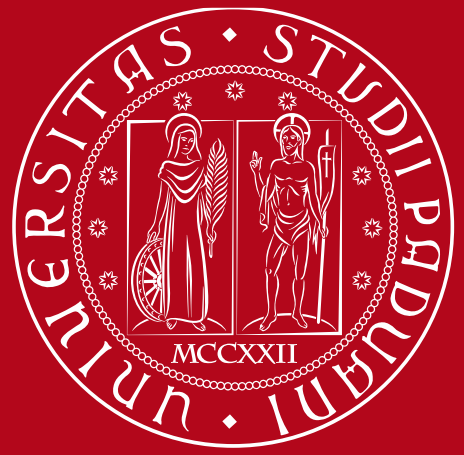


UNIVERSITÀ
DEGLI STUDI
DI PADOVA

The case of Netflix

AA 2022/23

leonardo.mazzoni@unipd.it

The relevance of Netflix

Fabio Viola • 2°
Professor | Videogame Designer and Producer | Interactive Screenwriter | ...
1 giorno • Modificato •

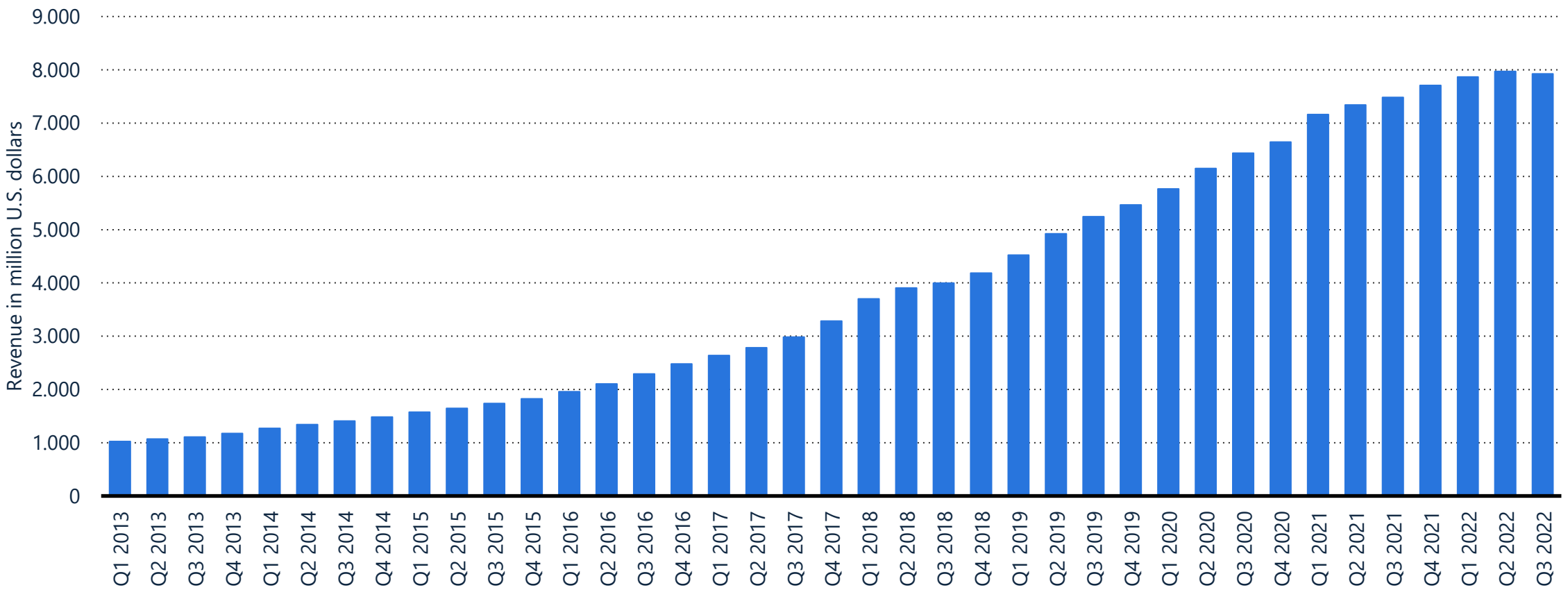
La serie tv Regina degli Scacchi è stata vista da oltre 60 milioni di abbonati Netflix divenendo il contenuto più visto in 63 nazioni. Oggi i media, soprattutto cinema e gaming, modellano comportamento e generano effetti duraturi:

- Su Google la ricerca del termine scacchi è raddoppiata
- Su Google la ricerca "come si gioca a scacchi" ha raggiunto picco degli ultimi 10 anni
- Su eBay sono cresciute del 215% le transazioni di scacchi
- Su Chess.com il numero di giocatori è quintuplicato
- Il numero di ore speso davanti alle partite di scacchi giocate online su Twitch è raddoppiato
- Il libro a cui la serie tv si ispira è entrato nella Top10 bestseller New York Time a 37 anni dalla sua pubblicazione

#netflix #cinema #movieindustry #gamification #chessgame #revenue #entertainmentindustry

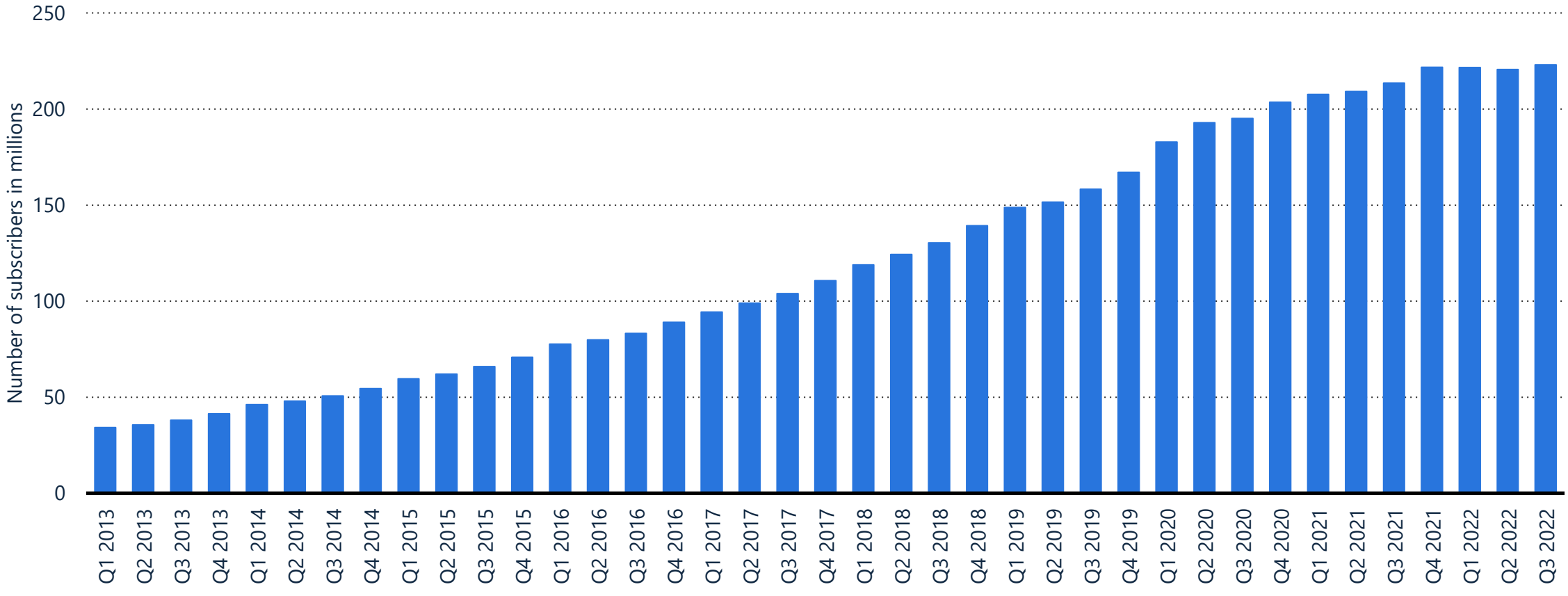
Revenue generated by Netflix from 1st quarter 2013 to 3rd quarter 2022 (in million U.S. dollars)

Netflix's quarterly revenue 2013-2022



Number of Netflix paid subscribers worldwide from 1st quarter 2013 to 3rd quarter 2022 (in millions)

Quarterly Netflix subscribers count worldwide 2013-2022



The beginning

In 1997 Reed Hasting, a computer scientist by profession had rented the movie Apollo 13 from a blockbuster video store. However when he failed to return the DVD on time, he was forced to pay late payment charges of $40. The incident set him thinking of alternative and better ways for renting movies.

From video rental company...

- Netflix (*Net* “the Internet”+ *flicks* - “films, movies”) was started in **1997** under the name Kibble - Rental DVDs 4$ by DVD (plus 2$ for the delivery service)

- In **1999** the company introduced a DVD subscription service → monthly fee 15$ for 4 DVDs → digital request by customers (online queue/wishlist with the favourite titles) and an algorithm send back the information on the basis of the availability
- In **2000** personalised movie recommendation. By 2000, Hastings had settled a business model charged users a monthly subscription and users settling up a queue of movies they wanted to watch and were mailed the DVDs by US postal service.

…To streaming provider...

