

**STREAM CAPTURE: RETURNING CONTROL OF DIGITAL
MUSIC TO THE USERS**

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I. INTRODUCTION

I WANNA SAY A SPECIAL WELCOME TO EVERYONE THAT'S, UH,
CLIMBED INTO THE INTERNET TONIGHT AND, UH, HAS GOT INTO THE
M-BONE. AND I HOPE IT DOESN'T ALL COLLAPSE.

— MICK JAGGER¹

A number of streaming Internet music services have popped up recently, both in the U.S. and abroad. These services come in many shapes: some function akin to radio stations,² some deliver on-demand streams à la jukeboxes,³ and some even stream your own music back to you from the “cloud.”⁴ The multitude of companies attempting to cash in on streaming Internet music can in part be attributed to the excellent monetization properties of streams. Streaming services — whatever the overarching arrangement may be — essentially provide single use products (streams) that perish as they are consumed. In short, Internet music streams have the commercially desirable properties of private goods: rivalry and excludability. In addition, certain classes of streaming services may take advantage of a statutory licensing scheme, giving service providers a vast library of perishable goods to deliver to consumers at low expense.⁵ However, companies attempting to monetize streaming Internet music might soon have to confront a technological development similar to one that previously threatened over-the-air video and cable: the ability to capture streaming content. For television, the threat was video stream recording devices, such as the VCR and TiVo. For Internet music streams, it

1. Mick Jagger of the Rolling Stones, opening the first major streaming Internet multicast concert in 1994. See Peter H. Lewis, *Peering Out a 'Real Time' Window*, N.Y. TIMES, Feb. 8, 1995, at D1.

2. See, e.g., PANDORA INTERNET RADIO, <http://www.pandora.com> (last visited Dec. 21, 2011).

3. See, e.g., *What Is Spotify?*, SPOTIFY, <http://www.spotify.com/us/about/what> (last visited Dec. 21, 2011); Wikipedia, *Grooveshark*, <http://en.wikipedia.org/wiki/Grooveshark> (as of Dec. 15, 2011, 10:08 AM) (“Grooveshark . . . allow[s] users to search for, stream, and upload music for a charge that can be played immediately or added to a playlist.”).

4. See, e.g., AMAZON CLOUD DRIVE, <https://www.amazon.com/cloudrive> (last visited Dec. 21, 2011); MUSIC BETA BY GOOGLE, <http://music.google.com/music/listen> (last visited Dec. 21, 2011). For a comparison of the form and features offered by the various streaming music services cited *supra*, see Courtney Boyd Myers, *Showdown: Spotify vs. Rdio vs. Grooveshark vs. Pandora*, THE NEXT WEB, July 14, 2011, <http://thenextweb.com/apps/2011/07/14/showdown-spotify-vs-rdio-vs-grooveshark-vs-pandora>, and Michael Muchmore, *Apple iCloud vs. Amazon Cloud Player vs. Google Music Beta*, PCMAG.COM (June 6, 2011), <http://www.pcmag.com/article2/0,2817,2386491,00.asp>.

5. In the U.S., a compulsory or “statutory” license is available for non-interactive, non-subscription digital audio transmissions. 17 U.S.C. § 114(d)(2) (2006). Pandora Radio is an example of a service that takes advantage of § 114 statutory licenses, and thus restricts its customers’ ability to skip a song or request individual songs. See Peter Kafka, *Pandora’s Music Fees Are Huge! And Not That Bad.*, ALL THINGS D (Feb. 12, 2011), <http://allthingsd.com/20110212/pandoras-music-fees-are-huge-and-not-that-bad>.

comes from services like Dar.fm⁶ and software like PandoraJam.⁷ These tools can permanently capture transient music streams without any loss in quality,⁸ allowing users to save media for playback whenever desired — in effect, transforming Internet music streams to locally stored MP3 files⁹ and giving them the properties of public goods. Users can then access, duplicate, and share these copies outside the control of the originating streaming service, thus depriving the service provider of ad revenue and the content owners of royalties.

This Note discusses the nature of Internet streaming, the businesses rushing to embrace it, and the inevitably disruptive technologies seeking to displace it. Although of uncertain legality, stream capture tools threaten to undercut the economic incentives behind the burgeoning streaming music industry. In Part II, this Note introduces what I refer to as the “service-product spectrum,” and explores the evolution of music through this analytical lens. I conclude that streams — through the imposition of a service layer — have just as much in common with mechanical musical instruments, such as player pianos, as they do with sound recordings. Part III discusses the emerging technologies that allow one to “capture” streaming media. I examine stream capture from a technological perspective and explain why streaming music is an artificial technological deviation from traditional digital music as a product, and thus can be considered a form of Digital Rights Management (“DRM”). Then, I conduct an economic analysis of stream capture technology using a rivalry versus excludability table. This Part finishes with a discussion of legal and business ramifications for companies in the streaming media industry. In Part IV, I briefly discuss alternative compensation schemes in view of stream capture technology.

