

Video Streaming Technology and Its Impact on the Media Ecosystem of the 21st Century

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Abstract

Video streaming technology has emerged as one of the most significant phenomena of the digital era, transforming the media ecosystem and reshaping how audiences access content. This paper explores the origins, characteristics, and types of video streaming, as well as the technological and social conditions that have enabled its development. It analyzes key video streaming models, including on-demand streaming, live streaming, and hybrid formats, with particular attention to VOD platforms such as Netflix and YouTube. The study discusses major changes in the media landscape driven by this technology, including shifts in business models, the globalization of media corporations, and the rise of new content creators. Special attention is given to the impact on audience habits, the development of recommendation algorithms, and challenges such as piracy and regulatory issues.

Keywords: video streaming, media ecosystem, digital transformation, media corporations, audience habits

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Introduction

The continuous development of digital technologies over the past three decades has gradually enabled the emergence of various platforms. Every new possibility, such as networking, content sharing and downloading, written communication exchange, online data storage, and many others, was quickly adopted and developed in different ways upon its inception. Consequently, the nature of the digital sphere has become increasingly complex, as each feature has led to the branching and definition of one or more new sub-spheres with specific characteristics and diverse applications. Simultaneously, due to its convergent and multimedia nature, each of these new spheres has remained closely connected to the others.

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Therefore, while many contemporary studies of digital technologies rightly focus on the digital world as a whole, it is essential to emphasize that this realm consists of numerous interconnected elements. Each element evolves both independently and in coordination with others, bringing about new changes and possibilities that, in turn, pave the way for further innovations and transformations.

One of the innovations that has significantly enriched the digital sphere is the phenomenon of streaming. This now widely accepted element of the digital world, particularly popularized through streaming platforms like YouTube and Netflix, marked a historical turning point in how society interacts with online content. This change was so significant that some authors, somewhat optimistically, declared the “end of broadcasting” as early as the beginning of the millennium (Bhandari et al., 2000). While that prediction did not come true, the following years undoubtedly saw the beginning of a transformation in how media content is created and consumed (Krikke, 2004), along with changes in audience habits (Burroughs, 2015).

The goal of this paper is to examine the streaming phenomenon, systematize and present the conditions that needed to be met for this technology to be considered mainstream, with a particular focus on video streaming, and highlight some of the most significant changes in the media world driven by this technology.

Origin, Characteristics, and Types of Media Streaming

The term “streaming” comes from the English word “stream,” meaning “flow of water” (Online Etymology Dictionary, n.d.; Merriam-Webster, n.d.), and refers to a technique and technological process of continuous real-time content distribution to users without requiring downloading (Kozamernik, 2002; Maciejewski, Fischer, Roginska, 2014). The term was first used in the 1970s, developed as a concept in the 1980s, but its practical application only occurred in the 1990s.

The primary feature of this technique is online access to content, meaning access without the permanent transfer of data to the user’s computer device, regardless of the technological means that ensure such transfer is avoided or managed afterward (Maciejewski, Fischer, Roginska, 2014:10). This is a critical distinction that sets streaming apart from other methods of content exchange and access—namely downloading, where users must first download and store content on their devices before viewing or interacting with it (Wu et al., 2001).

The most significant distinctions between streaming and downloading are:

1. Live content transmission: Streaming enables live content delivery without requiring download time.
2. No storage space required: Content does not occupy device memory, removing storage limitations.
3. Internet speed optimization: Streaming uses only the internet speed necessary for real-time transmission.
4. Combining with non-streaming content: Streaming can be integrated with other types of content.
5. Targeted distribution: The same content can be distributed simultaneously to a large, targeted audience (Kozamernik, 2002).

Thus, streaming is a much faster method, reliant solely on a predetermined internet connection speed rather than storage capacity. Moreover, the process can be more tightly controlled by the distributor, especially regarding access permissions and intended audiences, unlike downloading, where content formally leaves the distributor's control once downloaded.