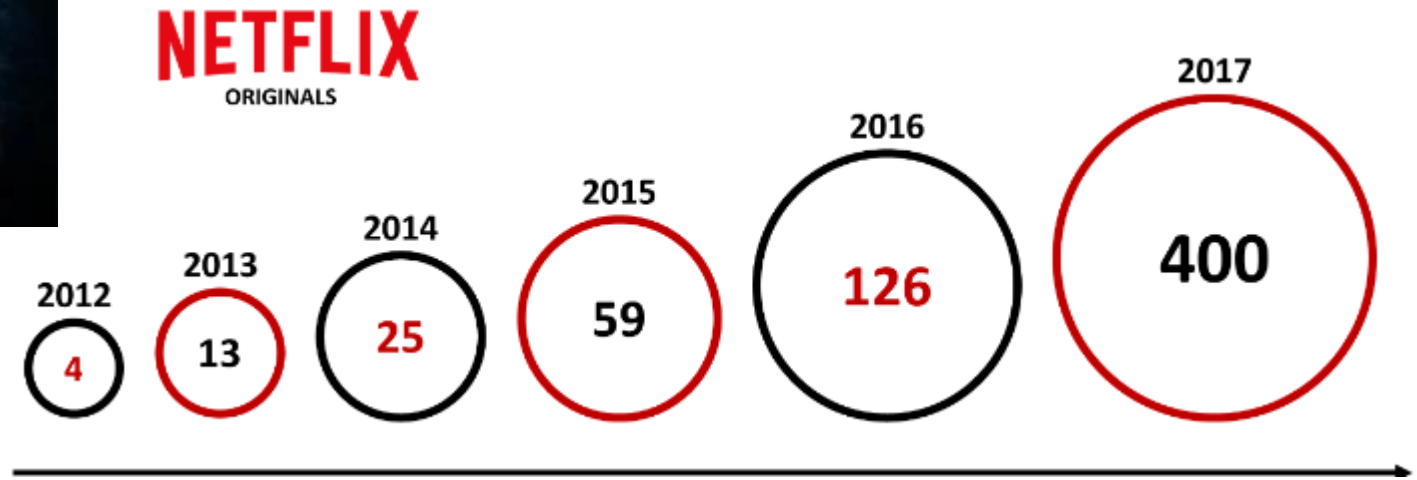
- **2007** Offering unlimited access to movie and TV series

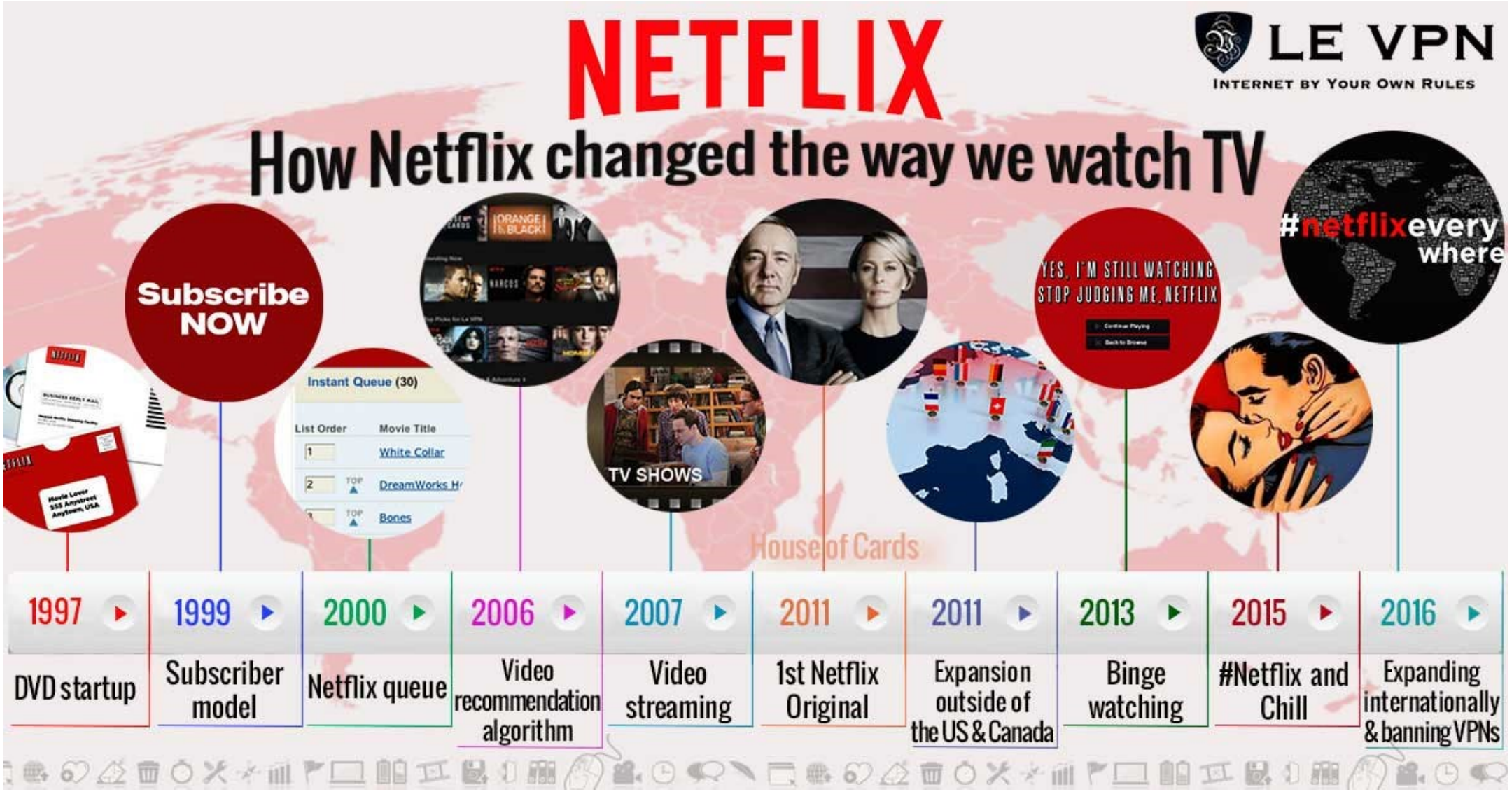
- By early **2008** Unlimited online streaming

- In July **2011** Netflix announced the largest price increase in its history and in September Netflix decided to divide and streaming operations into two separate independent companies

..And content creator!

Number of content created




NETFLIX
How Netflix changed the way we watch TV
LE VPN
INTERNET BY YOUR OWN RULES
Subscribe NOW
Instant Queue (30)
List Order
Movie Title
White Collar
DreamWorks H
Bones
TV SHOWS
House of Cards
YES, I'M STILL WATCHING
STOP JUDGING ME, NETFLIX
#netflixeverywhere
1997 DVD startup
1999 Subscriber model
2000 Netflix queue
2006 Video recommendation algorithm
2007 Video streaming
2011 1st Netflix Original
2011 Expansion outside of the US & Canada
2013 Binge watching
2015 #Netflix and Chill
2016 Expanding internationally & banning VPNs