II. EXPERIENCING MUSIC

A. The Service-Product Spectrum

Before jumping into a technical analysis of streams, I want to briefly discuss the evolution of music and the very recent development of digital music. In approaching these topics, a helpful question

6. DAR.FM: DIGITAL AUDIO RECORDER, <http://www.dar.fm> (last visited Dec. 21, 2011).

7. PandoraJam, BITCARTEL SOFTWARE, <http://www.bitcartel.com/pandorajam> (last visited Dec. 21, 2011).

8. Though the capture of digital data preserves quality, the original stream provided by many free streaming Internet music services is less than “CD quality.” Some services, such as Pandora, allow paid subscribers to upgrade to a higher quality stream. See, e.g., *Pandora One*, PANDORA INTERNET RADIO, <http://help.pandora.com/customer/portal/articles/84834-pandora-one> (last visited Dec. 21, 2011).

9. MP3 is just one format of digital music file. Wikipedia, *MP3*, <http://en.wikipedia.org/wiki/Mp3> (as of Dec. 21, 2011, 7:37 PM). Because of its widespread use, this Note will often use “MP3” to represent the idea of a locally stored persistent digital music file.

to have in mind is: what is a service and what is a product? The answer to this question, though not always clear, reflects the way we experience music and informs our expectations of the medium. Throughout much of history, music has been experienced exclusively as a service, or something that one needs to receive from a service provider in order to enjoy. The advent of sound recordings — especially digital sound recordings — “product-ized” the medium, allowing consumers to take music with them wherever they go, manipulate it, and engage with it at will. Internet music streams, however, remove consumers’ control over the access and playback of music, transforming digital music once again into a service.

This evolving nature of music demonstrates that there are many potential factors that determine where something may lie on the service-product continuum. The most useful factor for our analysis is the control a consumer has over his experience — namely, whether the control lies with the consumer such that he can experience music without the help of others. This Note reduces this “locus of control” inquiry to two parts: storage — the ability to record or save music; and recall — the ability to play back or perform music.¹⁰ With the service-product question in mind, we turn to an analysis of the origins of music.

B. Music As a Service: Manual Notation and Performance

Music began as a service and has remained exclusively so for most of its existence. Until very recently in human history, a person wishing to hear music required the performance of a musician.

1. Notation and Composition

Archeological findings reveal that humans have been creating musical instruments since prehistoric times.¹¹ But, like the art of storytelling, music began as an oral tradition. Unfortunately, human memory can be inconsistent and has an uncertain and limited shelf life, which posed a problem for oral tradition.

10. There are several tempting but erroneous frames of analysis to avoid. First, the method of payment — whether consumers rent, own, rent-to-own, pay in installments, trade, or swap is irrelevant. Second, the question of who provides the good or service is not determinative as a good or service provided to oneself retains its essential character. In other words, it does not matter if a musician plays for an audience or his own enjoyment — the performance is still a service. The situation is similar to the concept of imputed income, “[t]he benefit one receives from the use of one's own property, the performance of one's services, or the consumption of self-produced goods and services.” BLACK’S LAW DICTIONARY 831 (9th ed. 2009).

11. See, e.g., Pallab Ghosh, ‘Oldest Musical Instrument’ Found, BBC NEWS (June 25, 2009), <http://news.bbc.co.uk/2/hi/science/nature/8117915.stm>.

Millennia later, humans started devising ways to record instructions for performing music. Modern music notation dates to around the first half of the eleventh century.¹² Notation solved the permanence problem, allowing music to be accurately preserved. However, the recall mechanism for this storage medium still depended on humans: experiencing the music still required an able performer who could read the notation. Sheet music, though an important invention, is still only a product that makes it easier for a person to render the service of music.

2. Mechanical Musical Instruments

Eventually, humans would create mechanical musical instruments such as music boxes and player pianos, thus developing a mechanical recall mechanism. However, a stiff tradeoff between cost and flexibility existed for a time. Early, cheaper mechanical playback devices (such as music boxes) often inseparably married the stored music to the recall mechanism. In contrast, instruments with swappable storage, like a player piano, permitted consumers to choose a variety of songs for playback, but remained too expensive for personal use by the average consumer.¹³ Additionally, these mechanical playback devices could neither record live music nor play back arbitrary notes not present in a musical composition. Many of the limitations of these devices can be attributed to the fact that they were still storing musical compositions; true storage and recall of sound recordings would not come until later.¹⁴

C. Music As a Product: Mechanical Recording and Playback

The availability of music as a product exploded with the development of sound recording and playback devices in the late 19th century. Sound recordings were a breakthrough because they allowed audio itself — rather than just musical composition — to be recorded, and machines could play back such recordings without the aid of a skilled performer.

12. See C.F. ABDY WILLIAMS, *THE STORY OF NOTATION* 251 (1903).

13. Wikipedia, *Sound Recording and Reproduction*, http://en.wikipedia.org/wiki/Sound_recording (as of Apr. 27, 2011, 08:11 PM) (“Piano rolls were the first stored music medium that could be mass-produced, although the hardware to play them was much too expensive for personal use.”).

14. See U.S. COPYRIGHT OFFICE, *CIRCULAR 56A: COPYRIGHT REGISTRATION OF MUSICAL COMPOSITIONS AND SOUND RECORDINGS* (2009) [hereinafter *CIRCULAR 56A*], available at <http://www.copyright.gov/circs/circ56a.pdf> (explaining the difference “for copyright purposes, between *musical compositions* and *sound recordings*”).

1. Analog Sound Recordings

Sound recordings were invented in 1877 with the advent of the phonograph cylinder.¹⁵ The technology was a major consumer item by the 1900s. Later technological advances such as the 8-track and compact cassette tape provided analog recordings of increased fidelity. Analog sound products are seeing a small revival in the marketplace,¹⁶ but lack the qualities that make digital music widespread: the ability to be reproduced and transmitted at near-zero cost.

