Sizing the piracy universe

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September 2013

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1 Executive Summary

1.1 Introduction

This report draws data from a wide range of reliable sources to provide an estimate of the shape and size of the piracy universe. It is based upon an in-depth study of a range of ecosystems commonly used for the distribution of infringing content. Analysis demonstrates the number of unique internet users who employ each infringement method to obtain material as well as the overall proportion of internet bandwidth used by each ecosystem. In addition to original data collection by NetNames, the report draws on supplemental data from leading companies including Sandvine and Cisco.

The report, which has been commissioned by NBCUniversal, was prepared by the Piracy Analysis team at NetNames, formerly known as Envisional. In January 2011, Envisional published the report *An Estimate of Infringing Use of the Internet*, an analysis focused on the use of internet bandwidth for the distribution of infringing content such as pirated films, television, music, and software.[1] This new report includes an extended examination of bandwidth data that updates some of the findings from the 2011 publication. However, it takes a look at a broader range of considerations, including:

- a detailed examination of the number of users involved in a range of major internet ecosystems
- an evaluation of the level of infringement within each ecosystem
- an analysis of trends over time
- a look at business models and revenue generation used by sites that facilitate infringement
- a discussion of the rise of mobile
- and an analysis of the impact of enforcement efforts on infringement.

1.2 Main Findings

1.2.1 The continued growth of infringement

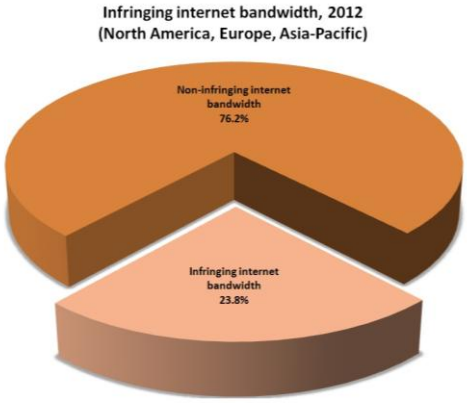
- Internet usage continues to **grow at a rapid pace**; and with it, so does internet-based infringement.
- **The practise of infringement is tenacious and persistent**. Despite some discrete instances of success in limiting infringement, the piracy universe not only persists in attracting more users year on year but hungrily consumes increasing amounts of bandwidth.
- The free and simple availability of copyrighted content through piracy ecosystems continues to drive the popularity of hundreds of web sites, the actions of hundreds of millions of internet users worldwide, and the consumption of thousands of petabytes of internet bandwidth. **Users of piracy ecosystems, the number of internet users who regularly obtain infringing content, and the amount of bandwidth consumed by infringing uses of content all increased significantly between 2010 and 2013.** [2]
- Even in regions where the legitimate distribution of content is advanced, the number of those involved in infringement has increased, the number of page views devoted to infringement has grown, and the absolute amount

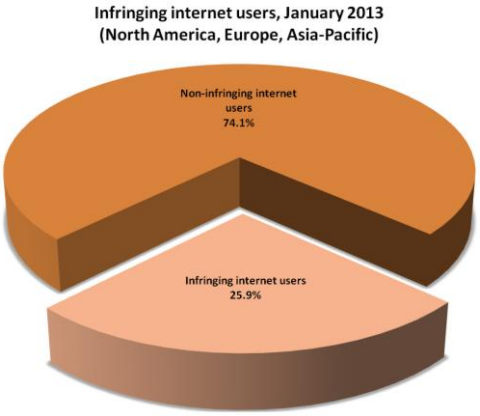
[1] *An Estimate of Infringing Use of the Internet*, 2011, Envisional. Available at: http://bit.ly/bandwidth-report

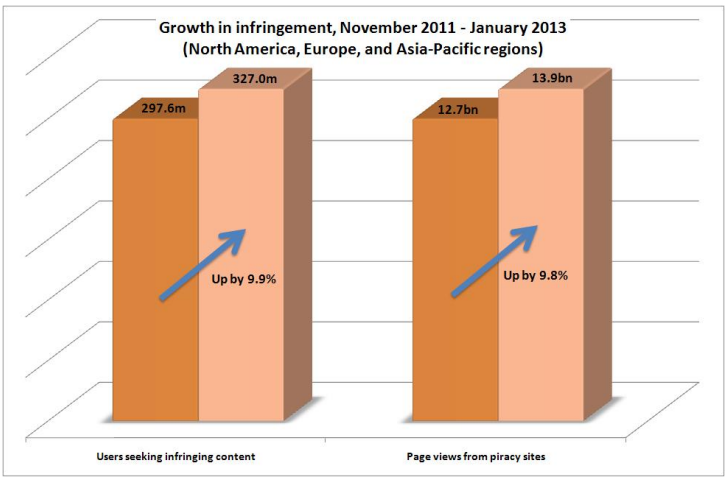
[2] In this report, the infringing status of pornography is not examined. Any mention of infringement refers only to the infringement of non-pornographic content. As such, 'non-infringing' consumption also includes consumption of pornography.