Website evolution 1999

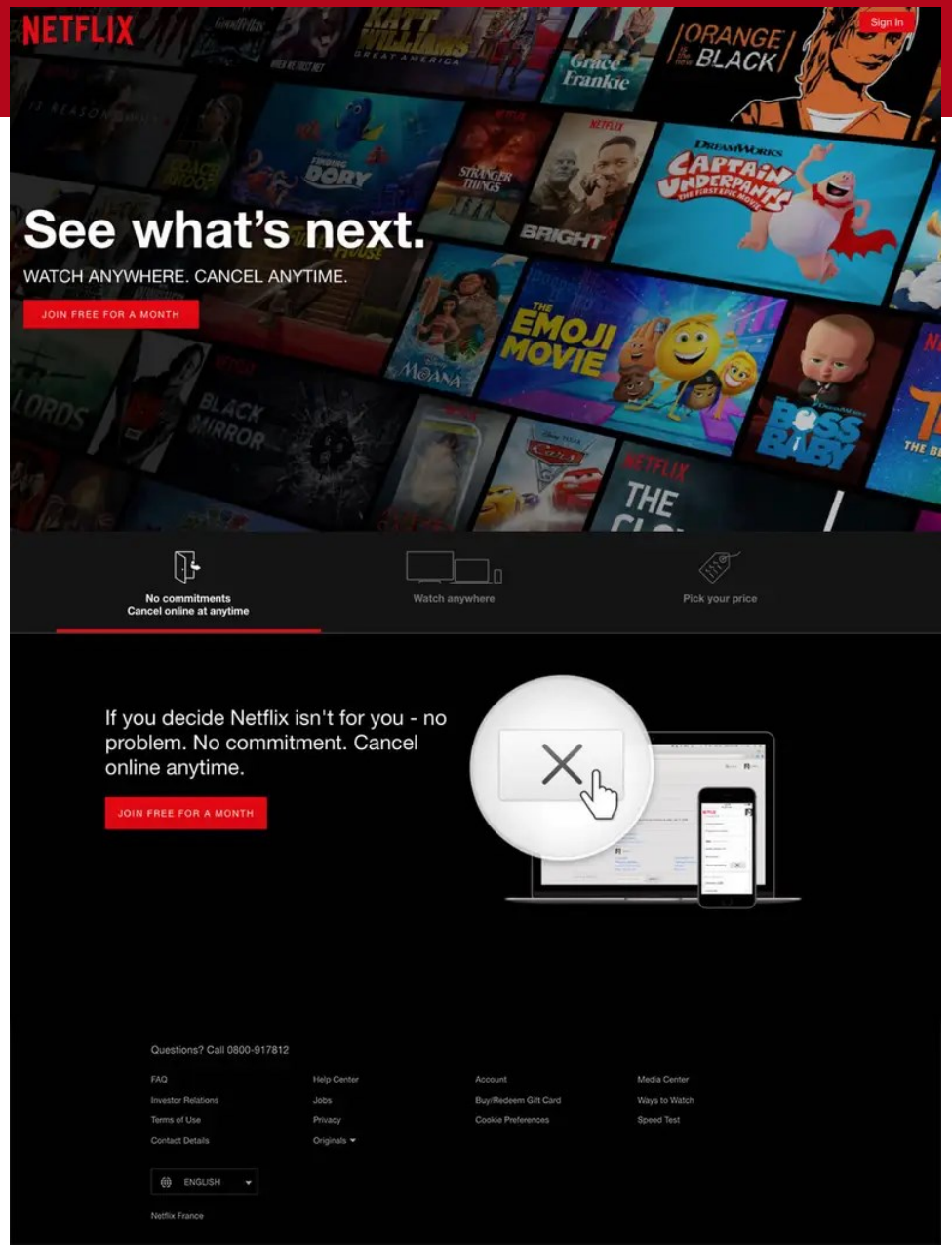
Website evolution 2004

Website evolution 2008

Website evolution 2009

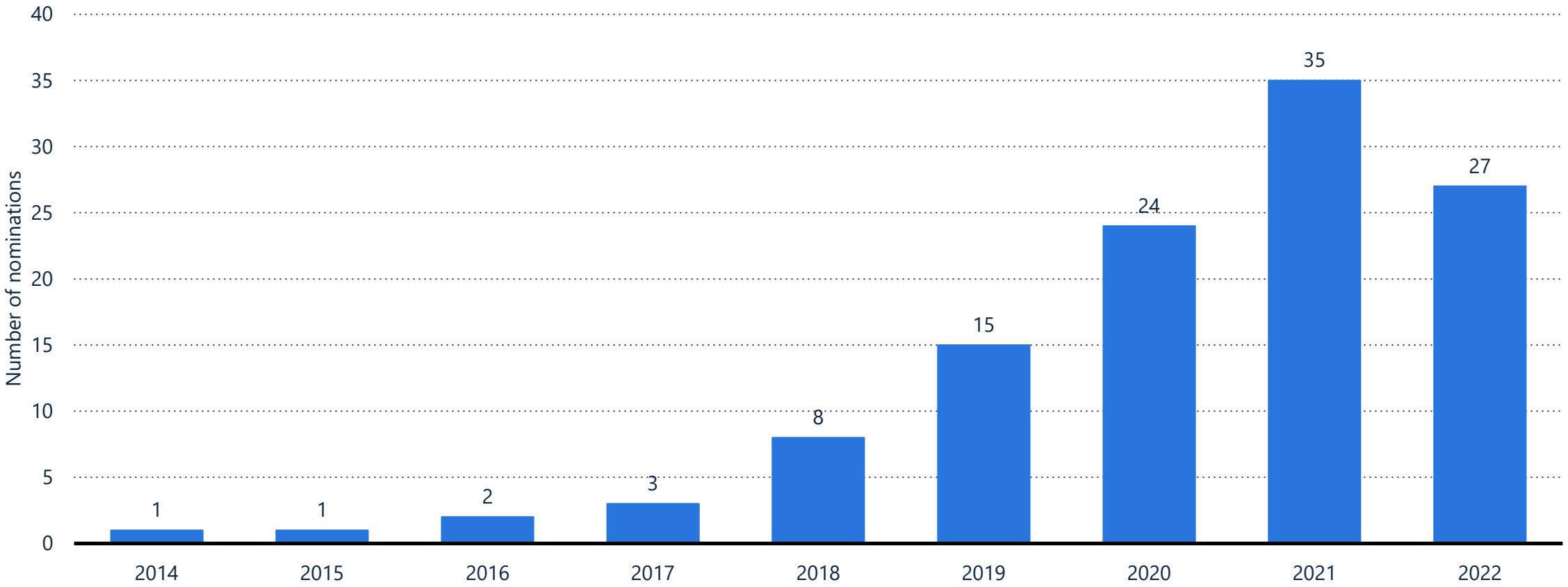
Website evolution 2012

Website evolution 2016

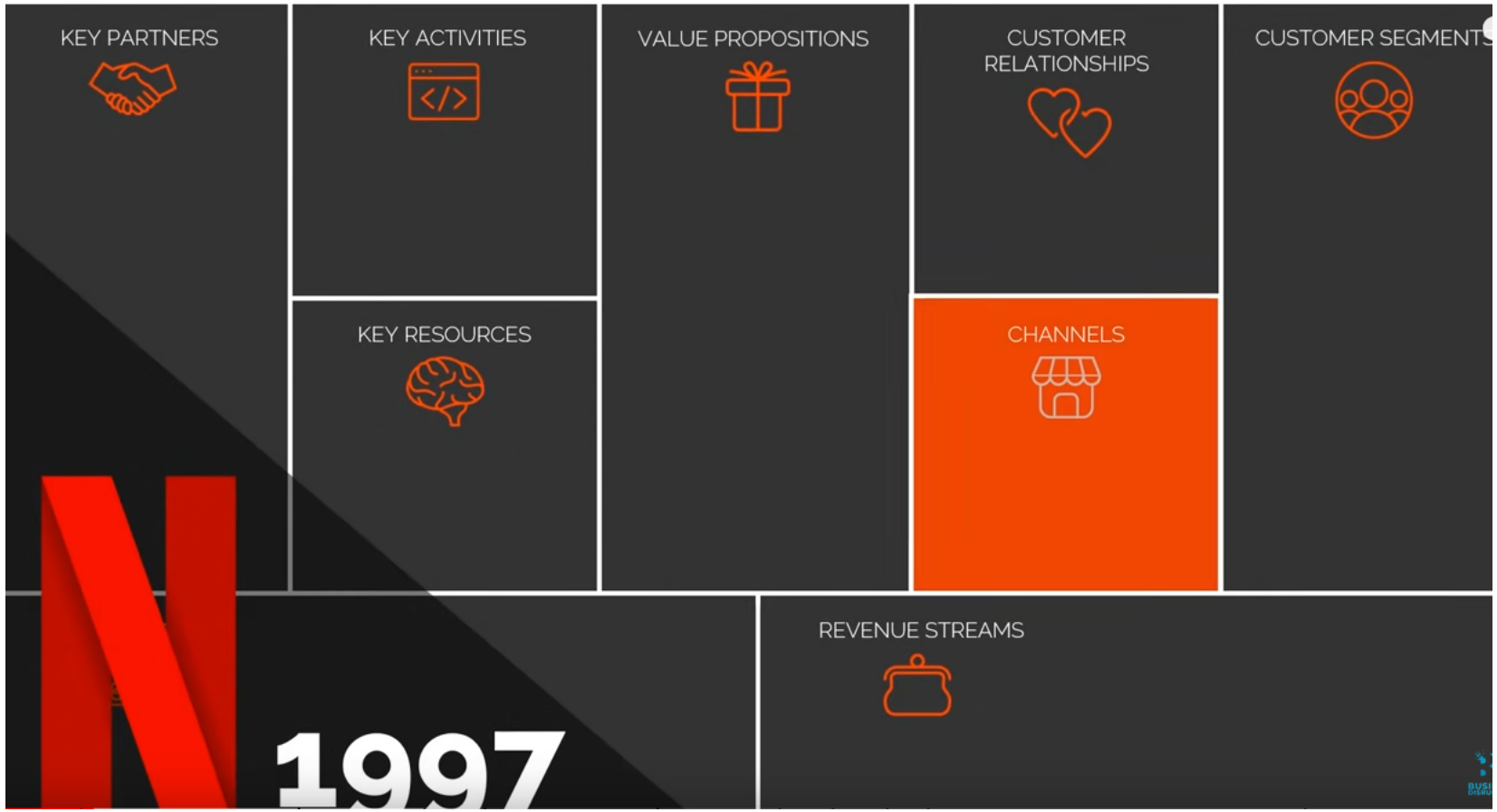


Number of Netflix Academy Awards nominations from 2014 to 2022

Netflix Academy Awards nominations 2014-2022



Business Model Innovation – home delivery

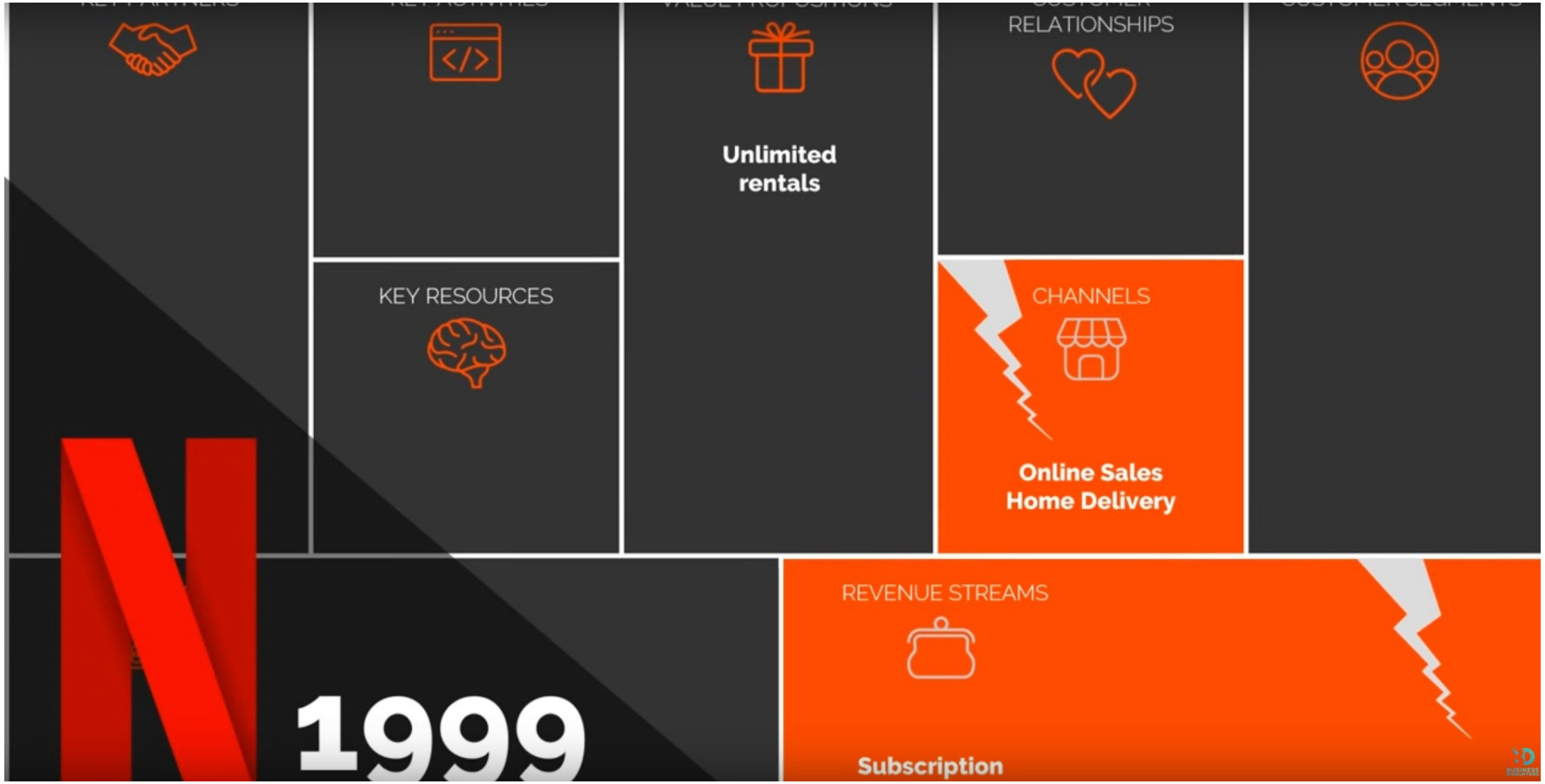


Business Model Innovation – multi devices

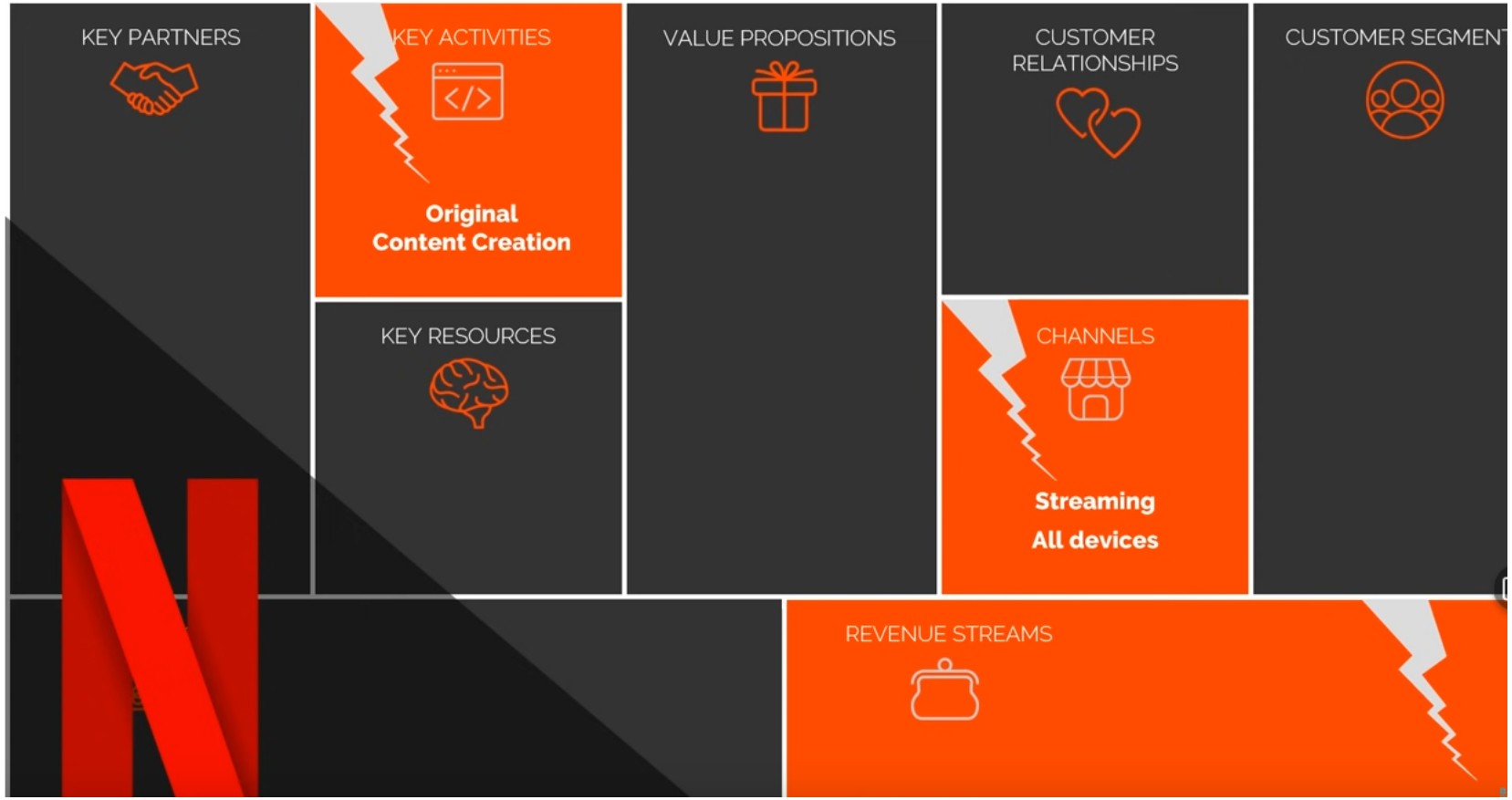
Business Model Innovation - subscription

Easiness of unsubscriptions