2. Digital Sound Recordings

The first real interaction of most consumers with digital audio was through personal consumer electronic devices such as the CD player. Although digital audio had early applications in telecommunications,¹⁷ commercial digital recordings did not appear until the early 1970s. By the early 1980s, the major record companies had embraced digital recordings, with Sony and Phillips introducing the CD in 1982.¹⁸

Over the years, the shape and form of digital storage would change. With the introduction of compression algorithms such as MP3, magnetic hard drives became a practical way for consumers to store large amounts of digital audio.¹⁹ Later, flash memory would overtake hard drives as the mass storage medium of choice in mobile devices, providing portability through the elimination of moving parts and reduced power requirements.²⁰ Music fixed in a digital format must reside on some physical storage medium. Thus, the storage and recall of digital sound recordings will remain tied to physical products — in effect, making the recordings themselves products as well.

15. See *The History of the Edison Cylinder Phonograph*, THE LIB. OF CONG., <http://international.loc.gov/ammem/edhtml/edcyldr.html> (last visited Dec. 21, 2011).

16. *Record Store Day Cues Up Its 4th Spin*, CBS NEWS (Apr. 16, 2011, 4:18 PM), <http://www.cbsnews.com/stories/2011/04/16/entertainment/main20054618.shtml>.

17. See Wikipedia, *Pulse-Code Modulation*, http://en.wikipedia.org/wiki/Pulse-code_modulation#History (as of Nov. 27, 2011, 6:22 PM).

18. *How the CD Was Developed*, BBC NEWS (Aug. 17, 2007, 10:30 AM GMT), <http://news.bbc.co.uk/2/hi/6950933.stm>.

19. See *MP3*, *supra* note 9 (“Because of the relatively small hard drives back in that time (~ 500–1000 MB) lossy compression was essential to store non-instrument based . . . music for playback on computer.”).

20. See, e.g., David Lammers, *iPod Upsets NAND Flash Applecart*, EE TIMES (Aug. 19, 2005, 12:42 PM) <http://www.eetimes.com/electronics-news/4054942/iPod-upsets-NAND-flash-Applecart> (“As Apple moves from a hard disk-based iPod to a flash-based iPod Mini player at the 4-GByte capacity, the switch could leave other NAND customers scrambling for supply . . .”).

D. Products As a Service: Digital Streaming Music

The service-product dichotomy has, up to the point of digital music, cleanly matched the music composition/sound recording copyright divide.²¹ This is not to say that musical compositions themselves are services; rather, to enjoy a musical composition, the work must be performed by a service-provider — such as a professional musician giving a concert or an amateur practicing piano in his own home. Digital music, as a form of entertainment tied to personal consumer electronic devices, allows consistent on-demand playback without a skilled musician. Thus at first glance, digital music would appear to be a product. However, streaming digital music services blur this distinction by retaining the portability of digital sound recordings in many cases,²² while stripping control of the product away from the consumer through the imposition of a service layer. This addition enables the service providers to extend the transaction and creates an opportunity for generating revenue for as long as a consumer desires access to a song.

1. Digital Music Streams

Large scale Internet music streaming began in 1994 with a November Rolling Stones concert at the Cotton Bowl in Dallas, broadcast live over the Mbone multicast service.²³ The Mbone system required specialized hardware but evolved to connect multicast-capable networks over the existing Internet infrastructure.²⁴ A year later, RealNetworks introduced RealAudio, the first “audio streaming solution” for the Internet,²⁵ with an estimated eighty-five percent of streaming content in Real format at its peak.²⁶

Both the technology and major players involved in streaming audio have changed over the years. RealNetworks is no longer a dominant player, but increases in Internet connection bandwidth and other advances in compression technology have allowed streams to flourish.²⁷

21. See CIRCULAR 56A, *supra* note 14.

22. Assuming ubiquitous Internet connectivity of sufficiently high bandwidth and low latency.

23. See Lewis, *supra* note 1.

24. Wikipedia, *Mbone*, <http://en.wikipedia.org/wiki/Mbone> (as of Oct. 2, 2011, 7:48 AM).

25. *About Us*, REALNETWORKS, <http://www.realnetworks.com/about-us/index.aspx> (last visited Dec. 21, 2011).

26. “In 1999, *Wired* magazine reported that about 85 percent of the streaming media flowing across the Internet used Real technology.” Kevin Featherly, *Streaming Media*, in *ENCYCLOPEDIA OF NEW MEDIA: AN ESSENTIAL REFERENCE TO COMMUNICATION AND TECHNOLOGY* 425 (Steve Jones ed., 2003).

27. See Jauvane C. de Oliveira & Shervin Shirmohammadi, *Audio Streaming — Introduction, Audio Compression, Dissemination over the Network, Real-time Transport Proto-*

2. Streams As Instruments

Streams can be divided into two categories, live and on-demand. Live streams are only available at a specific time, much like a live television broadcast of a sports event. Because each consumer desires the same content at the same time, one stream can be split (copied) and sent to multiple consumers through a multicast system.²⁸ In contrast, on-demand Internet streams allow individual consumers to elect to receive content of their choosing at any time. Thus each on-demand stream is inherently unique to the requester.²⁹

Music streams are transient in that once audio is transmitted to a consumer, the audio disappears. There is no local storage medium. For on-demand streams, of course, the audio is stored somewhere in the “cloud.” The key point is that a consumer may only access data in the cloud through a service. To recall a stream, a consumer must request another performance from the remote source.

