today's streaming market and make use of legal protection to protect their company from competitors. Being the biggest platform for streaming and collecting the amount of data they do from their users, the company must stand before some ethical dilemmas with how they use the data and what content Netflix can show so that they do not appear to be biased.**

***Index Terms*—Netflix, open source software, software ecosystem, business ecosystem, streaming services, artificial intelligence**

I. Introduction

Today there are a lot of different streaming services you can use to browse content to watch at your own leisure [21]. Netflix is amongst the bigger streaming services, and it so happens that they are a big contributor to open source software as well. Netflix, like a few others, run a successful streaming service were you can watch all kinds of TV-shows and movies. Some of the TV-shows and movies are produced by Netflix, making them both a subscription streaming service and a production company. What most people are not aware of is that they also leverage and contribute open source software, as well as invest into their different open source projects to further develop the technology.

Netflix uses a system for recommendations that they call *Cinematch*. It uses all ratings it gets from movies anonymously, along with the different kinds of movies, to recommend movies or TV-shows that the user might like [18]. The algorithm used by *Cinematch* is improved upon constantly and uses artificial intelligence to improve the recommendations it gives and gives the user a more pleasant experience. This is Netflix's trump card and a huge value proposition!

A. Netflix and open source software

Netflix have started a good few open source projects that function as a platform upon which others can build their own services or products [15]. The different open source software projects focus on different things you can find in their streaming service and related things. They have projects focused on reliability for cloud based elastic deployments, technology to operate services responsible with the best possible performance and security, technology for data that can be served in real-time, technology for assisting with analysing big data, and some others we will not put focus on [16].

B. Netflix and software ecosystem

Because of their widespread involvement in open source software Netflix is involved in several ecosystems. Even without considering their open source software projects, Netflix is a part of a business ecosystem with other production companies, platforms that run Netflix, airlines that use Netflix for entertainment on board, and many others. In the ecosystems were Netflix's open source projects are used, most of which have an Apache-2.0 licence, Netflix will probably play a big part, but not an active or leading part.

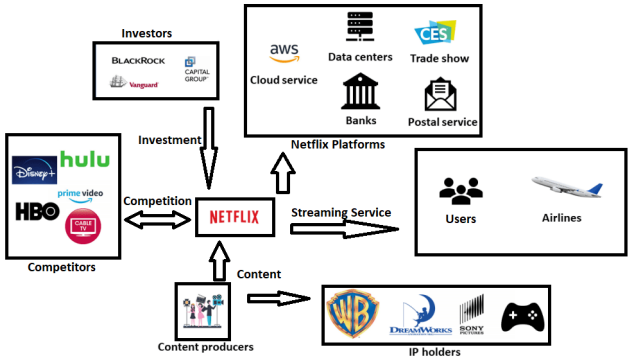

Fig. 1. Netflix's Business Ecosystem

II. Business Aspects

Netflix is one of the most successful companies in the world at this date with a huge customer segment and reliable service. Netflix have not always been the biggest streaming service in the world, from 1997 to 2006 Netflix provided with a service where the company sent out DVDs for rental through mail [19]. This changed in 2007 when DVDs where mostly replaced with video streaming and in 2013 Netflix conquered the world by reinventing the entertainment business by also becoming a TV and movie studio. By doing this, Netflix expanded their target audience and evolved their business aspects to become a successful business company.

A. The Netflix algorithm and user-watch behaviour

Netflix's recommendation algorithm uses machine-learning and *Big data*. Big data refers to massive datasets that can be used to reveal pattern and trends and can be considered big data if its a large quantity of information [1]. Netflix collects thousands of data points from several places to make suggestions to users with this algorithm. The ML-algorithm gives Netflix the ability to automate millions of decisions

based off the user activity which gives these recommendations as it uses the users past activity. Machine-learning uses probability to discover likelihood, in this case, of a user to like the recommendations which creates a smart solution for automated hand-picked content. This algorithm and big data is strongly connected to the OSS which involves Netflix. More in-depth about the algorithm is for the readers interest to search for.