Owing to these innovations, streaming quickly found applications across various fields and in diverse ways. Hendrik Storstein Spilker and Terje Colbjørnsen identify five dimensions—or ten types—of modern **media streaming and its usage**:

1. Professional vs. User-Generated Streaming (Creator Perspective): The key difference lies in whether content is provided by amateurs or professionals, institutions, and organizations in the relevant field.
2. Legal vs. Pirated Streaming (Copyright Perspective): Is the distributed content owned by the distributor, or is it pirated?
3. On-Demand vs. Live Streaming (Content Type Perspective): Is the content broadcast live, or does the user select (demand) specific content from an existing database?
4. Single-Purpose vs. Multi-Purpose Platforms (Platform Type Perspective): Is the streaming technique used solely for one purpose, or does it have multiple uses and applications?
5. Niche vs. Broad Audience Streaming (Audience Perspective): Is the content intended for a broad audience or a specific niche segment? (Spilker & Colbjørnsen, 2020).

Combining different dimensions reveals various forms, types, and applications of this technology, including different types of streamers and streaming services. However, another essential dimension for fully conceptualizing streaming use is the type of content. While the term is now mostly associated with distributing video materials, it equally applies to other forms like audio content (Spotify), text (Google Books, Kindle), and e-information (Google Maps) due to the high convergence of the digital world (Maciejewski, Fischer, Roginska, 2014). In fact, video streaming is the latest development in this technology, preceded by various historical and technological conditions.

Historical and Technological Conditions of Streaming's Emergence

The idea of streaming as a simultaneous transmission or flow, which audiences can join and adjust to their needs, is not new. Raymond Williams, in his analysis of television, recognized this concept long ago (Williams, 1974). As Benjamin Burroughs explains, streaming is as much culturally as it is technologically driven, with many historical attempts at creating streaming-like systems. He mentions Thomas Edison's telephonoscope, live music broadcasts over the phone, early radio transmissions, and the press's efforts to create their streaming equivalents (Burroughs, 2019).

While television and radio partially satisfied audience needs at certain points in history, they fell short of offering personalized experiences, and modifying

or selecting content flow was nearly impossible. True streaming only became possible when specific technological conditions were met, primarily through digital technologies like computers and the internet. Yet, these alone were insufficient—specific software and hardware solutions had to be developed. On the software side, streaming consists of browsers, web pages, algorithms, formats, and compression software that enable the smooth flow of interoperable content between software and hardware. The hardware includes desktop computers, laptops, iPads, mobile phones, and internet-connected set-top boxes (Burroughs, 2019:2).

Furthermore, these solutions needed to reach a certain level, particularly concerning video streaming. The three most significant advancements enabling streaming's rise in computer technology are often cited as:

1. Development of high-quality video and audio compression.
2. Development of streaming servers.
3. Advancements in internet speed for both uploading and downloading data (Kozamernik, 2002; Hartsell, Yuen, 2006).

These aspects are crucial due to how streaming functions. Raw (uncompressed) video and audio files are enormous and take up vast amounts of memory. Since the quality provided by these large formats is unnecessary for personal devices, effective compression methods were developed to preserve satisfactory quality while significantly reducing file size.

Encoded and compressed content is transmitted over the internet using specific protocols that ensure addressing (Internet Protocol - IP), data transfer (User Datagram Protocol - UDP), and control (Real-Time Streaming Protocol - RTSP). The user's device receives, decodes, and plays the content using the same protocols (Wu, et al., 2001:283).

It is essential to note that, despite the term “streaming”, this transfer is not continuous. Data is sent in small packets rather than in a steady flow. As each packet is played, new packets are downloaded, while previously played packets are erased from internal memory, creating the illusion of continuous streaming (Hartsell, Yuen, 2006:36; Colbjørnsen, 2020:4). This process underscores the importance of a good internet speed to maintain an uninterrupted stream. Additionally, processing power and data processing speed are critical. If either is insufficient, the transfer will be disrupted, causing playback delays or buffering (Shattuc, 2020:145-146).

The required data distribution and processing speed, along with compression levels, depend on the type of content being streamed. Historically, audio streaming flourished in the 1990s, leading to numerous internet-only radio stations by the next decade (Spilker, Colbjørnsen, 2020). Audio compression is much simpler, with a minimum data transfer speed of 0.256 megabits per second (Mbps) (Thompson, 2020).