In this way, on-demand digital music streams are similar to mechanical musical instruments; they can be viewed as cyberspace player pianos. The difference between a digital stream of a song and a local MP3 copy of the same song is akin to the difference between hearing a player piano play a song and owning a recording of the player piano performing the song. If one owns the player piano, it is akin to the Amazon Cloud or Google Music service. If someone else owns the player piano, it is like Spotify or Grooveshark. If one cannot even choose which piano roll one listens to, it is analogous to Pandora.³⁰

III. STREAM CAPTURE: STREAMS AS PRODUCTS

A. Streaming Technology and Capture Techniques

1. Streaming and Progressive Downloading

Streaming is a method of transmitting data packets so that the earlier packets can be re-assembled and processed before the entire file is downloaded, allowing for immediate display or playback. Web de-

col (RTP), ONLINE ENCYCLOPEDIA, <http://encyclopedia.jrank.org/articles/pages/6671/Audio-Streaming.html> (last visited Dec. 21 2011) (explaining current compression and streaming technology).

28. Wikipedia, *Multicast*, <http://en.wikipedia.org/wiki/Multicast> (as of Nov. 21, 2011, 12:50 AM) (defining multicast as “the delivery of a message or information to a group of destination computers simultaneously in a single transmission from the source”).

29. Because of their lack of interactivity, services like Pandora are not pure on-demand and can take advantage of statutory licensing. See *supra* note 5. However, because of the level of individualized customization available to users of such services, for example, custom radio stations, this Note considers such streams to be on-demand.

30. See *supra* notes 2–4 and accompanying text.

signers had applied the same technique during the dial-up era so that users could navigate web pages while waiting for large graphics to load.³¹ A question arises as to what to do with the data packets that have already been consumed. Herein lies the difference between progressive streaming and progressive downloading — progressive downloading preserves the completed file for file seeking and later access while streaming discards the used data.

Downloading is an essential step in both progressive downloading and streaming; streaming simply takes the extra step of making the downloaded data inaccessible. Therefore, streaming imposes additional technological restrictions on the consumption of digital media, which can be seen as a form of DRM. DRM technologies attempt to control user action with respect to purchased media.³² In contrast to traditional digital music, streaming music's perishing nature prevents users from saving, replaying, sharing, and even rewinding or fast-forwarding through media which they have been granted access.

In light of the service-product discussion above, users have traditionally consumed digital music in the form of data tied to consumer products under their full control. Streams abrogate a user's control over his or her music experience. Thus, perishing streams can be viewed as an attempt to use technological controls to turn something originally product-based into a service.

2. Stream Capture Services and Products

An emerging market for stream capture technology has led to the development of stream capturing services and products. All of these tools work the same way in principle: capture, aggregate, and save all streaming data. However, these tools come in forms as varied as streaming services themselves, and often target a particular streaming service provider. For example, using PandoraJam,³³ a user can record songs off of the popular Pandora radio service and tag these songs to be automatically added to the user's iTunes library.

Other stream capture services purport to be streaming service providers themselves. Dar.fm³⁴ allows a user to shift live streams to on-demand ones by recording Internet radio stations to a digital locker on the site. Although the downloaded content remains stored in the cloud on Dar.fm's servers, the service expands the user's control over

31. See Featherly, *supra* note 26, at 424.

32. *Digital Rights Management*, ELECTRONIC FRONTIER FOUND., <https://www EFF.ORG/issues/drm> (last visited Dec. 21, 2011).

33. *PandoraJam*, *supra* note 7.

34. DAR.FM, *supra* note 6 (on the homepage, click on the box at top left called "See how it works," and press play when pop-up window opens on the site). DAR is short for "Digital Audio Recorder."

content recall,³⁵ thereby shifting Internet radio from a Pandora-esque level of control closer to that of an Amazon Cloud drive (i.e., from non-interactive control to interactive control).

Streaming video content is similarly at risk. MPEG Streamclip³⁶ is downloadable software that, among other things, allows a user to “download videos from YouTube and Google by entering the page URL.”³⁷ MPEG Streamclip automatically identifies the stream and allows the user to save the content in a variety of formats, including the option of eschewing the video component in favor of pure audio.³⁸ Thus, a consumer desiring a particular song merely needs to search on YouTube for a high quality music video to progressively download.

Streaming service providers such as YouTube are in a constant fight to hide and obscure media streams from increasingly sophisticated stream capturers. When viewed as another form of DRM applied to traditional digital music, the arms race to secure and capture streams makes sense, and does not bode well for streaming service providers, as discussed below in Part III.D.1.

B. Of Public and Private Goods

Amazon recently made headlines by launching its tandem “Cloud Drive” (storage) and “Cloud Player” (recall) streaming locker service ahead of rumored services from Google and Apple.³⁹ Amazon joins a market already populated by other streaming locker services such as mSpot⁴⁰ and MP3tunes,⁴¹ and services such as Spotify⁴² and Pandora⁴³ that allow consumers to stream music they have not purchased.