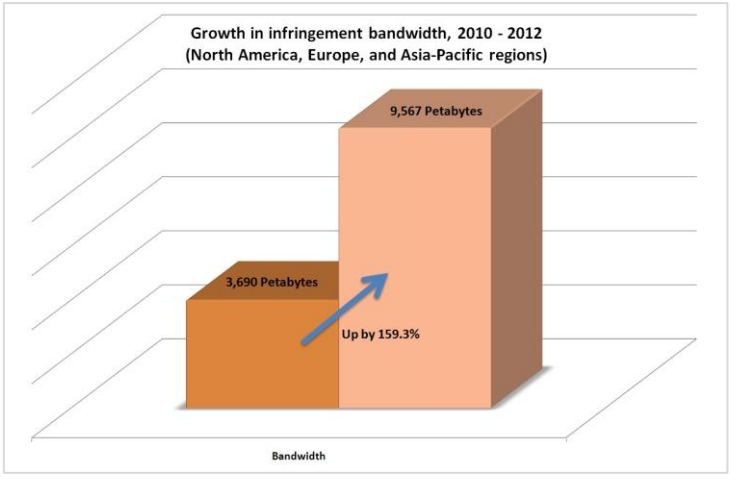
of bandwidth linked to infringement has risen. This suggests that in addition to encouraging the growth of legitimate sources, additional tools may be required to help content owners prevent infringement.

- Each web site included in this analysis was verified by a NetNames analyst as one that is focused on providing infringing content or providing links to infringing content. 'Focused' means that the infringing material comprised more than half of all links or all files posted on the site in January 2013.
- Almost every piracy-focused site included in this analysis is owned and run for profit.
- **Worldwide, 432.0m unique internet users explicitly sought infringing content during January 2013**.
- Three key regions – **North America, Europe,** and **Asia-Pacific** – make up a majority of the internet world, comprising 82.6% of all internet users and 95.1% of all bandwidth consumed. **Focusing on these regions**, an analysis of all ecosystems of the internet commonly used to obtain infringing material (such as bittorrent, video streaming, cyberlockers, and other file sharing networks) found that:
  - Absolute **infringing bandwidth use increased by 159.3%** between 2010 and 2012, from 3,690 petabytes to 9,567 petabytes. This figure represents **23.8%** of the total bandwidth used by all internet users, residential and commercial, in these three regions.
  - **327.0m unique internet users explicitly sought infringing content** during January 2013 in the three regions. This figure **increased by 9.9%** in the fifteen months from November 2011 and represents **25.9% of the total internet user population** in these three regions (i.e., 1.26 billion internet users).[3]
  - **13.9 billion page views** were recorded on web sites focused on piracy in January 2013. This figure **increased by 9.8%** in the fifteen months from November 2011.