When exploiting big data companies must create a feasible business model as the companies must relate their knowledge of the market to the big data regarding how it can be used financially and if it is technically doable, otherwise the companies will waste resources and capital [5]. Today's companies are tempted to use big data and purchases hardware and software infrastructure which typically ends up with massive datasets and expensive infrastructure which then impairs the business. This is where Netflix shines as they created an algorithm and used big data in the right way to ensure the data is used for a good cause in the business model, to give users the shows and movies they want so Netflix gets the revenue, and at the same time contribute to the OSS community.

A study regarding the user watch-behaviour has been made by *Shruti Lall* and *Raghupathy Sivakumar*. According to this journal, Netflix uses data from the users behaviour of which day the user is watching, which genre, if the user is *binge-watching* specific content etc. which gives data to the algorithm to advertise and recommend content to the specific user prior to the days the user is most active. [23]. With this data Netflix can almost guarantee that the user will see some content that seems interesting which will improve the probability that the user will continuously stay loyal to Netflix as it provides with content that satisfies the user. This research dives in into how Netflix´s recommendation algorithm works more or less based upon their own research which gave a good accuracy based on the prediction how a user will execute the specified content. For more in-depth on the numbers, statistics and how the data is used please read the journal.

B. Customer segments

Netflix's customer segment is targeted to anyone who wants to stream content which is shows or movies, independent of age, gender or background. However, Netflix's customer segments is divided into different groups depending on the taste of the user. There are four customer segments in Netflix's business model where they use their algorithms and technology to give a users their specific recommended shows and movies based on different criteria [4]. These four segments are: segmentation where the user gets a unique taste cluster out of 2000 which is determined by viewing history, user segments based on viewing behaviour, browsing behaviour etc., segments that targets non-users through advertisement such as geographical promotions and age, and lastly segmentation based of AB testing of new features or platform improvements. A/B testing refers to randomized experimentation process where two or more versions of a specific variable e.g. (web page, page element) are shown in different segments to the website visitors at the same time to determine which version leaves the maximum impact and drive the business metrics [25]. By using these methods, Netflix grants a system which is powerful and gives a pleasant user experience, hence the popularity with the system.

C. Value proposition

Netflix have a lot of value propositions in their system which tells the customers what they will get from subscribing to Netflix and why they should choose their system above all else. This grants customers who stay loyal to Netflix which gives Netflix high value on the market. What Netflix has to offer is a huge content library, no advertisement interruption, binge watching, personalised recommendations and on-demand consumption which the customer mostly requires. This is also combined with the mobility to watch on any smart device and to download content for off-line replay.

D. Channels

To provide their customers with information and news regarding their system, communication channels is a critical area in the business model. Netflix itself is the channel for content distribution and information. Mainly, Netflix communicates with their customers via their personal devices with a screen and internet connection, e.g. tablet or mobile OS through notifications and updates via application stores. These notifications are sent every day to the personal device which contains information regarding new shows or movies that will be released or shows that match the user depending on the taste cluster profile received of the 2000 existing ones.

Netflix also communicates with customers and non-paying customers in social medias and media outlets. When a new movie or show is about to release Netflix usually advertise on social medias and on media outlets such as bus stops or magazines. This provides with information to potential customers regarding their service which makes their business model stronger and more effective.

E. Revenue model

The costs for providing with the worlds leading streaming service is quite high. The costs for Netflix is mostly based on the costs of revenue, which is content amortisation, payment processing fees, customer service, streaming delivery costs and operation costs such as cloud service. This is shown in Figure 1 which lands on estimated $12.5 billion this quarter but the costs of marketing, technology and development and administratively costs are also included in the total costs of the company.