The surge of companies rushing to embrace streaming music is in part attributable to the excellent monetization properties of streams. Streaming services, whether they charge per play or by monthly fee, essentially provide single-use products (streams) that perish as they

35. *See id.*

36. *MPEG Streamclip Video Converter for Mac and Windows*, SQUARED 5, <http://www.squared5.com> (last visited Dec. 21, 2011).

37. *Id.*

38. *See id.*

39. MG Siegler, *Amazon Beats Apple and Google to Cloud-Based Music Storage/Streaming*, TECHCRUNCH (Mar. 28, 2011), <http://techcrunch.com/2011/03/28/amazon-cloud-drive-player>.

40. Ryan Singel, *mSpot's Streaming Cloud Music is Hot — On Android*, WIRED (Sep. 23, 2010, 9:01 AM), <http://www.wired.com/epicenter/2010/09/mspot-expands>.

41. Alex Pham, *MP3tunes Lets Subscribers Tap into Digital Music Locker from Mobile Devices*, L.A. TIMES: POP & HISS (July 12, 2010, 7:32 PM), http://latimesblogs.latimes.com/music_blog/2010/07/mp3tunes-launches-digital-music-locker.html.

42. SPOTIFY, <http://www.spotify.com/us/about/features> (last visited Dec. 21, 2011).

43. PANDORA INTERNET RADIO, *supra* note 2.

are consumed.⁴⁴ In addition, streams have the commercially desirable properties of private goods: rivalry and excludability. A good is rivalrous if one person's use of the good diminishes others' use of the good. A good is excludable if it is possible to prevent someone from using it.⁴⁵ Table 1 shows a rivalry versus excludability table:

	Excludable	Non-Excludable
	(Private Goods)	(Common Goods)
Rivalrous	<ul style="list-style-type: none"> • Ice Cream Cones • Clothing • Personal Electronic Devices • Section 114 [On-Demand] Music Streams⁴⁶ 	<ul style="list-style-type: none"> • Fish Stocks • Natural Gas Deposits • National Health Service • Unsecured Wireless Internet
Non-Rivalrous	(Club Goods) <ul style="list-style-type: none"> • Cinemas • Satellite TV • Private Parks • P2P Networks⁴⁷ 	(Public Goods) <ul style="list-style-type: none"> • Air • Antenna TV • National Defense • Digital Music Files

Table 1: Rivalry vs. Excludability of Goods

In the southeast quadrant are *public goods*. Public goods are both non-rivalrous and non-excludable, and they suffer from market failures such as the free-rider problem.⁴⁸ The free-rider market failure in turn leads to underproduction of the good in question.⁴⁹ The unauthorized spread of traditional digital music through rampant file sharing has led many scholars to approach digital music as a public good.⁵⁰ Thus, I have added “Digital Music Files” to the southeast quadrant.

In the northwest quadrant, at the intersection of rivalry and excludability, we have *private goods* like food and clothing. On-demand streams fit into this category as they are both excludable and rivalrous: excludable because the underlying music remains safely and

44. This is not to say some streaming services will not allow a consumer to stream the same song multiple times, but that each stream is a unique transmission; a new performance in its own right.

45. N. GREGORY MANKIW, *THE ESSENTIALS OF ECONOMICS* 218 (6th ed. 2011).

46. I specify “On-Demand” streams here. Live music streams necessitate contemporaneous viewing, and one person's access of the stream does not prohibit others from jumping on. Thus, live multicasts are club goods.

47. P2P networks with manageable scalability actually get better as more people join, and thus are the antithesis of rivalrous. Although it may be difficult to stop any one user from file sharing, exclusive P2P networks exist — for example, private BitTorrent trackers.

48. See WILLIAM W. FISHER III, *PROMISES TO KEEP: TECHNOLOGY, LAW, AND THE FUTURE OF ENTERTAINMENT* 199–203 (2004).

49. *Id.*

50. See, e.g., FISHER *supra* note 48; Glynn S. Lunney, Jr., *The Death of Copyright: Digital Technology, Private Copying, and the Digital Millennium Copyright Act*, 87 VA. L. REV. 813 (2001).

remotely in the service provider's cloud, performed only for contracting consumers; rivalrous because each individual stream is a unique transmission to the requesting consumer and lasts only as long as it takes to listen. Under the Digital Performance Right in Sound Recordings Act of 1995 ("DPRA"), codified at 17 U.S.C. § 114, service providers can stream music subject to a statutory license. These § 114 streams provide an even stronger case for rivalry. The royalty implicated with each unique request keeps the marginal cost for the service provider fixed and non-zero. Two different requestors (or even the same requestor making a later, second request) are unable to access the same stream. They may access an identical stream performance, but not that same first transmission. Thus, request of one stream by one party incurs a royalty, preventing a second party from simultaneously accessing the same stream and availing herself of the same royalty.