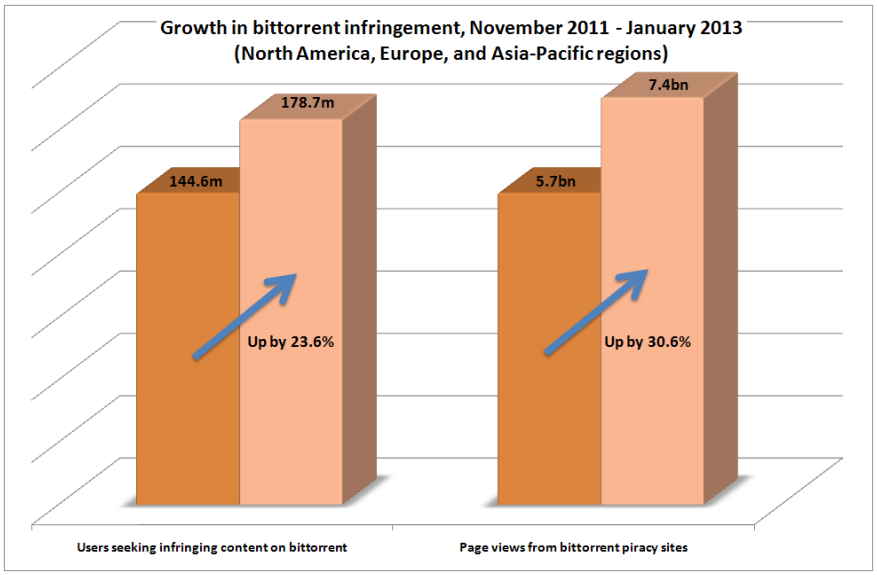


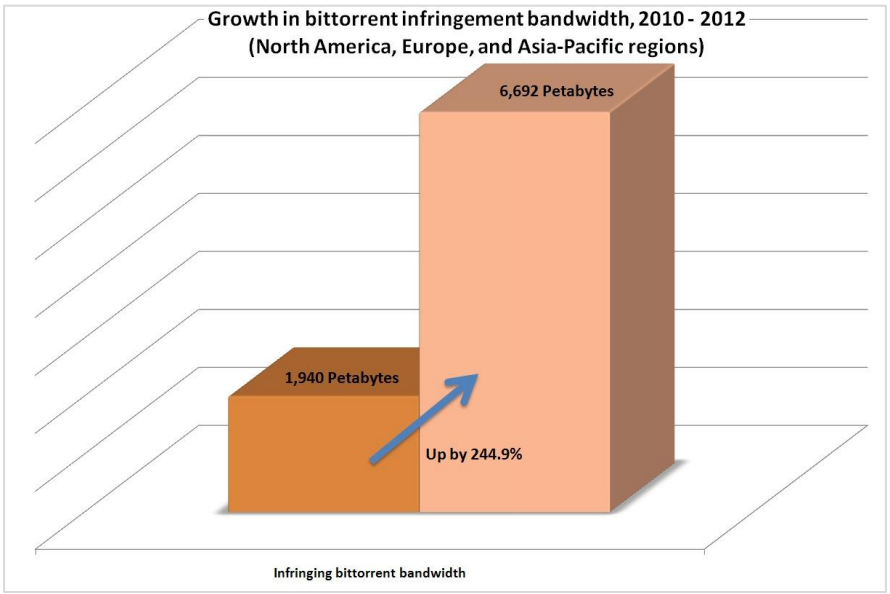
[3] comScore derived total internet population includes persons aged 15+ accessing the internet from a home-owned or work-owned computer and excludes mobile devices, internet cafes, libraries, etc.

1.2.2 Infringement ecosystems

BitTorrent

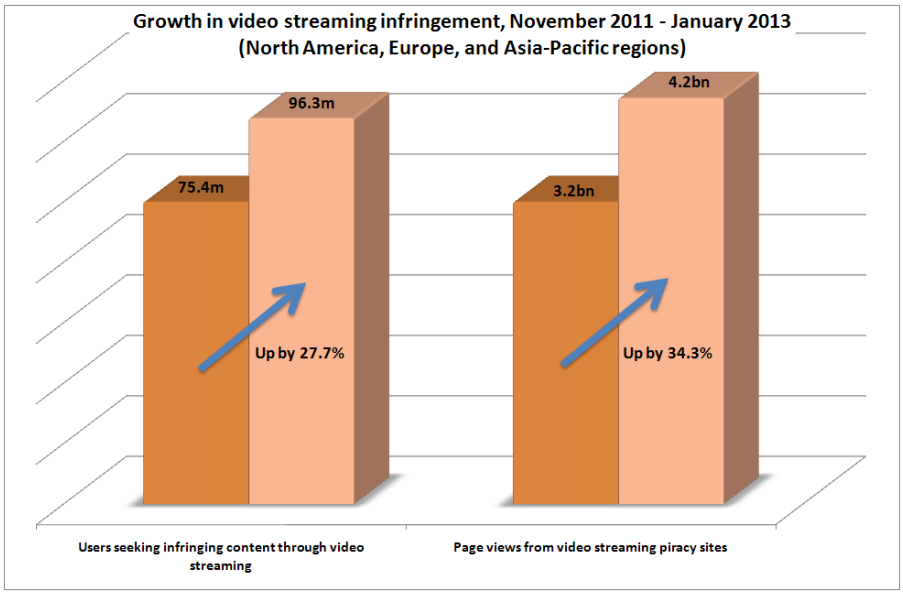
- Bittorrent is the most popular peer-to-peer file distribution system worldwide. The protocol is one of the highest consumers of internet bandwidth. BitTorrent users search dedicated web portals for torrent files for particular content. Torrent files open in a bittorrent client which then connects users to swarms of other downloaders.
- In three key regions (**North America**, **Europe**, and **Asia-Pacific**), the absolute amount of bandwidth consumed by the infringing use of bittorrent comprised 6,692 petabytes of data in 2013, an increase of 244.9% from 2011.
- In the same three regions, infringing use of bittorrent in January 2013 accounted for:
  - 178.7 million unique internet users, an increase of 23.6% from November 2011
  - 7.4 billion page views, an increase of 30.6% from November 2011