Netflix's revenue today comes from mainly the subscription fees, which is 99% of the revenues, from the users as this subscription is the only form of payment Netflix requires from the customers. However, as they own a studio for producing content, Netflix also gain revenue based off Netflix-owned content through licensing.

According to Innovationtactics, the total revenue overcomes the costs of the business model which gives Netflix a favorable

profit for their company and market. Netflix's earnings is in this quarter of the year (Q3 2021) going very good as the curve have sky-rocketed since the summer which gives Netflix a quarterly revenue of $7.48 billions [14]. We see that Netflix remains in a strong growth phase with their revenue growing for every year which proves of a stable competitor in the streaming market and a bright future. Netflix also states that they seek to grow their revenue because it allows them to invest in more and better content and to improve their service so the customers can be even more satisfied and they do not plan to add tiers of subscription as it could cause the loss of some customers.

F. Ecosystem

Netflix is a part of a huge ecosystem where the different companies provide with value-adding activities and offer result of these activities to each other [24]. This ecosystem provides Netflix with a lot of resources and also protection and management. Mostly, the Netflix platform consists of the cloud service, data centers and banks which provides the company with the resources to stream to people all over the world as the content is stored in the cloud but also in the data centers. Without this, Netflix can not broadcast to other devices and will then lose their customers and revenue. Netflix extended enterprise which is the part of the ecosystem where other companies actions and resources matter. Here Netflix is provided with capital from its investors such as Leslie J. Kilgore, Vanguard Group Inc., & BlackRock Inc. [7], which gets their rights to the company. The intellectual property holders play a big role in this ecosystem to provide content, such as *DreamWorks*, who license content to Netflix and other competitors. Other content producers sends in content to Netflix and to the intellectual property companies to extend the content of the system and the ecosystem. This creates a huge network of actors which helps Netflix be the a successful streaming company and makes it grow.

III. Legal Aspects

As a streaming service with a lot of functionality and content which has exploded in popularity the company needs to apply different patents, trademarks, copyrights, licenses and GDPR appliance. This is to ensure that other companies or competitors does not steal the property of Netflix's branding, original content, functionality and design. Without these Netflix would not be a worlds leading streaming service and another company would probably take the throne.

Netflix, which is very active in the OSS community, have their software available on GitHub with a Apache 2.0-license marked at the software [13]. The Apache 2.0-license is a permissive license which means that the software Netflix uses and takes (assuming that software also is permissive) can be modified, copied, added to, subtracted from, etc. without any obligation to share those updates to the creator [2]. For companies that participate and distribute open source, permissive licenses mean fewer problems with compliance issues and grants a more safer platform for Netflix to distribute and develop software in the business [22]. However, three areas in legal and technical issues which are important to audit with relation to OSS to ensure that the software is appropriate and effective for OSS that needs to be done. These are compliance with company policies, compliance with OSS licensing terms and the technical review of products prior to the release. If the procedures and guidelines for implementing the policy reflect the company's business model and tolerance for risk, the company should be able to take advantage of the benefits of OSS in a rational, efficient manner. As Netflix's software is highly based on OSS and it has succeeded, it is safe to say that Netflix have reviewed these areas and applied it to their company.

As Netflix is a huge streaming company with history of providing DVD rental before they have enormous of patents. These patents applies to the functions in the Netflix-service and for the DVD-service where certain patents applies to both [10]. Patents is a crucial point for Netflix's business model for gaining and retaining its customers as it provides Netflix with functions such as the *skip*-button and the recommended content algorithm. According to *Quality Oracle* who says: "Netflix's patented technology works to provide a streamedlined user experience and a comfortable viewing experience, whilst maximising consumer engagement to ensure the viewer returns to Netflix's services time and time again, which translates into regular, habitual use.". [20] tells us that without these patents Netflix's service and platform couldn't be what it is today. There exists patents for almost everything that Netflix provides with, this because of ensuring that their ideas and functions are held for them self.