Although there were successful video streaming attempts in the 1990s, video streaming only became widely accessible in the mid-2000s with platforms like YouTube (Spilker, Colbjørnsen, 2020). The delay compared to audio streaming stems from the fact that even with modern compression, video streaming requires

between one and several dozen megabits per second (Christiansen, 2022).

Today, these speeds are standard worldwide, enabling rapid video streaming growth. A decade ago, video streaming became the fastest-growing internet usage segment, accounting for over 30% of all internet traffic related to entertainment (West, 2014). Recent research shows it now accounts for 70% of internet activities and is projected to surpass 80% by 2027 (Ericsson, 2022).

Video Streaming – Types and Specificities

The primary reason behind the widespread popularity of video streaming lies in its versatile applications. Fundamentally, video streaming can be divided into on-demand streaming, live streaming, and a hybrid model combining both — live-to-video-on-demand streaming. In the first case, content stored on servers is accessed as needed; in the second, videos are processed and distributed simultaneously as they are recorded, remaining accessible only during that timeframe. The third model is a mix, where recordings are distributed while being filmed but also stored for later on-demand access (Li et al. 2021). Each of these techniques is actively used in modern communication, information dissemination, and data transmission.

Xiangbo Li, with his associates, highlights four distinct models and their applications in live streaming:

One-to-One – Used in video calls and chats, characterized by low image quality and slight communication delay.

One-to-Many – A single person broadcasts live video to numerous viewers, such as live streams on Instagram, Facebook, or YouTube. This includes individuals and websites that legally or illegally stream live television (Lobato, 2019:8).

Many-to-One – Multiple cameras send video feeds to a single user, commonly used in surveillance systems.

Many-to-Many – Multiple users from different locations stream live video to a broader audience, typical in video conferencing (Li et al. 2021:204-205).

These models share transactional, ephemeral characteristics, accessible only during the live broadcast. Users must be notified of the broadcast time in advance and be present at that specific moment, making live streaming suitable mainly for occasional, short-term events and interactions.

In contrast, video-on-demand (VOD), always accessible at the user's convenience, offers entirely different applications. This system, often referred to as OTT (Over-the-Top) media, delivers video content via the internet, bypassing traditional broadcasting, cable, or satellite distribution (Kim, Baek, Kim, 2021). Interpretations of what constitutes OTT distribution vary: some consider only VOD as OTT, while others include both VOD and live streaming (Chalaby, Plunkett, 2021:3211). These features, among others inherent to digital media, have led to discussions about VOD services as drivers of the post-television era (Radošinská, 2017; Tana, Eirola, Nylund, 2020:108). While predominantly used for entertainment, series, and film distribution, they are also applied in education, internet TV, and related systems (Li et al. 2021:204).

VOD services are commonly categorized based on their operational and business models:

1. **TVOD (Transactional Video-on-Demand)** – Content distribution based on transactions. Users pay fees to purchase or rent individual content for a specific time (Lobato, 2019:8). Examples include iTunes and Google Play Store (Baschiera, Re, 2019:2).
2. **AVOD (Advertising-Based Video-on-Demand)** – Free or lower-cost access supported by advertisements, often algorithmically targeted (Vašíčková, Szczepanik, 2018). YouTube's basic version is a classic AVOD example.
3. **SVOD (Subscription-Based Video-on-Demand)** – Users pay a monthly subscription fee for access to the service's entire content library (Lobato, 2019:8). Popular platforms include Netflix, Disney+, and Amazon Prime Video.
4. **IPTV (Internet Protocol Television)** – Provides television broadcasting services over the internet, often highly regulated. IPTV combines standard TV with features like rewinding, VOD, and video clubs (Juluri, Tamarapalli, Medhi, 2015:1-2). Examples include EON and ORION Telekom in Serbia.
5. **Hybrids** – Platforms operating through multiple models or combinations. These platforms, unlike others focused on professional content, often include user-generated content (Lobato, 2019:8). YouTube Premium exemplifies such hybrids.

The last two models represent the hybrid streaming type combining live and VOD features. They are essential when discussing SVOD services due to the unique opportunities they provide and their competition with other models.