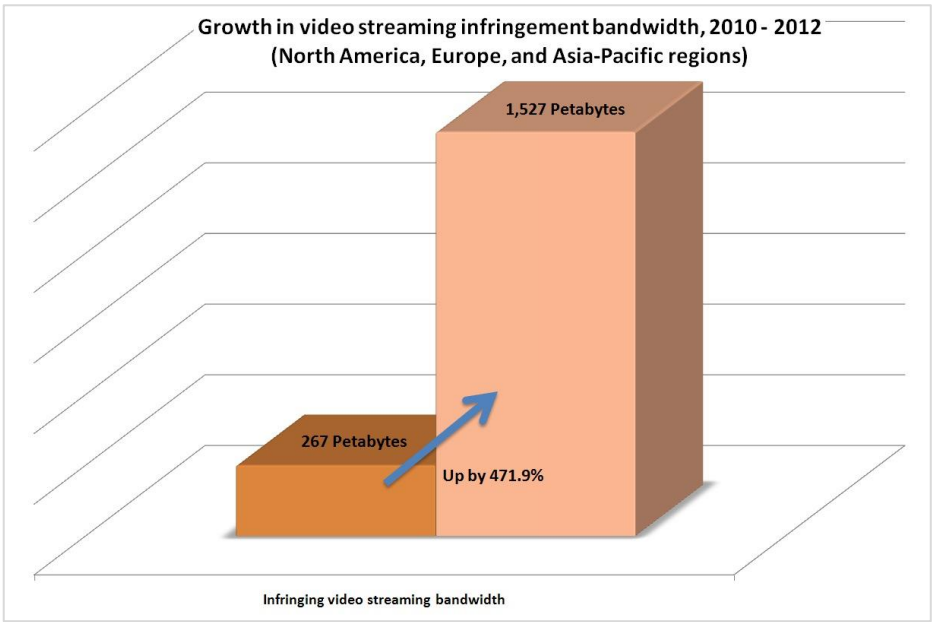




Video streaming

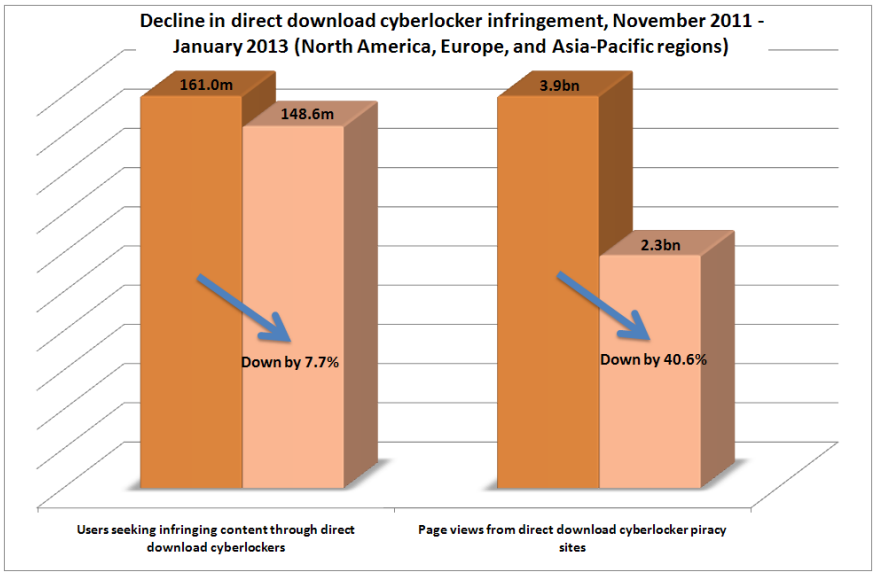
- Infringement through video streaming generally combines video streaming link sites with video hosting sites that are often called video streaming cyberlockers. Users search a link site for the content they desire, then click through the link to a streaming cyberlocker to watch the title.
- In three key regions (**North America**, **Europe**, and **Asia-Pacific**), the absolute amount of bandwidth consumed by the infringing use of video streaming comprised 1,527 petabytes of data in 2013, an increase of 471.9% from 2011.
- In the same three regions, infringing use of video streaming in January 2013 accounted for:
  - 96.3 million unique internet users, an increase of 27.7% from November 2011
  - 4.2 billion page views, an increase of 34.3% from November 2011