To be able to protect their unique service and the corresponding intellectual property Netflix has copyright which makes them the legal owner of the content and their service [11] [20]. Every content on Netflix and the service itself must be protected be copyright so that they can have their unique service on the market while at the same time keep the content to Netflix. It also allows customers to consume content which in legal rights is owned by a third party company. How the content that is copyrighted affects the business model is that if Netflix owns the intellectual property then the content of that specific show or movie is supposed to be on the platform. This could attract customers who has a need to look for this specific content which grants more revenue for the company.

Trademarks provide Netflix with security over the company's branding. This is applied to the red 'N', the brand name and the design of its logotype which represents the company. This ensures protection over the 'Netflix' name so that other companies cannot use their branding. The trademark is also necessary as it allows others to advertise publicly which makes customers recognize the logotype and name more. This advertisement is within the bounds of the law if the advertisement is truthful and the use of the trademark shall not give any untruthful impressions or statements [3].

When handling millions of accounts from the customers their data must be secured and the customers need to know how their data is being used. GDPR, which is the a law in

EU which regulates how companies may use personal data, is a requirement for Netflix to use to be able to be on the market as data is a key part of their service. The big part of the data which Netflix stores are already available in the account information [12]. How they use it is just to remember the account information for every customer to gain easier access to Netflix and their service. As told by the GDPR law, Netflix must follow the law such as that if a customer has a cause of deleting the data of the customer from their database or prevent data collection then that can be done. According to a research published at IEEE regarding data processing against GDPR they state that cloud-service providers could be a problem for GDPR [17]. This is because of that it might not be possible to delete the data of a customer that requires deletion immediately as the data might be stored in some kind of archives. Also Netflix must provide with security measures such as encryption for ensuring higher security for the customers personal data but also when transferring the data. If the company breaks the law of GDPR and uses the data without consent from the customer then they must pay a huge amount of fines for breaking the law which both affects the economic part of the business model but also the reputation of Netflix.

IV. Ethical Aspects

With the amount of users Netflix has daily, and the technology they both use and share as open source software, a few ethical problems arise. The recommendation system that collects user-data and uses an AI system brings a few to the surface [8], and the content Netflix has on their platform with a certain opinion could bring another.

A. Artificial Intelligence

The amount of information processed by the Netflix algorithm for recommendations is of concern when looking at it from an ethical perspective. Thanks to an academic journal published by Microsoft in collaboration with the University of Washington [6], there are some guidelines to consider when you use artificial intelligence to interact with user-data and then with the users themselves. Netflix does amazing in most of the categories brought to light by the journal, however, in some of the categories they are questionable at best.

For example *G17*, the category about providing global control, they are lacking to live up to ethical standards. This is according to the description in the journal ”Allow the user to globally customize what the AI system monitors and how it behaves.”. In the case of Netflix’s AI, the user gets close to no control over how the AI behaves or what it monitors. This however, might be a difficult problem to solve in a user friendly way. Something to consider would be to have prompt, on the screen the first time the user logs in, that lets the user select settings for the systems connected to AI with a short description of how this will impact their experience.

Another category that is a bit lacking would be *G1* where the description goes ”Help the user understand what the AI system is capable of doing”. A user new to Netflix probably does not know that the recommendation system is using AI. Without explaining the impact of doing so, the user is given the possibility of giving content they watch positive or negative feedback. This will impact what recommendations the AI gives the user, but the explanation for this is lacking. A very simple solution for this would be to give a message to the user when they make this choice with the information that their recommendations will be impacted by this and that they can change their choice at anytime. They could also give a short description on the recommendation system where they mention that it is based on an AI system that learns from what you watch and how the user gives feedback.

B. Content Freedom

As Netflix has a lot of media to choose from, there are not only legal restrictions on the content they display. Netflix can choose their content to avoid certain topics, or to prioritize them. This could lead to an assumed bias or it could influence peoples opinions by having them watch media expressing opinions Netflix either agrees with or accepts spreading through their services. The ethical question in this topic is then how picky Netflix can be with their content. Can they pick and choose how they like or should they allow all kinds of content?