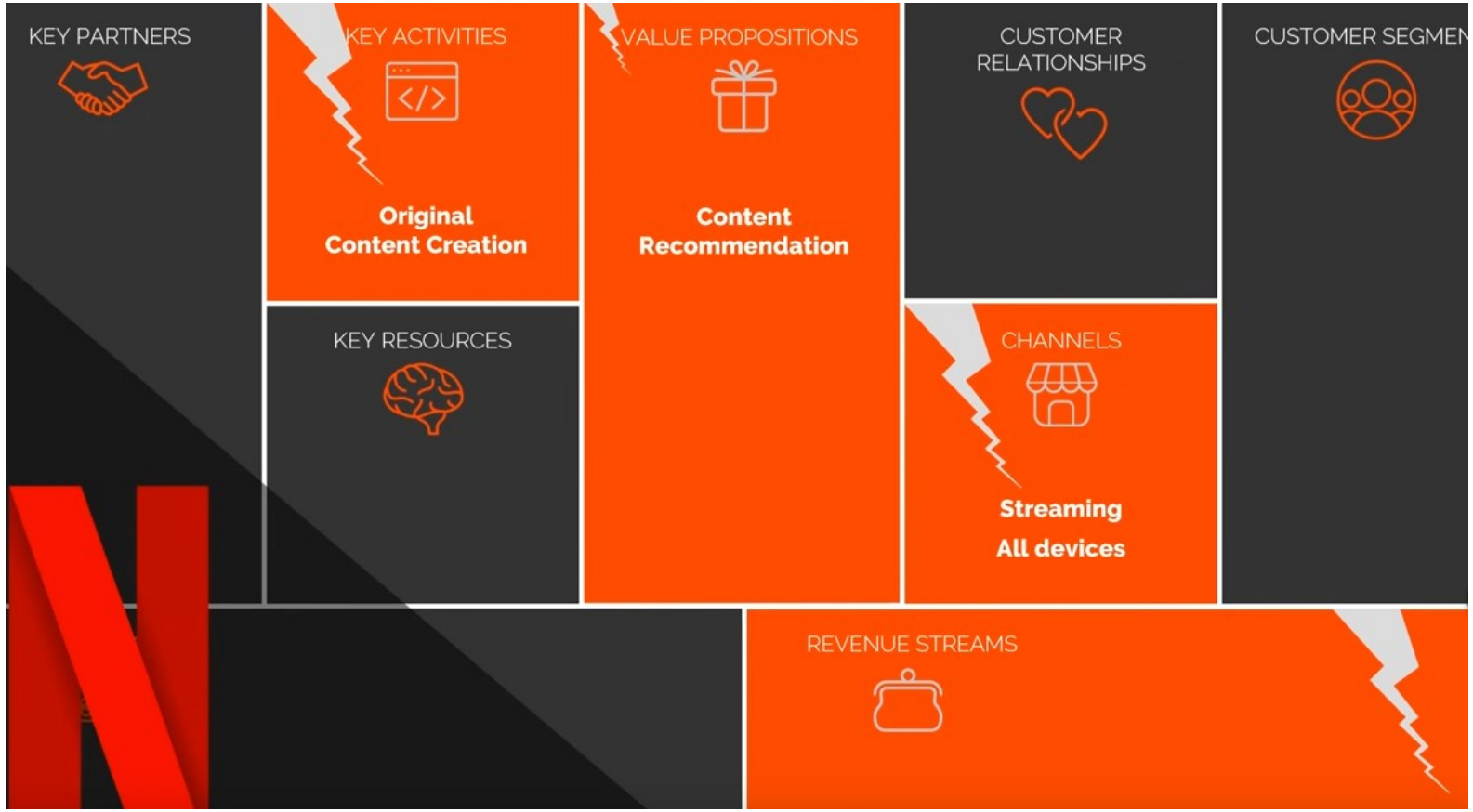
Importance of large base of subscribers



Business Model Innovation – original content creation



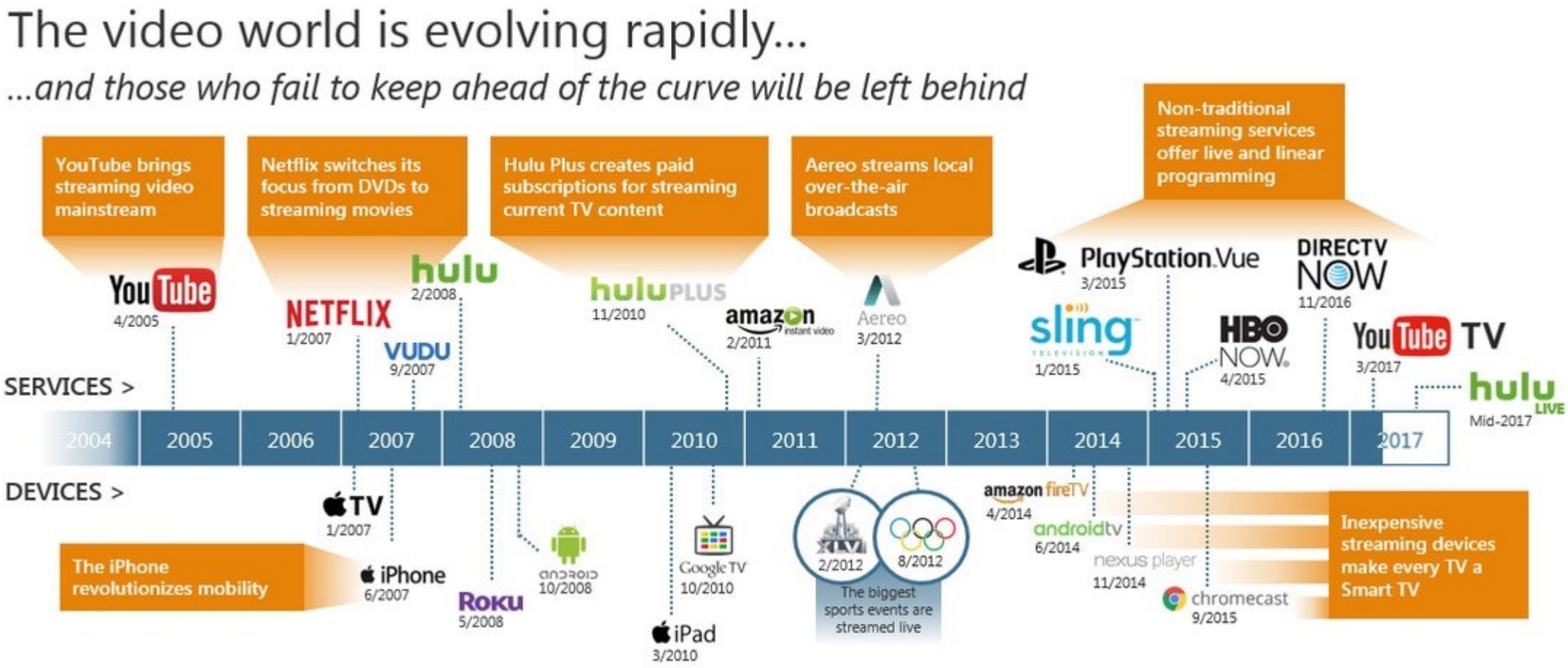
Business Model Innovation – value creation (recommendation and entire season releases)



Techno-economic dynamics

- Massive shift in consumer behaviour
- Growth of internet data usage
- Post TV era
- Use of multiple devices

Customers evolution in the video industry



Interaction with the users

DVD renting mail delivery

N Catalogue

Preferences of customers

DB building

Interaction with the users

First recommendation system!