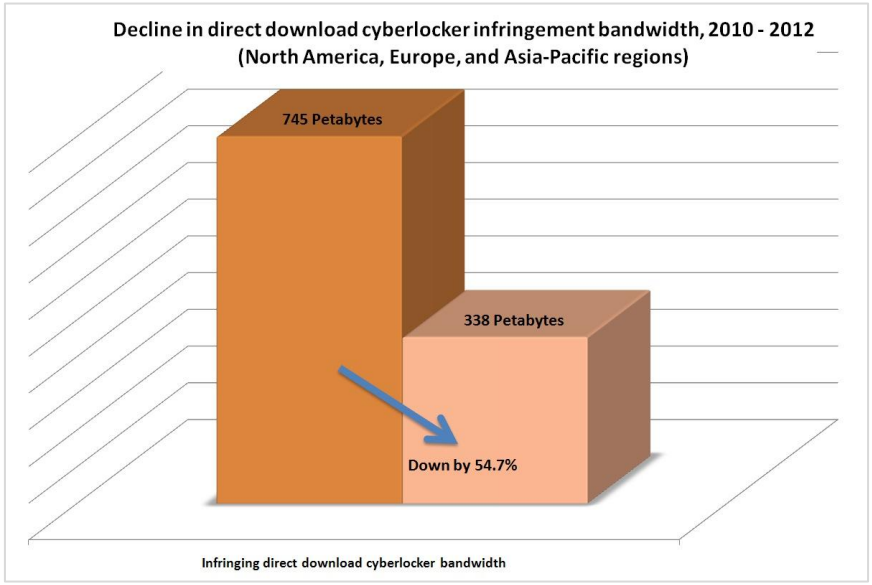




Direct download cyberlockers

- The user experience of infringement via direct download cyberlockers usually involves visiting a direct download cyberlocker link site to locate links for a piece of content that are followed to a direct download cyberlocker from which files can be downloaded. The direct download cyberlocker ecosystem was affected by the seizure of the MegaUpload site in January 2012 and the subsequent closure of other popular direct download cyberlockers. In three key regions (North America, Europe, and Asia-Pacific), the absolute amount of bandwidth consumed by the infringing use of direct download cyberlockers comprised 338 petabytes of data in 2013, a decrease of 54.7% from 2011.
- In the same three regions (**North America**, **Europe**, and **Asia-Pacific**), infringing use of direct download cyberlockers in January 2013 accounted for:
  - 148.6 million unique internet users, a decrease of 7.7% from November 2011
  - 2.3 billion page views, a decrease of 40.6% from November 2011





1.2.3 Ecosystem business models

- Almost every piracy-focused site included in this analysis is **owned and run for profit**. Business models differ slightly within the different ecosystems discussed, but the majority of these sites draw revenue from advertising, with others supplementing this income by offering users premium subscription accounts designed to offer faster access to content.
- **BitTorrent portals** exist almost exclusively on advertising revenue, frequently displaying banner advertisements and pop-up windows for casinos, dating sites, and download services.
- **Video streaming link sites** also tend to display numerous advertisements, some of which are designed to confuse users into believing they lead to legitimate or free video content in an effort to gain advertising traffic or to push malware onto users' devices. Link sites may also gather revenue by uploading content to video streaming host or video streaming cyberlocker sites. These host sites pay uploaders of popular material and those who persuade others to sign up for premium accounts.
- In addition to generating revenue through advertisements, **video streaming host sites or cyberlockers** often promote paid 'premium' accounts that offer users faster, advertisement-free access to content, as well as the ability to download video.
- **Direct download cyberlocker link sites** generate revenue through advertisements. They also enter into income-generating affiliate agreements with cyberlockers: the affiliate is paid when users purchase premium accounts or when users generate significant numbers of downloads from the cyberlocker.
- **Direct download cyberlockers** also feature many advertisements but place a greater focus on encouraging users to sign up for paid 'premium' accounts that offer a faster and simpler download experience for content.

1.3 Distribution and enforcement

Expanding efforts to distribute content legitimately through systems such as Netflix and BBC iPlayer for video, Steam and Origin for games, and Spotify and Pandora for music has helped draw millions of users into legitimate content arenas. At the same time, efforts to restrict infringement through legal action or other methods have been only intermittently successful, limited by the abilities of those involved to use available processes and techniques to adequately tackle the complexities of the internet world and the adaptive nature of infringement, driven by a voracious online appetite for pirated content.

In some regions, legitimate distribution services have significantly altered the online landscape. For instance, Netflix is now responsible for nearly one-third of all downstream peak-time bandwidth in the United States and has nearly 30m active subscribers in the country. Its growth and that of other legitimate streaming sites has helped drive overall levels of bandwidth consumption higher within the US. As a consequence, the relative proportion of bandwidth devoted to piracy has fallen: in North America, the percentage of total downstream bandwidth devoted to infringement fell from 15.7% in 2010 to 11.4% in 2012. Yet this should not be taken as demonstrating an overall drop in levels of infringement in the region. In fact, the actual amount of bandwidth consumed by infringement continued to grow at a rapid pace during this period, increasing by 48.2% in North America between 2010 and 2012. Further, the period from November 2011 to

January 2013 saw the number of users involved in infringement in North America grow by 40.5% from 45.4m to 63.8m. The overall proportion of internet users engaged in infringement rose by more than a third, from 21.6% in November 2011 to 29.6% in January 2013.

This overall increase in infringement in North America is matched by similar findings for other key regions such as Europe and Asia-Pacific. The rise in the number of users involved in infringement, the page views devoted to piracy, and the amount of bandwidth consumed by infringement comes despite the discrete success stemming from the law enforcement operation against MegaUpload which limited the attractiveness and use of direct download cyberlockers. In January 2012, the MegaUpload direct download cyberlocker was closed after an international law enforcement effort. The fallout led to other major direct download cyberlockers also closing or changing their mode of operation. Between November 2011 and January 2013, the number of visitors worldwide to direct download cyberlockers fell by 8.3%; the number of page views dropped by 41.0%; and the amount of bandwidth devoted to direct download cyberlockers fell by 54.7% between 2010 and 2012. Evidence clearly shows a sustained and likely permanent drop in the popularity of direct download cyberlockers following the MegaUpload operation.