The dilemma of political opinions and biased content on media, among them Netflix, is in part discussed by Yuwei Ge in her article about *#MeToo* where she explores the opinions in media after the *#MeToo* movement became big in 2018 [26]. She explores how strong opinions regarding feminism, sexism, and rape have been expressed through media more after the movement, how this effects peoples views on those topics, and in turn how big of an effect the opinions expressed in media can effect the viewers. Netflix joins this by showing and create more content regarding sexual harassment that is with contact with the *#MeToo* movement which shows development.

This is an ethical dilemma that gives you the options of either giving Netflix full creative freedom over what content they have on their platform, or having them show content with all kinds of opinions to make sure that they are not bias, or to come up to a certain compromise with a committee created to make sure media displayed on streaming-platforms is diverse enough.

V. Summary

The streaming service that Netflix provides is constantly evolving both in content and in software development. The company have evolved both to a large-scale software development company but also in popularity and their contribution to the OSS community and entertainment industry which requires legal measurements with content and software and creates some ethical dilemmas. It seems that Netflix does not live up to ethical standards regarding that the customer can’t control what the AI monitors and how the AI uses the customers data which is not told. This could backlash and affect Netflix’s growth in business with a negative impact, which requires action.

References

[1] Codeacademy, "Netflix Recommendation Engine". 2021. [Online]. Available: https://www.codecademy.com/articles/how-netflix-recommendation-works-data-science. [Accessed Nov. 30, 2021]

[2] FOSSA, "All About Permissive Licenses". 2021. [Online]. Available: https://fossa.com/blog/all-about-permissive-licenses/. [Accessed Dec. 9, 2021]

[3] Gordon Feinblatt LLC, "Beyond Brand X - Using Another's Trademark in Your Own Advertising". 2005. [Online]. Available: https://www.gfrlaw.com/what-we-do/insights/beyond-brand-x-using-another%E2%80%99s-trademark-your-own-advertising. [Accessed Dec. 9, 2021]

[4] Innovationtactics, "Netflix Business Model Canvas". 2019. [Online]. Available: https://innovationtactics.com/netflix-business-model-canvas/. [Accessed: Nov. 27, 2021]

[5] J Heidrich, A Trendowicz, C Ebert (2016), "Exploiting Big Data's Benefits", IEEE Software 33.4, pp 111-116. 2016 doi: 10.1109/MS.2016.99

[6] Microsoft, "Guidelines for Human-AI Interaction" 2019. [Online]. Available: https://www.microsoft.com/en-us/research/uploads/prod/2019/01/Guidelines-for-Human-AI-Interaction-camera-ready.pdf. [Accessed Dec. 08, 2021]

[7] Matthew Johnston, Investopedia, "Top Netflix Shareholders". 2020. [Online]. Available: https://www.investopedia.com/articles/insights/060716/top-3-netflix-shareholders-nflx.asp. [Accessed Dec. 10, 2021]

[8] Mack, J. E., Owusu, T. D., & Scarpino, J. J. (2016). Confidentiality, Privacy, Accessibility and Security of Big Data Usages within Mobile Recommender Systems, as Society Embraces Cloud Based Technology. Issues in Information Systems, 17(1), 185–195.

[9] Narayanan, A., & Shmatikov, V. (2007). "How to break anonymity of the netflix prize dataset". arXiv preprint cs/0610105v2.