N Catalogue

Data-driven recommendation

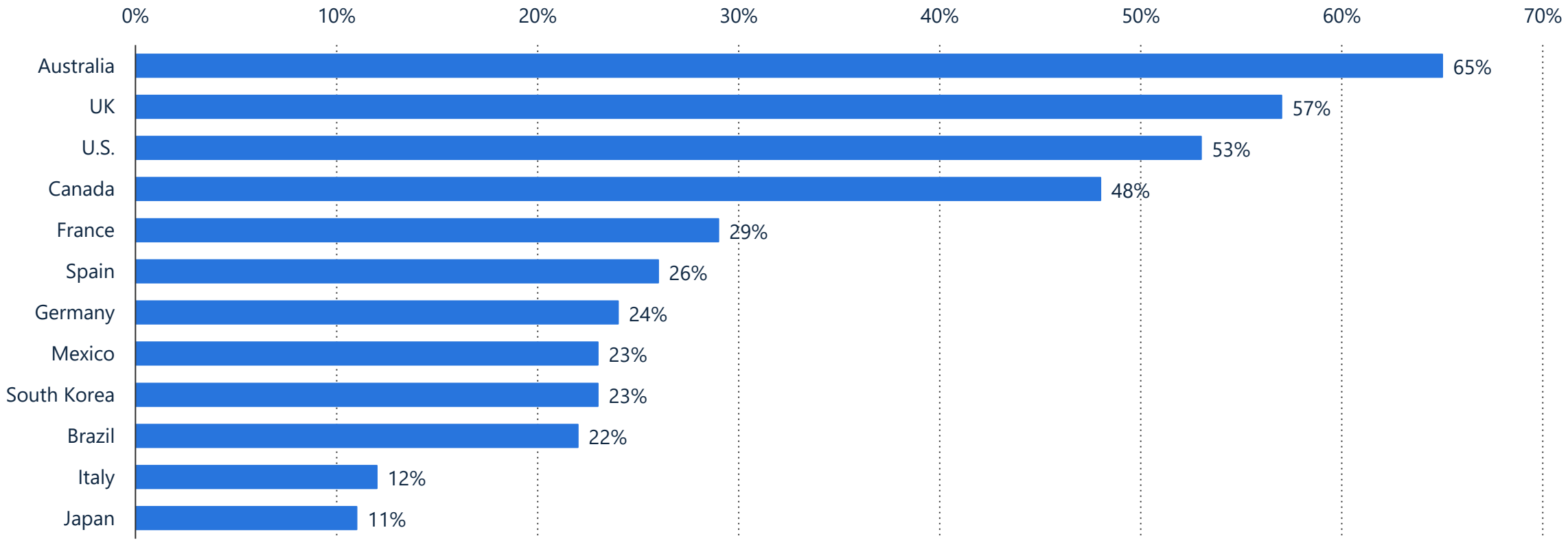
Preferences of customers

DB usage for customisation

Internationalisation strategy

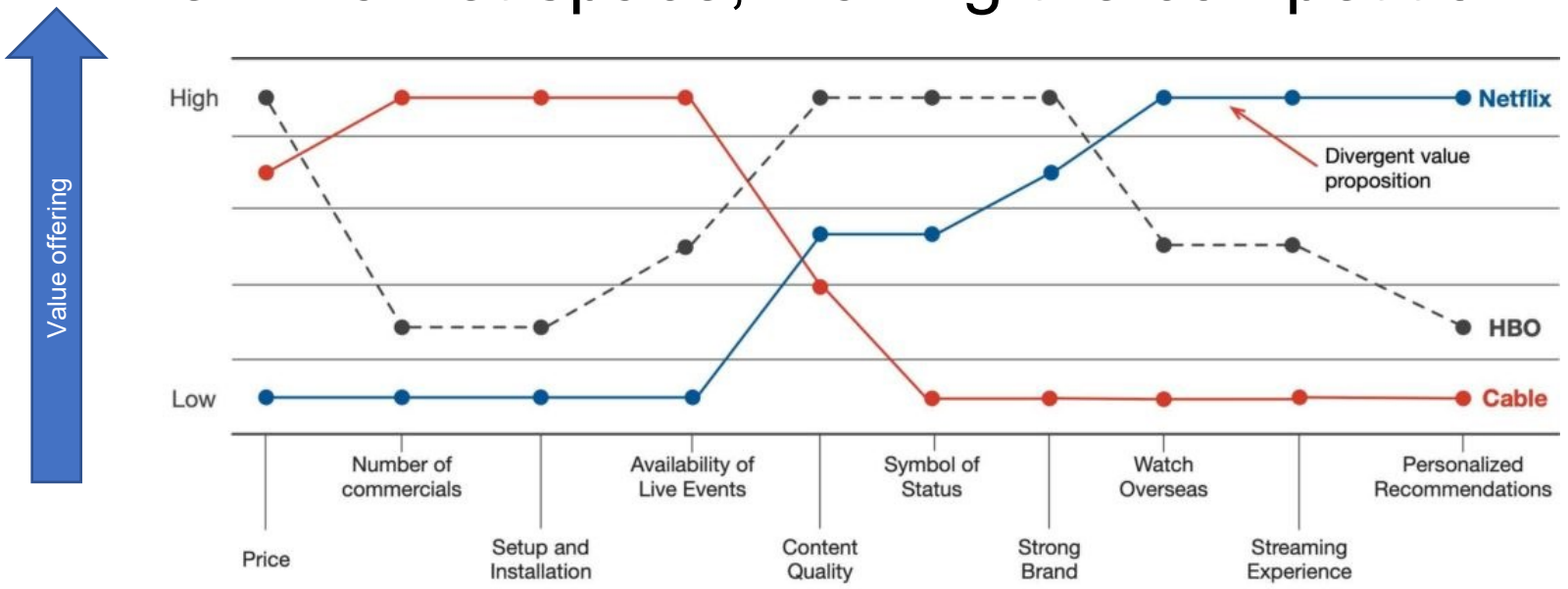
Share of subscribing Netflix households in selected countries worldwide as of 2022

Penetration rate of Netflix worldwide 2022, by country



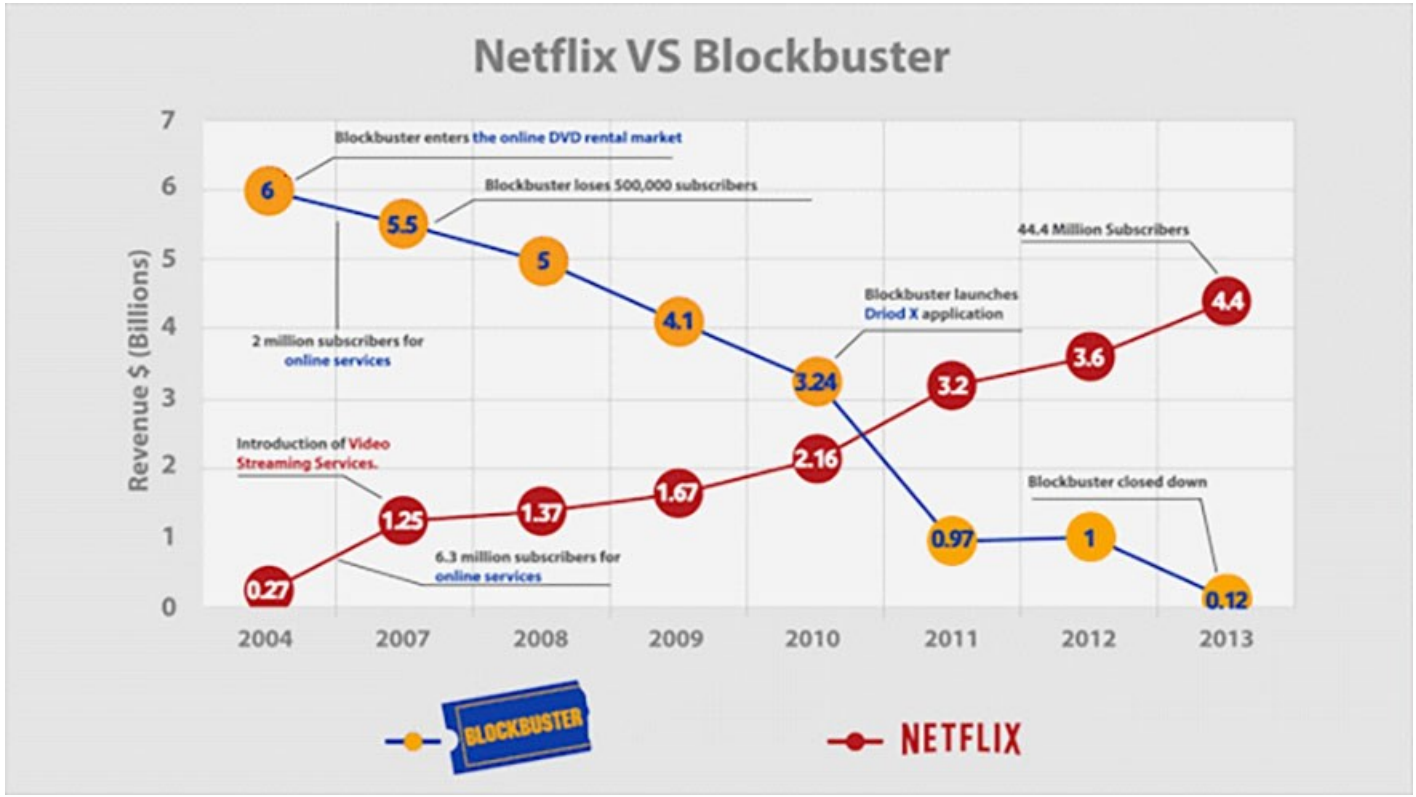
First mover advantage?