The closure of MegaUpload also involved the closure of the streaming cyberlocker MegaVideo, an incident which in turn affected other popular streaming cyberlockers. Yet this disruption did not have a similar permanent impact on infringing use of video streaming as for the direct download cyberlocker ecosystem. Video streaming, both as a legitimate and illegitimate practice, is simple to engage with and deeply embedded in typical user routine. Video streaming bandwidth consumption of all kinds has exploded over the last few years, increasing by over 170% between 2010 and 2012 in North America, Europe, and Asia-Pacific. Infringement through video streaming has increased even more dramatically: the amount of bandwidth devoted to infringing video streaming has grown by more than 470% over the same period, despite the loss of well-known hosts such as MegaVideo.

This demonstrates clearly how quickly online piracy can react to system events such as site closures or seizures. User behaviour is modified, often in moments, shifting from locations or arenas impacted by events to others that offer a comparable spread of infringing content via a similar or different consumption model. The practise of piracy itself morphs to altered circumstances, with use of video streaming and bittorrent escalating as direct download cyberlockers fell away.

The value to content owners of the international law enforcement action against MegaUpload and the effect on the overall direct download cyberlocker ecosystem is undeniable. However, the recovery of video streaming cyberlockers from the same incident and the overall growth in infringing users, page views, and bandwidth consumption by infringing video streaming use demonstrates a need for content owners to have access to tools and methods that allow them to react no less quickly as users and site operators do to changes and transformations in the different piracy ecosystems.

1.4 Methodology

The research presented in this report draws on data from a number of sources. In all cases, data from external sources was used to strengthen and augment original research conducted by NetNames. The selection of sites which comprise the different ecosystems studied in this report are based on the company's experience, knowledge, and monitoring of digital piracy for more than fourteen years.

Information on unique and unduplicated **visitors** and **page views** for sites that fall into each infringement ecosystem are gathered from comScore. comScore figures on *unduplicated* visitors are one of the main sources of information which underpins this report: unduplicated data counts a visitor to, say, ten different bittorrent portals, or to a bittorrent portal and a direct download cyberlocker, once only, ensuring that a unique count of users within and across infringement ecosystems can be prepared.

In all ecosystems studied in this research, a careful account has been made of levels of **non-infringing use**. Discussion of piracy and infringement often provokes emotional and spirited debate. Within such an arena it is important to present a cautious and nuanced account of the different uses of successful and immensely popular technologies such as bittorrent, both for infringement and non-infringement. Using various techniques devised by NetNames, each explained in detail within the report, this research examines the types of content available within each ecosystem and the proportion of that content which is infringing. This information is then combined with data from comScore on the selected sites within each ecosystem to estimate the number of infringing and non-infringing users by employing probability to determine the frequency of infringing activity. These estimates enable this report to provide a figure for unique and unduplicated users who engaged in infringing activity in January 2013, both in each ecosystem separately and as part of the broader single piracy universe. Section 8 of the main report outlines this methodology in detail.

Data on **bandwidth use** was provided by Sandvine[4] who deploys network management solutions in many countries worldwide. Statistics from Cisco provided information on the growth of data consumption online.

The research provided in this report presents what is believed to be the first attempt to produce an accurate overall size estimate for the online piracy universe. Estimating any activity that comprises a range of user behaviours, motives, and actions can be problematic and is inevitably open to criticism and question. By carefully outlining in the body of the report the methodologies used to produce the conclusions, it is hoped that this research might prompt further study in one of the most fascinating and consistently changing areas of the internet.

[4] NetNames is very grateful to Sandvine for the company's openness and willingness to provide data for the study.

1.5 Report Structure

Following this summary of the main findings, Section 2 introduces the research in more detail and further outlines the methodologies employed to produce the primary conclusions, discussing issues which may affect the results. Sections 3, 4, 5, and 6 investigate the main internet ecosystems commonly used for infringement: specifically, bittorrent, other file sharing networks, video streaming, and direct download cyberlockers. Each ecosystem is discussed in depth and the approaches used to calculate unique users, proportion of infringement, and bandwidth use are outlined.

Section 7 considers infringement on mobile devices but concludes that further dedicated research is required in this area given the extremely rapid adoption of smartphones and tablets worldwide in recent years.

Section 8 concludes the report, drawing the research together and providing a repeatable framework to estimate the overall size of the piracy universe as it is used for infringement and the proportion of bandwidth consumed by infringing content.

Appendix A contains a list of the web sites used to calculate the data used in many areas of the report. Appendix B contains detailed data on a number of the overall findings on unique visitors, page views, and bandwidth use both on a worldwide and regional basis.

2 Introduction and methodology

2.1 Report goals

This report has two goals, simple to state but potentially difficult to achieve. The first is to accurately estimate the size of the worldwide piracy universe: how many unique internet users regularly engage in infringing activity through ecosystems typically used for piracy like bittorrent, cyberlockers, and video streaming. The second is to examine the amount of bandwidth used for infringement in different regions of the world. This second task broadly repeats but significantly extends research conducted by Envisional for a 2011 public report on infringing bandwidth use.