However, stream capture technology threatens not only to relegate streams to the mortal realm of public goods, but also to lead to potential underproduction by allowing consumers to take streams permanent prisoner as downloaded music files. Internet music streams would then be susceptible to the same control issues as traditional digital music.⁵¹

C. Legality

Stream capture technology is essentially the Internet audio analog of VCR and DVR technology. In *Sony Corp. of America v. Universal Studios, Inc.*,⁵² the Supreme Court held that the sale of VCR-like equipment to the general public did not constitute contributory copyright infringement.⁵³

However, later courts have pointed out that *Sony* involved "television broadcasts in a pre-digital era" and was "superceded [sic] to the extent that the [Digital Millennium Copyright Act] broadened copyright owners' rights beyond the *Sony* holding."⁵⁴ Still, 17 U.S.C. § 1201 forbids the circumvention of access controls rather than copy controls.⁵⁵ And in the case of stream capture, the issue is not the initial access to the stream but the creation of a copy by aggregating transient pieces of data. Thus, the act of creating a personal local copy by a consumer of a legally accessed stream is not prohibited by the

51. See, e.g., Lunney, *supra* note 50.

52. 464 U.S. 417 (1984).

53. *Id.* at 421.

54. *Realnetworks, Inc. v. DVD Copy Control Ass'n*, 641 F. Supp. 2d 913, 941 (N.D. Cal. 2009).

55. See 17 U.S.C. § 1201(a) (2006); see also CHILLING EFFECTS, <http://www.chillingeffects.org/anticircumvention/faq.cgi#QID94> (last visited Dec. 21, 2011).

DMCA. Importantly, the DMCA does however prohibit the *dissemination* of tools to others for circumventing copy controls.⁵⁶

Online stream capture locker services like Dar.fm pose slightly different issues than local stream capture tools for personal use, but these locker services are likely analogous to the Cablevision remote DVR system described in *Cartoon Network LP, LLLP v. CSC Holdings, Inc.*⁵⁷ In that system, as with Dar.fm, an individual user could remotely store a personal copy of content for his or her own later use.⁵⁸ When it comes down to it, the consumer is still the one pressing the record button. In *Cartoon Network*, the Second Circuit held that Cablevision's remote DVR system did not constitute direct infringement or public performance.⁵⁹

Though some forms of stream capture may be permissible under U.S. copyright law, the logical extension of the technology puts it squarely in conflict with the spirit of the § 114 statutory license introduced by the DPRA, as discussed *infra* in Part III.D.2. Further, a user may incur contractual liability from violating a Terms of Service or Use Agreement of the streaming music service.

D. Industry Ramifications

1. Disrupting a DRM-Enforced Business Model

Companies embracing digital music streaming likely entered the market with the idea that streams were inherently different from traditional digital music and that, somehow, these special qualities would make streams a lucrative venture while mitigating the problem of file-sharing. In fact, as early as 2001, industry analysts were predicting that streams would supplant the “quaint” idea of traditional music downloads.⁶⁰ However, when viewed as DRM, the slight technological tweak differentiating streams from traditional digital music downloads seems vulnerable.⁶¹ In light of the music industry's experience attempting to impose technical locks to prevent file sharing, commentators and industry experts have criticized the inability of DRM to protect licensing arrangements.⁶² If stream capture technology takes

56. See 17 U.S.C. § 1201(b) (2006).

57. 536 F.3d 121, 124–25 (2d Cir. 2008) (describing Cablevision's remote DVR).

58. See *id.*

59. *Id.* at 140.

60. See Kevin Featherly, *Streaming Music Distribution Displaces Downloaded Files*, HIGHBEAM (Feb. 12, 2001), <http://www.highbeam.com/doc/1G1-70345865.html>.

61. And, if one rejects the characterization of streams as a technological protection measure or DRM, then the Digital Millennium Copyright Act (“DMCA”) fails to cover the act of stream capture. See 17 U.S.C. § 1201(a) (titled Violations Regarding Circumvention of *Technological Measures*) (emphasis added); see also *id.* § 1201(a)(3).

62. See, e.g., Neil Weinstock Netanel, *Impose a Noncommercial Use Levy to Allow Free Peer-to-Peer File Sharing*, 17 HARV. J.L. & TECH. 1, 9–10 (2003) (“But skilled program-

off, companies may have to confront the possibility that they cannot rely on the inherent properties of streaming downloads to protect their intellectual property.

2. Statutory Licensing

The Digital Performance Right in Sound Recordings Act of 1995 (“DPRA”) established a limited public performance right in sound recordings for digital transmissions. The DPRA gave sound recording copyright owners the exclusive right “to perform the copyrighted work publicly by means of a digital audio transmission,” such as by streaming.⁶³ However, this exclusive right is subject to a statutory license under 17 U.S.C. § 114, whereby a service provider can, subject to several conditions,⁶⁴ automatically gain authorization to digitally perform a sound recording publicly in exchange for a royalty.⁶⁵ These royalties are collected, divvied up, and distributed to artists by a government-appointed non-profit.⁶⁶ Non-interactive streaming services like Pandora⁶⁷ take advantage of the much lower § 114 statutory licensing fees,⁶⁸ rather than negotiating directly with record labels.⁶⁹

Section 114 statutory licenses are offered (and priced) on the premise that a digital audio transmission represents a trackable,

mers can readily design software and other devices to circumvent [DRM technology]. In fact, computer security experts maintain that no technological barrier can ultimately prevail over determined hackers who have physical access to the encrypted items . . .”).

63. 17 U.S.C. § 106(6) (2006).

64. *See* 17 U.S.C. § 114(d)(2), (j)(13) (2006).

65. 17 U.S.C. § 114 (West 2010 & Supp. 2011).

66. *See* SOUNDEXCHANGE, <http://www.soundexchange.com> (last visited Dec. 21, 2011).