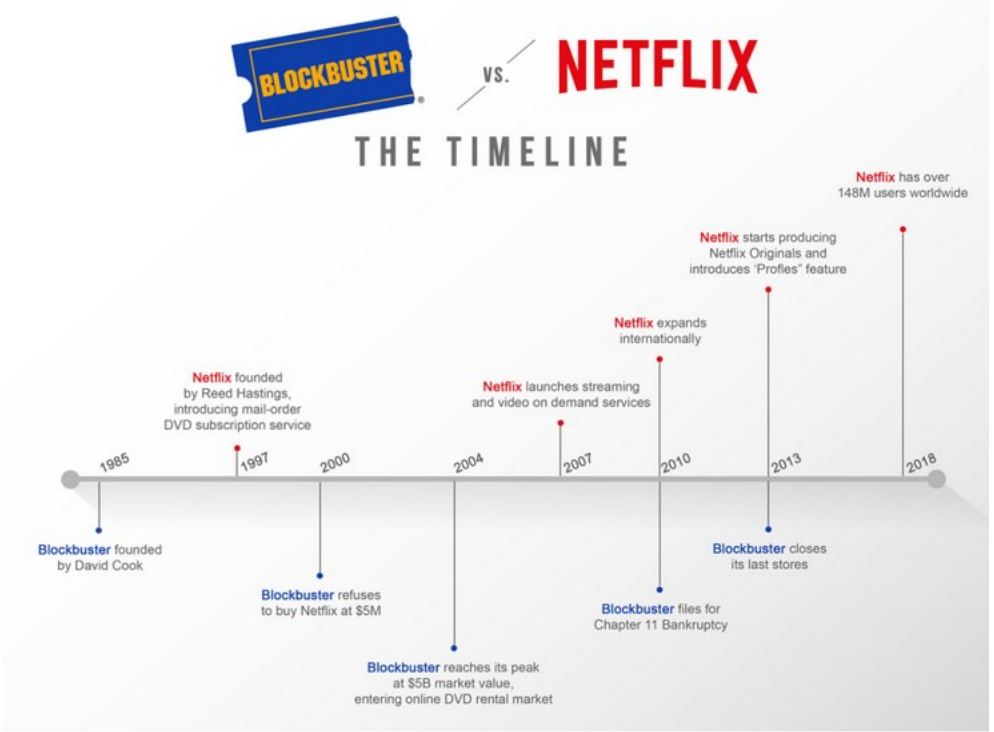
It bring the competition in «**blue oceans**», contributing to define a new market space, making the competition «irrelevant»



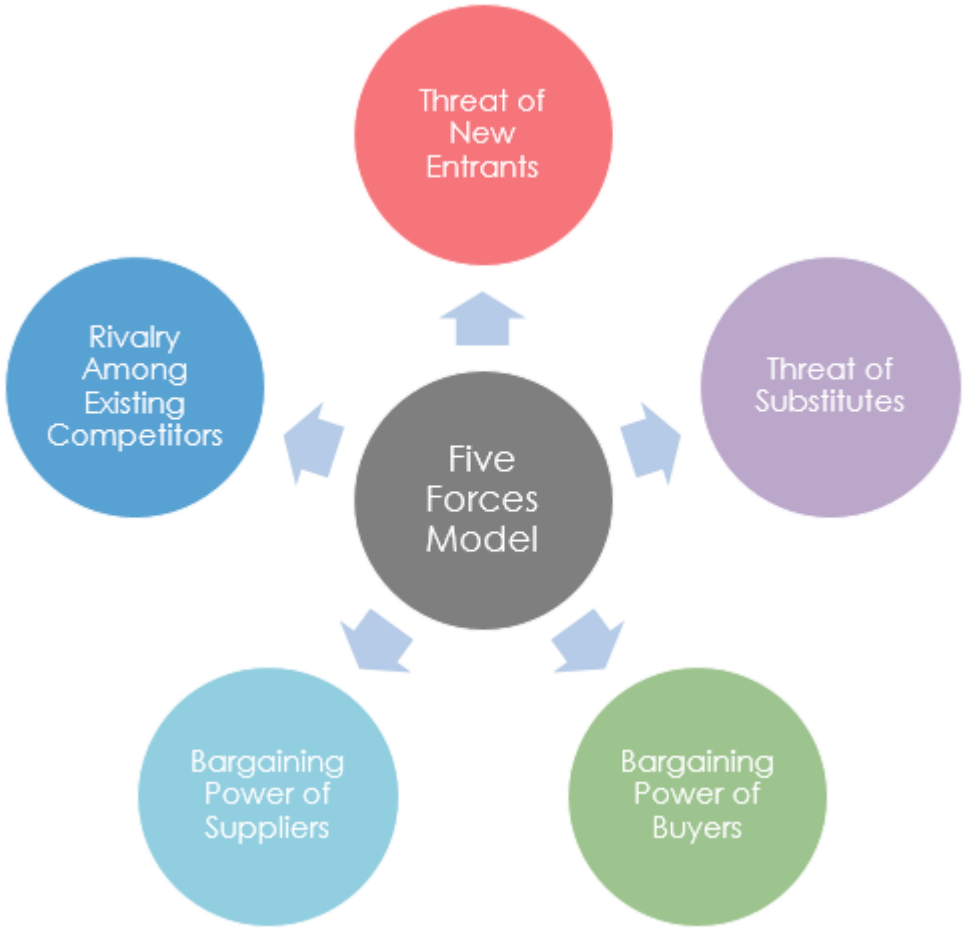
Netflix established a
New dominant design!

Competitive landscape





Porter model applied to Netflix



Five Forces	Who They Are	Level of Threat/ Bargaining Power	Rationale
Supplier bargaining power	Content providers (e.g., movie studios)	High	• Exclusive rights to content may be difficult to obtain. • There is a limited number of suppliers who can provide high-quality content.
Buyer bargaining power	Viewers and potential subscribers	High	• There is low or non-existent switching cost. • Buyers are more informed and have access to many streaming services.
Rivalry among existing firms	Hulu, Amazon Video	Moderate	• The products have little differentiation (especially for old content). • There are few competitors (i.e., a high concentration ratio). • The U.S. market is already saturated (i.e., slow market growth).
Threat of new entrants	Multinational information technology companies	Low	• There is a high level of economies of scale. • Government and legal barriers exist in multiple countries.
Threat of substitutes	Local television providers, video file sharing websites, and other online entertainment companies	High	• Local television providers produce local content. • It may cost less to use a television provider. • Internet television and video streaming may be more convenient and provide faster service. • Consumers could be indifferent to lower-quality video file sharing services if content was provided without a fee.

Technological Strategy

- Big data
- Artificial Intelligence
- Wisdom of the Crowd
- Infrastructures

Leveraging big data and subscribers data

- Location data
- Device data
- Number of times a program is paused
- Number of show incomplete
- Time (night/day)
- ….

With DVD no idea on the action between mail delivery and actions associated with the “consumption” of the movie. **With streaming all the customer journey is detectable!!**

Artificial Intelligence and product design

"AI profoundly transforms the context where innovation takes place. Why? **AI is inherently a decision-making technology**: it offers opportunities to automate many tasks relating to learning and devising solutions".

Is the transformation of the context induced by AI changing the design *process* and the *objects* of the design actions? For example, which decisions can be automated and which ones cannot?"

Catalyst

Innovation and Design in the Age of Artificial Intelligence

Roberto Verganti, Luca Vendraminelli, and Marco Iansiti

At the heart of any innovation process lies a fundamental practice: the way people create ideas and solve problems. This "decision making" side of innovation is what scholars and practitioners refer to as "design." Decisions in innovation processes have so far been taken by humans. What happens when they can be substituted by machines? Artificial Intelligence (AI) brings data and algorithms to the core of the innovation processes. What are the implications of this diffusion of AI for our understanding of design and innovation? Is AI just another digital technology that, akin to many others, will not significantly question what we know about design? Or will it create transformations in design that current theoretical frameworks cannot capture?

This paper proposes a framework for understanding the design and innovation in the age of AI. We discuss the implications for design and innovation theory. Specifically, we observe that, as creative problem-solving is significantly conducted by algorithms, human design increasingly becomes an activity of sensemaking, that is, understanding which problems should or could be addressed. This shift in focus calls for the new theories and brings design closer to leadership, which is, inherently, an activity of sensemaking.

Our insights are derived from and illustrated with two cases at the frontier of AI—Netflix and Airbnb (complemented with analyses of Microsoft and Tesla)—which point to two directions for the evolution of design and innovation in firms. First, AI enables an organization to overcome many past limitations of human-intensive design processes, by improving the scalability of the process, broadening its scope across traditional boundaries, and enhancing its ability to learn and adapt on the fly. Second, and maybe more surprising, while removing these limitations, AI also appears to deeply enact several popular design principles. AI thus reinforces the principles of Design Thinking, namely: being people-centered, abductive, and iterative. In fact, AI enables the creation of solutions that are more highly user centered than human-based approaches (i.e., to an extreme level of granularity, designed for every single person); that are potentially more creative; and that are continuously updated through learning iterations across the entire product life cycle.

In sum, while AI does not undermine the basic principles of design, it profoundly changes the practice of design. Problem-solving tasks, traditionally carried out by designers, are now automated into learning loops that operate without limitations of volume and speed. The algorithms embedded in these loops think in a radically different way than a designer who handles the complex problems holistically with a systemic perspective. Algorithms instead handle complexity through very simple tasks, which are iterated continuously. This paper discusses the implications of these insights for design and innovation management scholars and practitioners.

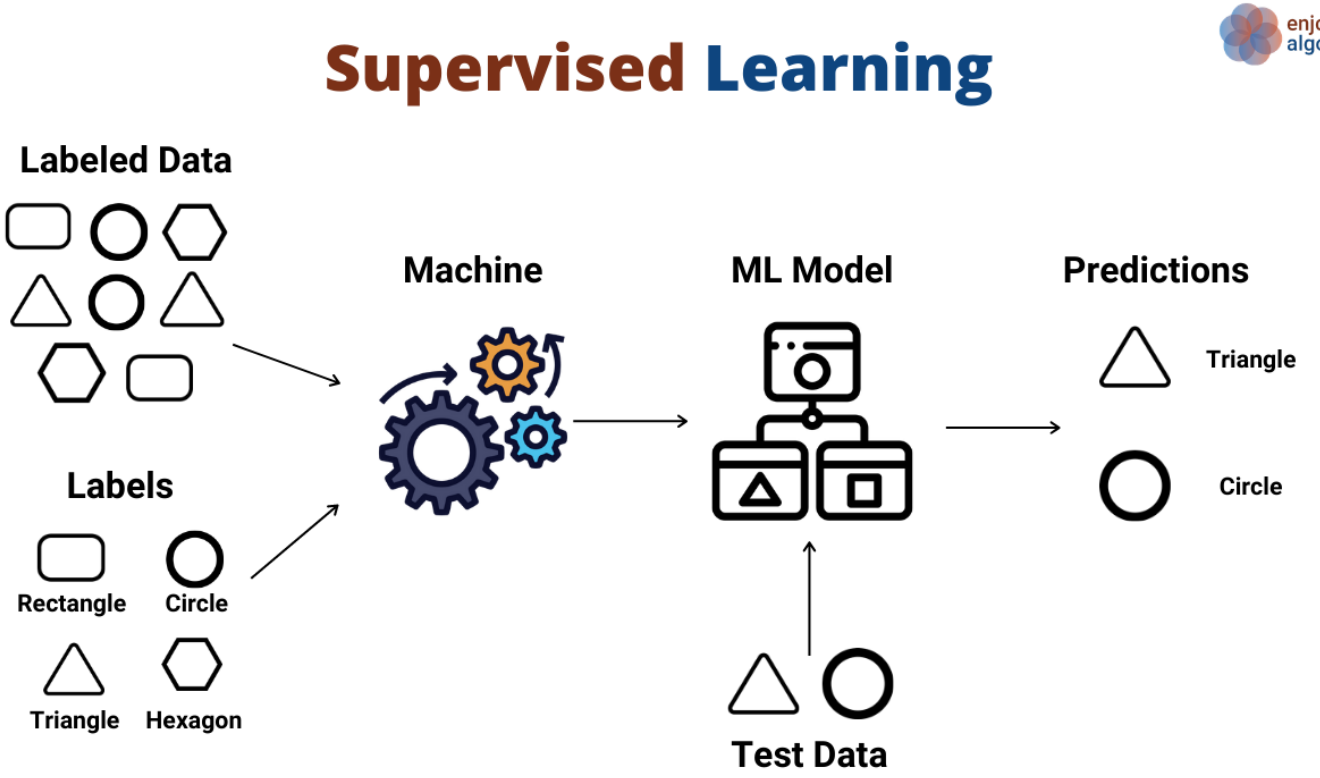
Netflix and the Data-Driven, Design Thinking Machine

Netflix started to leverage AI at least as early as 2010, to fuel its recommendation engine. In 2014, Netflix expanded its approach to invest extensively in understanding user behavior and develop a personalized streaming experience for each user.