Each of these tasks is complex and difficult and each requires a range of methodologies if they are to be brought to a satisfactory conclusion. This section of the report introduces the main problems which arise from an attempt to tackle these goals and discusses the different research methodologies, data points, and techniques used to calculate and refine the final conclusions reached.

An introduction to each main infringement ecosystem is followed by a discussion of the main web-based analytics used for measurement. These include an outline of the types of sites chosen for inclusion and the different metrics used from providers such as comScore. The provision of internet bandwidth data from Sandvine and Cisco is also explained.

2.2 Infringement ecosystems

This report analyses piracy or infringing activity within a number of categories. These reflect different ecosystems commonly used to locate, distribute, and consume infringing material. The methodology used to describe the size of each ecosystem in January 2013 is outlined below and discussed in more detail in each section of the report. It is important to note that the figure produced for the total size of each ecosystem **does not represent** the total number of users who use the ecosystem for infringement as some users will not download infringing content or use that ecosystem to obtain pornography only (which is not examined for infringement in this report). The determination of the total number of infringing users in each ecosystem is performed in Section 8 of this report.

In this report, the ecosystems are categorised as follows:

- **BitTorrent**, including analysis of the bittorrent network population, bittorrent client use, visitors to bittorrent portals, and the amount of bandwidth consumed by bittorrent online for infringing purposes. The most suitable metric for analysing the size of the overall bittorrent ecosystem was chosen to be **unduplicated visitors to bittorrent portals during a single month**. In January 2013, this figure was 212.8m for all bittorrent portals that received more than 50,000 unique visitors during the month.

Discounting those visitors who only use bittorrent to obtain non-infringing or pornographic content (see Section 8) results in a final figure of **infringing bittorrent users** of **204.9m**.

- **Other file sharing networks**, including analysis of the eDonkey, Ares, and Usenet populations and the amount of infringing bandwidth consumed by each network online. For these file sharing networks, the most suitable metric for analysing the size of each universe was the number of **unique users of clients for each network during a single month**. In January 2013, this figure for eDonkey was 9.3m; for Ares, 66.6m; and for Usenet, 5.0m. Discounting those users who only employ each file sharing network for non-infringing or pornographic content makes a small change to these figures but does not affect the headline total (see Section 8).
- **Video streaming**, including analysis of both video streaming link sites frequently used to locate infringing content and video streaming cyberlocker sites used to host and stream the video content to users, and analysis of the amount of bandwidth consumed by infringing video streaming online. The most suitable metric for analysing the size of the infringing video streaming universe was chosen to be **unduplicated visitors to video streaming link sites during a single month**. In January 2013, this figure was 112.5m for all video streaming link sites which received more than 50,000 unique visitors during the month. Discounting those visitors who only use such sites to obtain non-infringing or pornographic content during the course of a month (see Section 8) results in a final figure of infringing video streaming users of **112.0m**.
- **Cyberlockers**, including analysis of both cyberlocker link sites frequently used to locate infringing content and cyberlocker hosting sites used to store the content ultimately downloaded by users, and analysis of the amount of bandwidth consumed by infringing cyberlocker use online. The most suitable metric for analysing the size of the infringing video streaming universe was chosen to be **unduplicated visitors to cyberlocker host sites during a single month**. In January 2013, this figure was 228.8m for all cyberlocker sites which received more than 50,000 unique visitors during the month. Discounting those visitors who only use such sites to obtain non-infringing or pornographic content (see Section 8) results in a final figure of infringing cyberlocker users of **210.6m**.

The report also briefly discusses activity on mobile devices such as smartphones and tablets. The main processes by which each ecosystem functions are briefly outlined at the start of each section.

2.3 Web site visitor analysis

2.3.1 Site selection

Appendix A lists over six hundred web sites which form the basis of the visitor measurement analytics used in some of the different sections of this report. The sites are taken from a larger database of web sites maintained by NetNames which offer, or have offered in the past, infringing material. Given the constantly

growing and rapidly changing features and extent of the worldwide internet, it is possible – indeed, likely – that an occasional web site which should fall within the auspices of this research has been overlooked. However, NetNames is confident that the largest and most popular sites that facilitate and focus upon infringement are included and that omissions which might occur will do so in the long tail of less visited sites.

Each site included in Appendix A has been verified by a NetNames analyst as being focused on providing infringing content or providing links to infringing content. 'Focused' means that the infringing material comprises more than half of all links or all files posted on the site. For instance, previous analysis by NetNames shows that of all content held on ThePirateBay in December 2011, the majority was infringing (ranging from 78.1% for music to 92.9% for television).[5]

Sites are only included in analysis during months in which their operations were focused on offering infringing content. For instance, some of the sites included in Appendix A are no longer in operation or are no longer focused on offering infringing material – these range from the cyberlocker MegaUpload, shut down by US law enforcement in January 2012 to the bittorrent portal Mininova which removed all links to infringing content in November 2009. MegaUpload is therefore included in the analysis of cyberlockers up to and including January 2012; Mininova is included in the analysis of bittorrent portals up to and including November 2009.