Regardless of their type, all VOD services, along with social networking platforms, have comprehensively integrated digital world dimensions. They utilize numerical video representation, convergence, content compression, global internet distribution, and interactive audience engagement. Users can actively choose and personalize content based on their preferences. Additionally, a critical element of VOD platforms is creating extensive databases of user activities and feeding these data into recommendation algorithms. Thus, VOD services are a near-perfect product of the digital ecosystem, showcasing how its elements function together in practice. Simultaneously, streaming itself has brought numerous innovations and transformative changes to the media landscape.

Changes in the Media World Driven by Video Streaming

The primary innovation introduced by streaming in the media sphere is the transition in the way content is distributed. Instead of terrestrial or satellite broadcasters of television and radio signals, or, in a more radical case, printing and physically

distributing newspapers, the globally accessible internet network, through streaming technology, has become a universal means of immediate content distribution. This method is not only faster and more widely available than all previous ones but is also significantly cheaper. As a result, two continuous trends have emerged: the creation of global media conglomerates and new types of distributors on the one hand, and the rise of a large number of new content creators on the other.

As internet distribution replaced mass broadcasting, particularly in the case of television, national borders lost their significance in defining the areas where content would be broadcast, allowing many media outlets to become global media conglomerates relatively quickly through this transition. Naturally, this shift required significant changes in operational methods. As Jean Chalaby and Steve Plunkett explain, large media companies quickly integrated VOD systems into their offerings but also realized that the distribution and creation of content did not have to rely on a strict vertical hierarchy, where the corporation controls every segment of production. Instead, external collaborators could be engaged to address both content delivery and creation issues. Media companies began outsourcing a significant portion of their content production and distribution processes (Chalaby, Plunkett, 2021). These changes enabled the rise of new global media corporations that have used streaming as the foundation of their business, including well-known platforms such as Hulu, Amazon Prime, Netflix, and HBO.

It was not solely new, large companies that emerged as a result of streaming; individuals, amateurs, and citizen journalists also found space to capture public attention. The financial accessibility of streaming equipment, combined with simultaneous distribution and the potential for a vast audience, enabled individuals to become nationally and globally visible and relevant. Notably, this includes popular influencers and YouTubers, modern opinion leaders whose audiences often number in the thousands. Behind this phenomenon is the public's need for fast, up-to-date, and specialized responses to current events, whether for information, education, or entertainment. Still, these changes are neither one-dimensional nor truly democratic. Although SVOD models have long been regarded as the dominant paradigm in the streaming industry, prevailing market conditions between 2024 and 2026 reveal signs of market saturation and a strategic pivot toward hybrid monetization approaches. Confronted with escalating production costs and subscriber churn, major platforms such as Netflix and Disney+ have introduced lower-priced, advertising-supported tiers. This development effectively erodes the traditional distinction between AVOD and SVOD frameworks. This process of platformization within the media sector underscores a profound degree of economic concentration (Chalaby, 2025), wherein the long-term viability of operations no longer depends solely on content quality. Instead, sustainability increasingly hinges on platforms' capacity to monetize user data and sustain user attention within closed, proprietary ecosystems.

At first glance, it seems that traditional media systems cannot compete with the streaming community, where there is always an individual or group that is closer to the event, better understands it, or can present it in a more interesting way than any media outlet could. In fact, when it comes to journalism and streaming, several significant changes have occurred:

1. There are no longer any limitations in terms of deadlines and formats of journalistic texts.
2. Geography becomes less relevant for gathering information, creating, and distributing journalistic products.
3. Data flows and live social activities provide new and unfiltered raw materials.
4. Real-time feedback influences stories.
5. Individuals become more significant than brands (Anderson, Bell, Shirky, 2015:41).