The application screens that a user sees today are “designed in real time” by a machine. Many boundaries and parameters are specified by human designers at the outset of the process.

But the decisions about which movies to show, how to display them, which pictures to represent them with, and many other design decisions are done by algorithms embedded in the AI problem-solving loops”.

Supervised learning

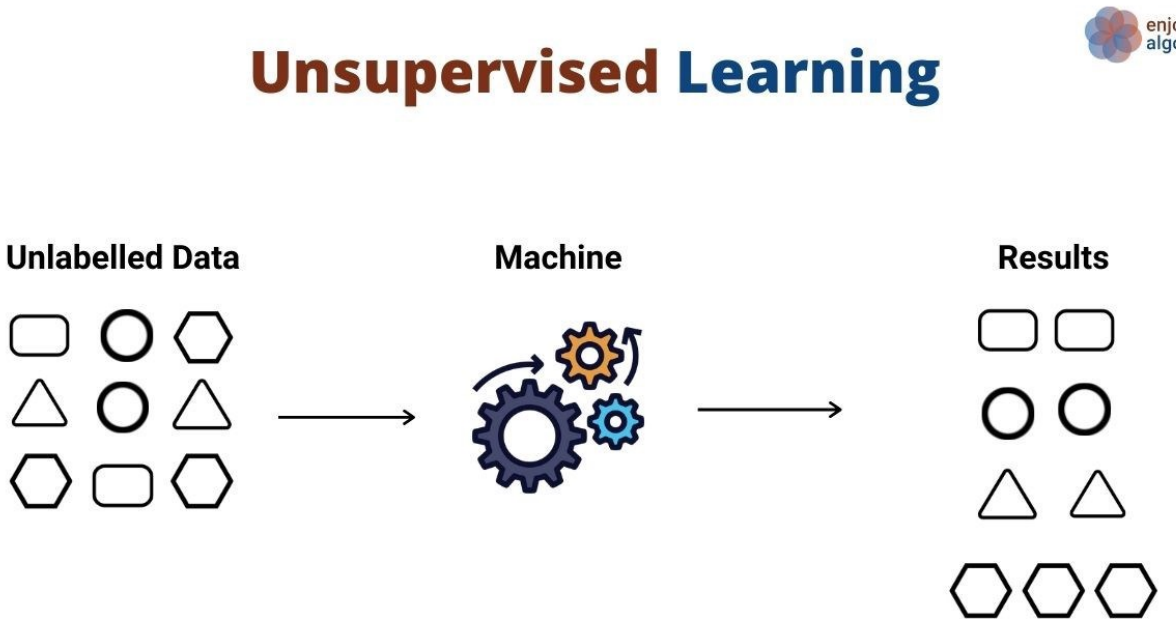


enjoy algorithms

Netflix uses supervised learning in a variety of scenarios.

For recommendations, Netflix has used labeled data sets made up of actions and results (e.g., movies chosen and liked) by people who are deemed by the algorithm to be similar to a given user. The richer the stream of data, the more the problem-solving loops are user centered.

Unsupervised learning



Netflix uses unsupervised learning to discover related groups of customers or to create different versions of the user interface that match different usage patterns. Even more advanced, Netflix uses data and AI algorithms to predict which content to create in the first place.

The first application of predictive analytics was back in 2013, to evaluate the potential **of House of Cards**, in collaboration with Media Rights Capital.

Reinforcement learning

Netflix recognized that viewers have enormous diversity in taste and preferences. So, the Netflix team decided that each user should be shown a cover artwork specifically designed for her, drawn from the frames of a movie. The artwork would highlight the aspects of the title that are specifically relevant to that specific user (Chandrashekar, Amat, Basilico, and Jebara, 2017).

The problem was complicated, as the Netflix team needed to figure out which movie selection to present, and then, which artwork to combine with that movie to maximize the match between user and recommendation.

A single season of an average TV show (about 10 episodes) contains nearly 9 million total frames. Asking creative editors to efficiently sift through that many frames of videos to design an artwork that would capture the audience's attention would be tedious and ineffective. Designing an artwork for each specific user according to his or her preferences would simply be impossible.

Netflix algorithm (early 2000s)

Cinematch → Netflix members were asked to rate at least 20 movies using five star system. 100 million user ratings for about 18,000 movies. Take any two movies and find the people who have rated both of them

Then look to see if the people who rate one of the movies highly rate the other one highly, if they liked one and not the other, of if they did not. Now do this for all possible pairs of 65,000 movies.

60% of Netflix rentals were recommended by Cinematch. By 2006 the progress of Cinematch had stalled. Hastings knew that recommendation systems were extremely hard to improve on (a fact proved by Root Mean Standard Error)

Hastings did a back a calculation and come out that if the algorithm could be improved of 10% (against 4-5% of the past years), Netflix would generate between 60 and 89 million in annual revenue for the next four years.

Netflix algorithm relying on the wisdom of the Crowds

- Contest strategy to create its own platform relying on the Crowds

Contest rules

- RMSE as benchmark to win the prize →1 $ million for an algorithm that increases thw Netflix Cinematch by at least 10%
- If no one reached that point 50,000$ to whomever made the most progress above a 1 percent improvement

Netflix algorithm relying on the wisdom of the Crowds

PROBLEMS/drawbacks

- Relising of data and customer privacy
- Tension between control and innovation
- Problems on IP rights→ how to protect innovation if open to external?
- If the algorithm created during Netflix contest were not sufficiently protected newcomers could abruptly enter to the market.
- Risk of information disclosure by participants → usually anonymity of clients and participants is used to protect, impeding collaboration and communication (limiting information sharing)

Netflix algorithm relying on the wisdom of the Crowds

SOLUTIONS/adv

- Hastings decide to host internally the contest, taking care of infrastructure and facilities → this implies high costs but lower than internal development

- The demonstrated advantage of crowdsourcing over internal development was in the quantity and diversity of solutions.
- The complexity of the challenge would require deep collaboration from many individuals.

- To guarantee rights to the winner Hastings had the idea to publish a coauthored paper on the winning algorithm → External disclosure to competitors

Netflix and Cloud Computing infrastructures

Since 2016 with

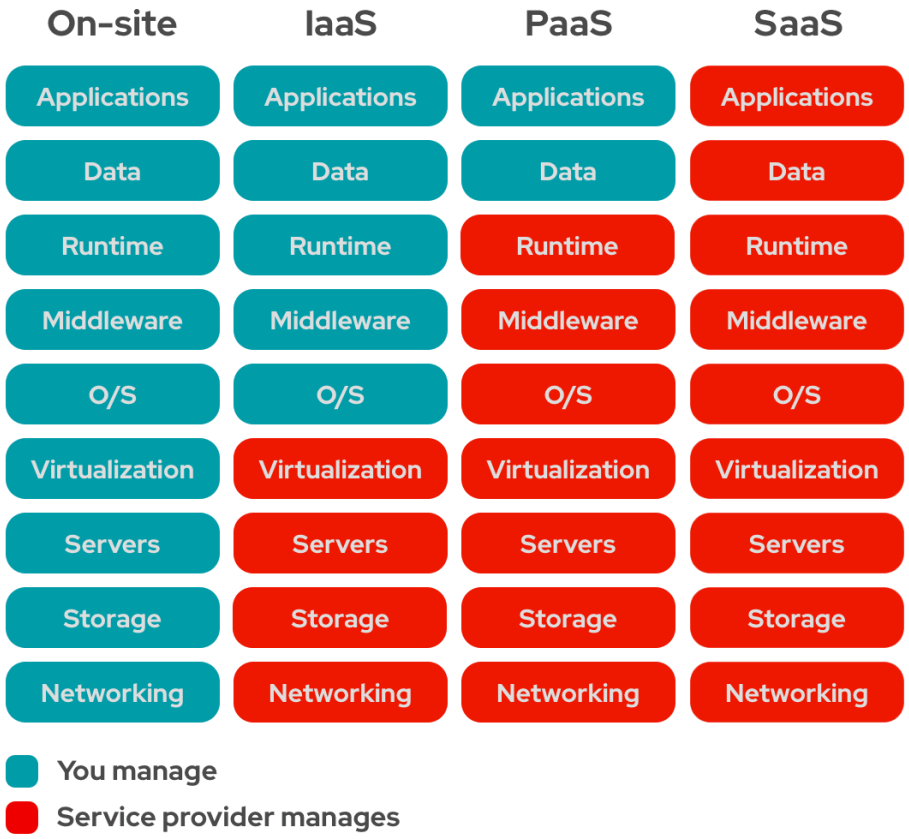
aws

over-the-top (OTT)

Netflix and Cloud Computing infrastructure

Netflix is based on an over-the-top (OTT) media service model, i.e. bypassing traditional distribution systems and distributing directly via the Internet

Netflix uses AWS as a cloud provider in a SaaS model for all processing, storage, recommendation engines, video transcoding needs (+100,000 temporary virtual servers)



Netflix Empowers Remote Artistry with Low-Latency Workstations Using AWS Local Zones

Overview

When Netflix built a visual effects (VFX) studio in the cloud using Amazon Web Services (AWS), the entertainment company's goal was to facilitate **collaboration among artists and content creators around the globe through remote workstations**.