67. An interactive service allows a user to request a song and listen to the requested song immediately or soon after the request is made. *See* 17 U.S.C. § 114(j)(7) (2006). The Pandora streaming service, which allows users to create personalized stations rather than playlists, skirts the line of interactivity.

68. For example, the Copyright Royalty Board set a statutory license royalty rate of \$.0019 per performance for 2010. BRIAN T. YEH, STATUTORY ROYALTY RATES FOR DIGITAL PERFORMANCE OF SOUND RECORDINGS: DECISION OF THE COPYRIGHT ROYALTY BOARD (Mar. 23, 2009), available at http://ipmall.info/hosted_resources/crs/RL34020_090323.pdf.

69. *See* Joe Mullin, *Pandora’s IPO Filing: Copyright Fees Eat Up Half Its Revenues*, PAIDCONTENT.ORG (Feb. 11, 2011, 7:50 PM), <http://m.paidcontent.org/article/419-pandoras-ipo-filing-copyright-fees-eat-up-half-its-revenues> (“[I]n other countries, the negotiations are more complicated. For now, Pandora acknowledges that without U.S.-style statutory licensing laws, moving into other countries is prohibitively expensive.”); David Oxenford, *Court of Appeals Determines that Launchcast is Not an Interactive Service — Thus Not Needing Direct Licenses From the Record Labels*, BROADCAST LAW BLOG (Aug. 22, 2009), <http://www.broadcastlawblog.com/2009/08/articles/internet-radio/court-of-appeals-determines-that-launchcast-is-not-an-interactive-service-thus-not-needing-direct-licenses-from-the-record-labels> (“Had the [Launchcast] service been found to be interactive within the meaning of the statute, the service would have to negotiate with each sound recording copyright holder for each and every song that it wanted to use on its service to get specific rights to use each song — potentially resulting in hundreds of negotiations and undoubtedly higher fees than those paid under the statutory license.”).

one-time performance.⁷⁰ But stream capture technology threatens to irreparably alter that calculus by making streams, at best, de facto sales and, at worst, completely thwarting any sensible valuation. Take, for example, the service of PandoraJam. PandoraJam allows a user with a paid Pandora One account to rip each song that plays on the radio at 192 Kbps, or 64 Kbps for those with a free account.⁷¹ Although 64 Kbps, and even 192 Kbps, falls below CD quality, the fidelity is high enough such that eighty million users spent 2.1 billion hours listening to the Internet radio service in fiscal year 2010.⁷² The DPRA was passed in response to the “potential of digital audio transmissions to supplant the purchase of CDs.”⁷³ If we assume that half of Pandora accounts are active, Pandora users listen to the equivalent of seventy full-length CD albums⁷⁴ per user, or 2.8 billion CDs.⁷⁵ Imagine if even ten percent of Pandora users chose to use PandoraJam or a similar service to save the music locally and replay it from their captured copy instead of reengaging the Pandora service, thereby stifling the generation of the successive royalties Pandora is required to pay. Artists would not only fail to receive the sale value of their captured albums, but they would also fail to receive fair remuneration⁷⁶ for the successive performances that would have occurred without the initial stream capture. A troubling threat of stream capture is to change digital performance royalties from something that can be valued ex ante, to something immeasurable ex post, as it is impossible to know what a user will do with the captured digital music.

If one also believes that digital music is moving toward becoming a public good — or at least that unauthorized file-sharing will continue to be a strong trend — there are other secondary transactions to consider: If one user stream captures a song or album, then places the captured songs on a file-sharing network, how much value has been lost for the artists and sound recording copyright owners (and captured by consumers as an externality) as the file makes its way around the Internet? Once a song leaves the cloud, its usage cannot be tracked. It is not too far-fetched to imagine a scenario where an artist allows the controlled streaming of previously unreleased songs before the release of a major album. What do stream capture technologies

70. Cf. JULIE COHEN ET AL., COPYRIGHT IN A GLOBAL INFORMATION ECONOMY 467 (2d ed. 2006) (explaining the policy underlying grants of § 114 statutory licenses).

71. Ryan Wagner, *Record Pandora Songs with PandoraJam*, CYBERNET NEWS (Apr. 13, 2011), <http://cybernetnews.com/record-pandora-songs>.

72. Erick Schonfeld, *With 80 Million Users, Pandora Files to Go Public*, TECHCRUNCH (Feb. 11, 2011), <http://techcrunch.com/2011/02/11/pandora-files-to-go-public>.

73. COHEN ET AL., *supra* note 70, at 466.

74. Using an average album time of forty-five minutes.

75. Admittedly, this hypothetical assumes each minute is spent listening to a unique song.

76. Fair remuneration is set by voluntary industry negotiation and Copyright Royalty Judges. See 17 U.S.C. §§ 114(f), 804 (West 2010 & Supp. 2011).

mean for artists' right of first publication and the ways new music is introduced to the public?

3. Ease of Use and Pervasiveness

Though the last Part hinted of doomsday scenarios, the ultimate degree of disruption from stream capture technology will likely depend on how available, visible, and easy the tools are to use. Many of the stream capture services discussed in this Note are designed to work with a particular service provider and may not transfer between services — even analogous ones. On the other hand, should such functionality ever make it into the default installation of a media player with a large following such as Winamp or iTunes, the practice could become as accepted as setting one's DVR to record *True Blood*.