Thus, it is not without merit to argue that individuals or groups streaming content can have a greater impact on the global public than large media corporations. This argument is supported by the fact that, in the summer of 2022, CNN, as the most followed media company on YouTube, had around 14 million followers (Maher, 2022), while Felix Kjellberg (PewDiePie), an individual, had 111 million followers on the same platform (Le Guyader, 2022). Of course, the content they distribute is not the same, and it should be noted that CNN also has other distribution channels, but this comparison highlights the impact streaming can have on shifting the balance of global communication power. Although platforms such as YouTube have indeed democratized access to content creation and distribution, contemporary visibility for creators is rigorously conditioned by algorithmic gatekeeping, whereby recommendation algorithms, rather than traditional editors, determine the allocation of attention and influence (Esteve-del-Valle, Sarchosakis, 2025). These systems frequently prioritize sensationalism or advertiser-friendly content to maximize engagement metrics and platform revenue, thereby reshaping content production incentives.

Individual creators thus operate in a state of persistent precarity, where abrupt modifications to monetization policies, algorithmic updates, or platform code can instantaneously diminish their reach and economic viability (Bidav, 2025). Concurrently, some established professional media organizations have not remained inert; they have proactively incorporated streaming technologies into their vertically integrated hierarchies, leveraging these tools for direct-to-audience distribution, enhanced interactivity, and sustained audience retention amid broader platform competition.

However, it is not merely media organizations and the news industry as a whole that have undergone changes due to the emergence of new methods of content transmission. The same has occurred with the “central creative industries” - film, music, and books (Hesmondhalgh, 2019, according to Sundet, Lüders, 2022:4). The basic business models, which relied on cinema distribution and the sale of physical copies of records, disks, and printed books, have been replaced by digital copies and online reproduction. Michael Smith and Raul Telang argue that the period of technological development is simultaneously the best and the worst for creative industries. On the one hand, similar to the information sector, it has enabled many small and unknown authors to publicly express and showcase their works

and creativity. However, the same technologies have also changed the competitive landscape, weakened the control established players had over content and consumers, and forced business leaders to make tough compromises between old business models and new business opportunities (Smith, Telang, 2016:3). Thus, instead of releasing records and disks, the music industry turned to profitable music streaming platforms, while film, especially television series, largely shifted from TV to VOD platforms. Publishing also pivoted to digital or audio versions of books. The length of songs, the transition from album releases to exclusive single releases, the timing of film releases, genre orientation, narrative structure techniques in series, and, especially, the definition of content and marketing and promotional communication strategies in these industries, have all been completely redefined (Smith, Telang, 2016: Herbert, Lotz, Marshall, 2019; Sundet, Lüders, 2022). Additionally, it is essential to consider another complicating factor for all these industries - the extremely simple piracy and the emergence of illegal copies in the streaming environment. Beyond piracy, a central challenge in the 21st-century media landscape lies in the inherent tension between global streaming platforms and national regulatory frameworks. While these platforms operate seamlessly across borders, states have increasingly enacted measures grounded in digital sovereignty or cultural sovereignty (Tambini, 2025), compelling global players to allocate a percentage of profits toward local production or to adhere to stringent quotas promoting domestic language, culture, and content. Such conflicts, centered on licensing, copyright management, and content investment, underscore that the contemporary media ecosystem is not merely a technological domain but a contested political arena in which struggles for control over cultural narratives unfold. These regulatory interventions reflect broader efforts to safeguard national cultural identities against the homogenizing tendencies of transnational platforms, even as they raise questions about trade relations, market efficiency, and the balance between global accessibility and local cultural preservation.

The audience did not take long to adapt to these changes. The sense of mobility, the need for interactive access to desired content at any time and from any place, has dramatically increased, particularly among the younger population (Sundet, Lüders, 2022). It is crucial that this instant access has diminished the need for permanent ownership of physical or digital copies and replaced it with the need for access to content (Herbert, Lotz, Marshall, 2019:4-5). However, the problem with this system is that access to certain content today does not guarantee that it will be available forever (of course, with a paid subscription). There can be many reasons for this, from the expiration of broadcasting rights on a particular platform to legal changes, or simply replacing one version of a series, film, or song with a new one where certain parts are removed, altered, or cut. Nevertheless, if we consider the number of users and subscribers of video streaming services, the impression is that they are not particularly concerned or aware of this issue. On the other hand, the lack or absence of advertisements, the possibility of unlimited viewing of desired content without interruptions, known as binge-watching, and the vast libraries of available content that, with the help of algorithms, are recommended based on user preferences, have led to additional consequences. The peak viewing

time for streaming services is significantly different from that on television and, according to various studies, most often occurs between 9 PM and 4 AM. This, particularly among the younger population, often results in a reduction of melatonin levels, increased obesity and cardiovascular problems, sleep deprivation, and fatigue (Tana, Eerola, Nynland, 2020). On the other hand, some studies have highlighted the significant role of streaming techniques in learning, meetings, and debates, offering better understanding of material and more comprehensive skill development (Liu, Hung, 2020). This method has proven particularly useful in distance learning, which became widespread during the COVID-19 pandemic worldwide.