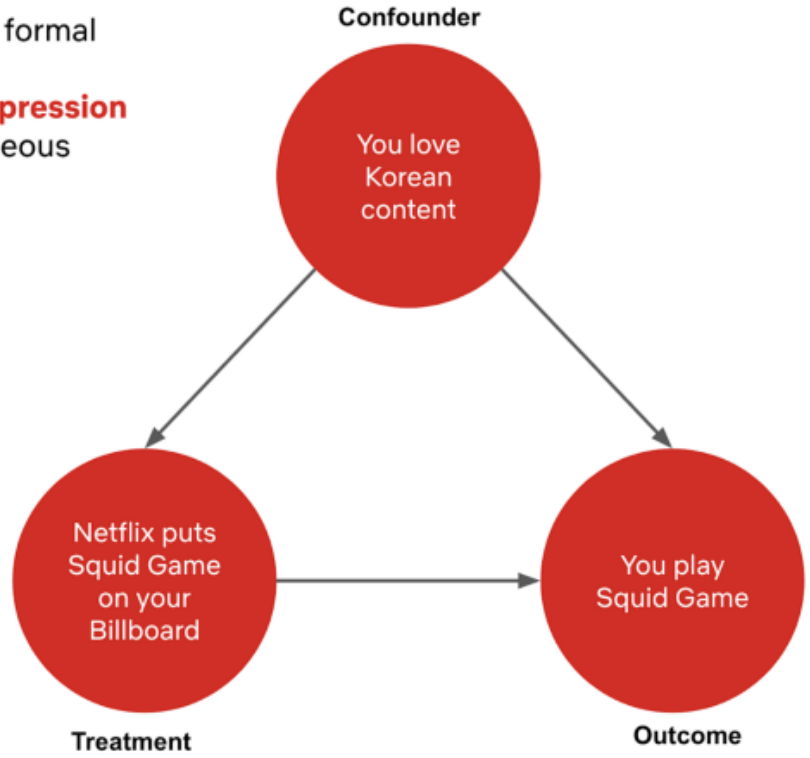
Once Netflix's artists and partners gained the ability to access secure, high-powered virtual workstations remotely, the company's next step was to achieve low latency for its applications to reduce lag and offer a seamless content-creation experience closer to artists. In 2020, Netflix began using AWS Local Zones, a type of AWS infrastructure deployment that places compute, storage, database, and other select AWS services close to large population and industry centers. By accessing AWS compute services on Local Zones, Netflix can achieve low latency for applications and facilitate virtual workstations for its VFX studio users, fostering collaboration among artists.

Netflix data science culture

Most machine learning algorithms used in personalization and search, including deep learning algorithms, are purely associative. They learn from the correlations between features and outcomes how to best predict a target.

In many scenarios, going beyond the purely associative nature to understanding the causal mechanism between taking a certain action and the resulting incremental outcome becomes key to decision making. Causal inference gives us a principled way of learning such relationships, and when coupled with machine learning, becomes a powerful tool that can be leveraged at scale.

Causal Inference provides formal tools to tease out the true **incremental** value of an **impression** for each profile: Heterogeneous Treatment Effect (**HTE**)



Netflix data science culture

Experimentation and causal inference is one of the primary focus areas within Netflix's Data Science and Engineering organization. To directly support great decision-making throughout the company, there are a number of data science teams at Netflix that partner directly with Product Managers, engineering teams, and other business units to design, execute, and learn from experiments. To enable scale, we've built, and continue to invest in, an internal experimentation platform (XP for short).

The Netflix XP balances execution of the current experimentation program with a focus on future-looking innovation. It's a virtuous flywheel, as XP aims to take whatever is pushing the boundaries of our experimentation program this year and turn it into next year's one-click solution. That may involve developing new solutions for allocating members (or other units) to experiments, new ways of tracking conflicts between tests, or new ways of designing, analyzing, and making decisions based on experiments. For example, XP partners closely with engineering teams on feature flagging and experience delivery. In success, these efforts provide a seamless experience for Netflix developers that fully integrates experimentation into the software development lifecycle.

For analyzing experiments, we've built the Netflix XP to be both democratized and modular. By democratized, we mean that data scientists (and other users) can directly contribute metrics, causal inference methods for analyzing tests, and visualizations. Using these three modules, experimenters can compose flexible reports, tailored to their tests, that flow through to both our frontend UI and a notebook environment that supports ad hoc and exploratory analysis.

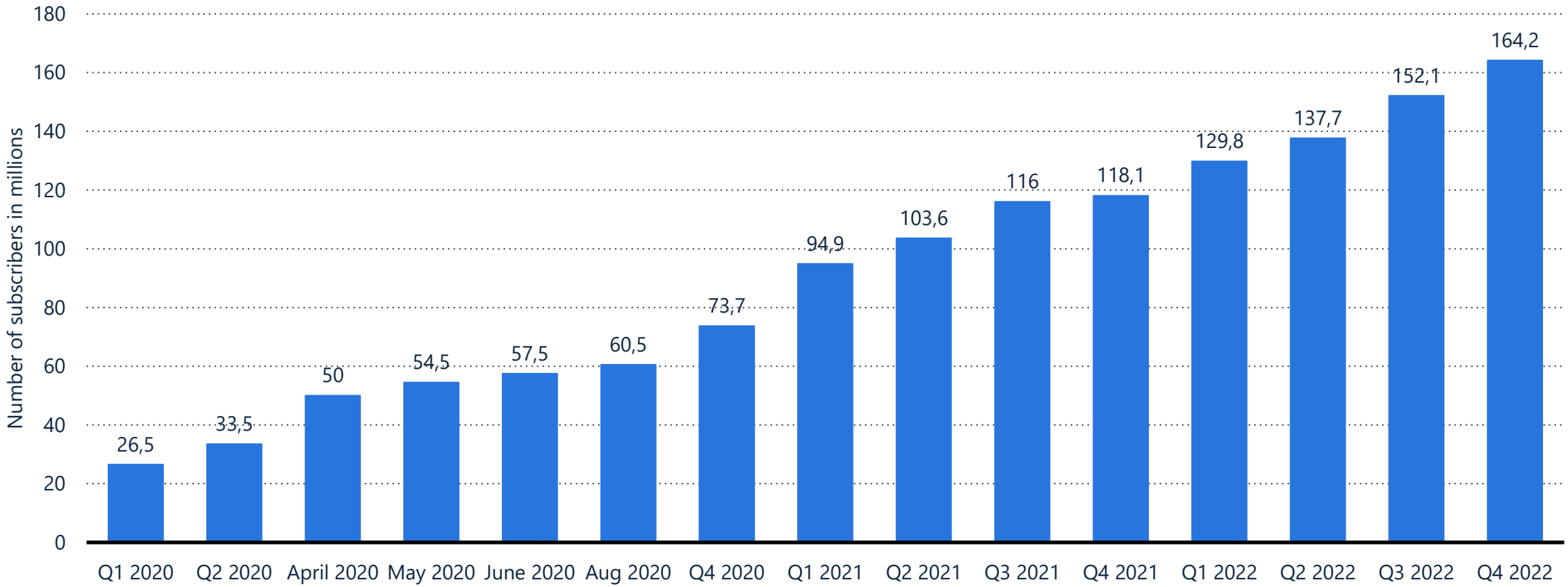
Netflix challenges

- Local markets
- Languages (only 20 languages in 190 countries)
- Local related contents (strong preferences for viewing domestic content)
- Local content providers
- Poor broadband penetration
- Expand typology of contents (e.g. sports?)
- Partnerships outside the entertainment industry (hotels, airline companies?)
- Different pricing models (adv?)

EMERGING LEADERS?

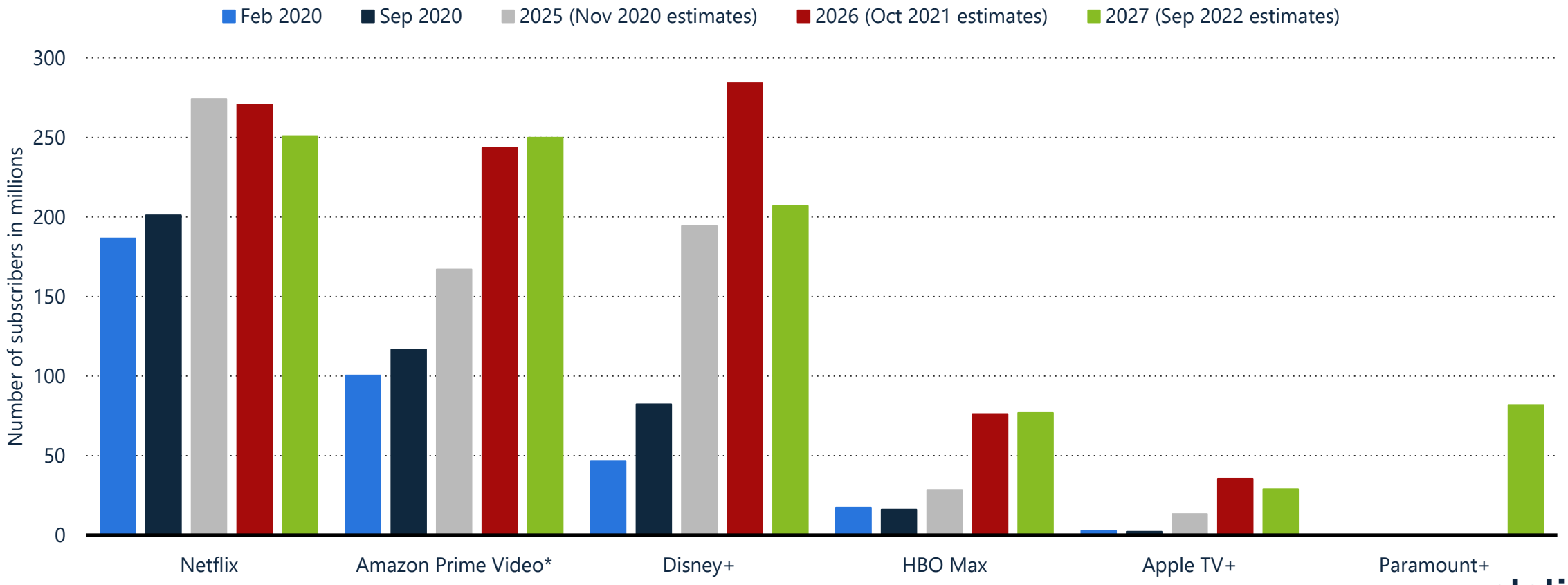
Number of Disney Plus subscribers worldwide from 1st quarter 2020 to 4th quarter 2022 (in millions)

Quarterly Disney+ subscribers count worldwide 2020-2022



Estimated number of subscribers worldwide from 2020 to 2027, by service (in millions)

SVOD subscriber count worldwide 2020-2027, by service



statista

Has Netflix reached its peak?

- Big data bubble? (decreasing quality as a sign of the importance of time and human creativity?)
- From unconscious co-creation to more awareness of customer role in the process?
- New competitors from other markets ? (attention and time scarce resources → Tik Tok/ Short Video can capture the new generation interests?)

Food for thought

https://www.wired.com/2009/08/netflix-prize-continues/

https://netflixtechblog.com/

https://www.asc.ohio-state.edu/statistics/dmsl/GrandPrize2009_BPC_BellKor.pdf