However, comparisons to the effects of DVRs on satellite and cable broadcasts may not be very helpful. The ways people consume the mediums of audio and video are too different. Music is much more recall-intensive, as people like to listen to popular songs or their personal favorites over and over. Humans also sense sound omnidirectionally, without the need to focus on it, allowing music to be the centerpiece, the background at a party, or a distraction while driving. Video requires much more involvement and attention.

IV. AN ALTERNATIVE COMPENSATION SYSTEM

As discussed above, DRM, or a technological lock, is unlikely to succeed as a content protection system. What, then, might be an alternative? In an important article on alternative compensation schemes, Glynn Lunney suggests a levy-based approach as superior to DRM.⁷⁷ Expanding upon ideas introduced by Lunney, Neil Netanel described his implementation of a noncommercial use levy ("NUL") in a 2003 journal article.⁷⁸ In turn, William Fisher

[f]ollow[ed] Netanel's lead [to] identify four categories of devices and services suitable for taxation: (1) equipment used to make copies of digital recordings; (2) media used to store such copies; (3) services used to gain access to the Internet, either to download files or to stream recordings; and

77. See, e.g., Lunney, *supra* note 50, at 910–12 (concluding that as between a strong encryption-based approach and a levy-based approach “a limited tax on copying technology and blank storage media is likely to prove more desirable”).

78. See Netanel, *supra* note 62.

(4) peer-to-peer systems or other services used to share files.⁷⁹

Earlier in the Note, I extolled the monetization properties of private goods. Looking back at Table 1, we find our four potential points of levy located in various quadrants of the public good/private good table. The first two of Fisher's options could fall under the private good category "personal electronic devices," and thus these first two options seem the most susceptible to levies. Since most consumer equipment used to make copies of digital recordings is also the same as that used to read digital recordings,⁸⁰ the two options correspond to the "recall" and "storage" rubrics advanced earlier. With option (1), one may be able to track the amount of equipment sold that could be used to make copies of digital recordings; however, one may not be able to accurately predict how many copies any individual piece of equipment will actually make. In contrast, with option (2), each storage medium has a quantifiable maximum storage capacity. Thus, due to tracking problems associated with option (1), a levy on the private good — "(2) media used to store such copies" — may be the best implementation of an alternative compensation levy system.

In fact, a levy on digital storage media could still be compatible with a digital performance royalty system. After all, streams do not take up any hard drive space unless captured as a digital file. Thus, only the trackable digital performance royalty would be implicated when merely accessing a stream. However, if the user chose to capture the stream, the resulting file would take up space on a digital storage medium. Once the user accumulates enough files to fill a storage medium, new media would then be required to provide more space, thereby requiring payment of a new levy. Alternatively, if the user chooses to delete older files on a storage medium in order to make room for newer music, a new digital performance royalty is implicated when the consumer chooses to again capture music from a streaming digital source. Thus, the user must pay, either through a levy or a digital performance royalty, for the ability to store newly captured music. A levy on digital storage media would also inherently exclude analog sound recordings, leaving vinyl records and cassettes unaffected. As analog recordings cannot be truly reproduced nor transmitted digitally, the scope of the levy would correspond well to the problem of file sharing over the Internet.

79. FISHER, *supra* note 48, at 217.

80. For example, the laser on a CD burner can read and write CDs, and the magnetic heads in a hard drive both read and write magnetic data.

V. CONCLUSION

With Internet radio stations like Pandora, online jukeboxes such as Spotify and Grooveshark, and locker services from Amazon, Google, and Apple, each new streaming Internet music service joins a burgeoning and varied market. However, all streaming services and their respective business models, whether based on § 114 statutory licenses,⁸¹ industry negotiation,⁸² or DMCA safe harbors,⁸³ rely upon a level of control over a user's music experience imposed by an artificial service layer. By introducing rivalry and excludability, this service layer relegates digital music — a medium that has traditionally been experienced as a product — to a private good under the control of remote service providers. Although the relegation of digital music to a private good provides excellent monetization opportunities for service providers in theory, this transformation may be vulnerable to the destabilizing nature of stream capture technology.

As seen before with other mediums like broadcast television, stream capture allows a user to capture streaming content for permanent local storage and recall. Once in the hands and under the control of a user, captured content can be accessed repeatedly and shared by the user, all immeasurable by the originator of the stream. Without the ability to control, or even accurately evaluate the extent of a transaction, service providers cannot be sure whether a “digital performance” has simply occurred or an unintended sale of music. Such valuation and measurement issues present a troubling threat to streaming Internet music business models and stymie an effective royalty scheme for statutory licenses.

Potential technological and legal countermeasures to stream capture technology may also have limited effectiveness. Industry experience with DRM has shown that maintaining effective technological protection measures may be untenable in the long run. And though the legality of an instance of stream capture may ultimately depend on the manner in which a stream is captured and fair-use considerations, the nature of current stream capture technologies likely leaves the act of capturing streaming Internet music inoffensive to the current incarnation of the DMCA.

Ultimately, whether stream capture will remain a novelty for power users or become a real nuisance for streaming service providers will depend on the pervasiveness and ease of use of stream capture technologies. Though the effects the introduction of video-tape recorders and DVRs had on television broadcast might not be directly analogous, streaming Internet music service providers should at least

81. For example, Pandora.

82. For example, Spotify.

83. For example, Grooveshark.

be aware of the potential destabilizing effects of digital stream capture technology.