These are just some of the key changes and observations related to streaming in the broadest sense, which various academic disciplines have explored in recent years. One might also assume, for example, that the advent of streaming accelerated the development and use of personal computers by several years, as it does not require memory space. This allowed many users to transition from slower and cheaper hard disk drives (HDD) with large memory space (which is unnecessary for streaming) to faster solid-state drives (SSD), which, in their cheaper variants, provide less space but enable two to three times the speed in data access and transfer (Brant, 2022). All areas of transformation—from computers to information industries, the arts, and entertainment, as well as the audience—strongly support the argument that streaming is indeed a revolutionary technology that has changed the way society functions. While these transitions may seem abrupt, they have occurred gradually, owing to the popularization of this new method of data, content, information, and communication transmission in general.

Conclusion

Although digital technologies, which contemporary society relies on today, seem commonplace and self-understood, they are the result of innovations and advancements across various hardware, software, and social fields. Similarly, streaming technology is not the product of a single moment but rather a process that has gradually embedded itself into the global media system. Understanding the conditions under which streaming emerged, along with its distinctive features, types, and innovations it directly introduced, as well as the conditions that prevailed before it, is of imperative importance for any serious analysis. Only from these conclusions can the transformations in communication, media, audiences, habits, and practices, which today represent the normal communicative environment, be observed.

This understanding is essential not only in academic and scientific contexts but also in broader societal frameworks, as it forms the foundation for all future research in this field. On the other hand, neglecting the history, changes, and contextual specifics of contemporary media and technologies - which is characteristic of the fast-paced nature of modern communication and existence - can lead to the trivialization of these important topics or, worse, to the inability to comprehend new changes, which will have their foundations precisely in these developments. Furthermore, the

lack of deeper discussion regarding streaming, a phenomenon that marked the first two decades of the 21st century, could result in the inability to understand and, more crucially, to predict new transformations in the pandigital world.

The transformation brought by streaming goes far beyond a mere technological shift from traditional broadcasting to on-demand access. It represents a profound redefinition of the political economy of media itself. Algorithms have emerged as the new gatekeepers, determining visibility and influence in ways that often eclipse the role once played by human editors or broadcasters. At the same time, national regulators and legacy media giants are actively renegotiating their positions in an ongoing struggle over digital sovereignty and cultural sovereignty.

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Tehnologija video striminga i njen uticaj na medijski ekosistem 21. veka

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Apstrakt

Tehnologija video striminga pojavila se kao jedan od najznačajnijih fenomena digitalne ere, transformišući medijski ekosistem i menjajući način na koji publika pristupa sadržajima. Ovaj rad istražuje poreklo, karakteristike i tipove video striminga, kao i tehnološke i društvene uslove koji su omogućili njegov razvoj. Analiziraju se ključni modeli video striminga, uključujući striming na zahtev, prenos uživo i hibridne formate, sa posebnim osvrtom na VOD platforme poput Netfliksa i Jutjuba. Studija razmatra glavne promene u medijskom pejzažu koje su proizašle iz razvoja ove tehnologije, uključujući transformaciju poslovnih modela, globalizaciju medijskih korporacija i uspon novih stvaralaca sadržaja. Posebna pažnja posvećena je uticaju na navike publike, razvoju algoritama za preporuke i izazovima kao što su piraterija i regulatorna pitanja.

Ključne reči: video striming, medijski ekosistem, digitalna transformacija, medijske korporacije, navike publike.

Received: 21st February 2026

Revision received: 6th March 2026

Accepted: 6th March 2026