[10] Netflix Help Center, Netflix patent. Available: https://help.netflix.com/sv/node/25888. [Accessed Dec. 9, 2021]

[11] Netflix Help Center, "Vilka meddelanden om immateriella rättigheter ska jag vara medveten om?". Available: https://help.netflix.com/sv/node/24852. [Accessed Dec. 9, 2021]

[12] Netflix Help Center, "Vad är dataskyddsförordningen (GDPR)?". 2021. [Online]. Available: https://help.netflix.com/sv/node/100629. [Accessed Dec. 9, 2021]

[13] Netflix Incorporated, Netflix Open Source Platform. Available: https://github.com/Netflix. [Accessed Dec. 9, 2021]

[14] Netflix Investors, "2021 Quarterly Earnings". 2021. [Online]. Available: https://ir.netflix.net/financials/quarterly-earnings/default.aspx. [Accessed Nov. 30, 2021]

[15] Netflix Open Source Platform. Available: https://netflix.github.io/. [Accessed Nov. 30, 2021]

[16] Netflix Open Source Software Center. Available: https://netflix.github.io/. [Accessed Nov. 30, 2021]

[17] O. Amaral, S. Abualhaija, M. Sabetzadeh and L. Briand, "A Model-based Conceptualization of Requirements for Compliance Checking of Data Processing against GDPR," 2021 IEEE 29th International Requirements Engineering Conference Workshops (REW), 2021, pp. 16-20, doi: 10.1109/REW53955.2021.00009.

[18] Patibandla, R. et al. (2021) 'Efficient Recommender System for Over-the-Top Media Service', 2021 2nd Global Conference for Advancement in Technology (GCAT), Advancement in Technology (GCAT), 2021 2nd Global Conference for, pp. 1–7. doi: 10.1109/GCAT52182.2021.9587630.

[19] Product Habits Blog, "How Netflix Became a $100 Billion Company in 20 Years". 2017. [Online]. Available: https://producthabits.com/how-netflix-became-a-100-billion-company-in-20-years/. [Accessed: Nov. 27, 2021]

[20] Quality Oracle, "How Netflix Uses Intellectual Property To Its Advantage". 2021. [Online]. Available: https://www.qualityoracle.com/how-netflix-uses-intellectual-property-to-its-advantage/. [Accessed Dec. 9, 2021]

[21] Seongcheol Kim, Hyunmi Baek, Dam Hee Kim, OTT and live streaming services: Past, present, and future, Telecommunications Policy, Volume 45, Issue 9, 2021, 102244, ISSN 0308-5961

[22] Silberman, G. P. (2014). A Practical Approach to Working with Open Source Software. Intellectual Property & Technology Law Journal, 26(6), 31–35.

[23] S. Lall and R. Sivakumar, "A Real-world Dataset of Netflix Videos and User Watch-Behavior: Analysis and Insights," ICC 2021 - IEEE International Conference on Communications, 2021, pp. 1-7, doi: 10.1109/ICC42927.2021.9500669.

[24] The Value Engineers, "A Business Model of the Netflix Ecosystem". 2019. [Online]. Available: https://www.thevalueengineers.nl/what-is-an-ecosystem-business-model/. [Accessed Nov. 30, 2021]

[25] VWO, "A/B Testing Guide". 2021. [Online]. Available: https://vwo.com/ab-testing/. [Accessed: Nov. 28, 2021]

[26] Yuwei Ge (2018) 'Marching Forward with #MeToo: The Representations of Women in American Political Television Series', Gender Forum, (70), pp. 40–59.

VI. Appendix: Contribution statement

A. Emil Dahlgren

- Research about Netflix's business model
- Writing the Introduction
- Created the overview figure
- Writing the Ethical Aspects
- Research for references used in the Introduction
- Research about Netflix's involvement with OSS and the ecosystems related to Netflix
- Research for references used in the Ethical Aspects
- Writing the abstract section

B. André Frisk

- Research about Netflix's business model and aspects
- Research about Netflix's legal aspects with licenses, patents, copyrights etc.
- Research for references used in Business Aspects
- Research for references used in Legal Aspects
- Writing about the Business Aspects and the business model
- Writing about the Legal Aspects for Netflix
- Writing the summary