In some charts, sites are only included when they comprise one of the twenty most popular sites in a particular category. This calculation is made on a monthly basis and as such, the composition of the top twenty sites may change from one month to the next. Appendix A highlights any site that was part of the top twenty during any month.

The main source of data on web site visitors used within this report comes from comScore. comScore is recognised as the industry leader in measurement of digital activity.

2.3.2 comScore

comScore's Media Metrix audience measurement service is drawn upon within this research to provide data on unique monthly visitors to a wide range of sites and users of applications of interest. This data is drawn from comScore's user panels of over 2m individuals in 44 countries, supplemented by census-based measurement systems in 172 countries. The company's methodology has passed audits from the Media Rating Council and the IAB.

comScore is believed to be accurate in its assessment of sites which have a substantial population but its panel-based approach may be less accurate when considering sites that have a small level of visitors. The company normalises its data according to demographics in each country but it is possible that, say, a small

[5] *Written report on matters related to the Pirate Bay web site*, December 2011, submitted to the UK High Court.

piracy-focused site in a country where comScore does not have a dedicated panel might be missed. For this reason, only sites with a **minimum of 50,000 unique visitors each month** were included in this research.

While comScore provides a range of analytics on various aspects of the digital world, this project uses the company's data in two main ways, both of which draw on comScore figures for unique monthly visitors to web sites (or unique monthly users of particular software applications such as bittorrent clients).

- **aggregate unique visitors** to a web site or set of web sites. That is, the combined total number of visitors to a site such as thepiratebay.se[6] or the total number of visitors to thepiratebay.se, torrentz.eu, kat.ph[7], and other bittorrent portal sites. When calculating visitors to a set of sites, this figure is a simple sum of all the visitors to each web site.
- **unduplicated visitors** to a set of web sites. This extremely useful data point examines the unique universe of users who visit any number of a specific set of sites. For instance, the unduplicated audience for bittorrent portals counts the individual users who visit any bittorrent portal once in a month. Thus a user who visits thepiratebay.se, isohunt.com, kat.ph, and torrentino.com is counted only once in an unduplicated audience figure, not once for each web site they visit. This is in contrast to the aggregate figure which would count that user four times, once for each bittorrent site they visit. The unduplicated data provides a shape to the overall bittorrent universe; it gives a figure that enables understanding of the total number of individual users who turn to bittorrent sites at least once a month to seek content.

As an example of the difference between each of the two data points, comScore estimated that the *unduplicated* number of visitors worldwide to bittorrent portals in January 2013 was 212.8m. That is, 212.8m internet users visited at least one bittorrent portal during January 2013. This compares to an aggregate or combined figure of 555.0m.

The unduplicated figure for visitors to sites within each ecosystem is frequently used in this report as a way to size the boundaries of that ecosystem. Specifically, comScore data is used in short-term, long-term, and regional analysis of the web sites and applications selected by NetNames for inclusion in Sections 3 (bittorrent), 4 (other file sharing), 5 (video streaming), and 6 (cyberlockers) of this report.

Short-term (fifteen month) analysis

- On a monthly basis between **November 2011** and **January 2013**, the number of *aggregate* visitors were recorded to all sites which had **more than 50,000 unique visitors** in each ecosystem category. If a site had 100,000 visitors in December 2012 but 40,000 visitors in January 2013 then it would be included in the calculation for December 2012 but not for January 2013. Analysis also includes sites which may have gone offline during the monitoring period – for instance, bittorrent portal BTJunkie.org closed in January 2012 but visitors to the site are included in the analysis up until the point that it shut down.

[6] ThePirateBay changed domains to thepiratebay.sx in June 2013.

[7] KickassTorrents changed domains to kickass.to in June 2013.

- On a monthly basis between **November 2011 and January 2013**, *unduplicated* visitors to all sites which had more than 50,000 unique visitors in each ecosystem category. The same methodology is applied to site selection as for aggregate visitors.
- Short-term analysis also examines the number of **total page views** across all sites from a category which had more than 50,000 unique visitors each month. For instance, there were 1,811,802,000 page views on thepiratebay.se in January 2013. This is compared to total page views from November 2011.

Regional analysis

- comScore data for the distribution of visitors by region of the world is employed to help define popularity for different types of web site.
- The methodology used in this report for the regional breakdown of visitors takes as a starting point the comScore unique monthly visitors to all web sites for a particular category in January 2013 with **more than 50,000 unique visitors** (for instance, thepiratebay.se received 58,962,934 visitors in January 2013 according to comScore). This provides the **same base of sites** as that for the short-term analysis discussed above.
- For each individual site, the number of total monthly unique visitors is then split between five major regions of the world (North America, Europe, Asia-Pacific, Latin America, and Middle East & Africa) according to comScore's World Metrix data for that site for the same month (for thepiratebay.se, this provides figures of 20,106,360 visitors from North America, 16,450,659 from Europe, 11,733,624 visitors from Asia-Pacific, 5,188,738 visitors from Middle East & Africa, and 5,483,553 from Latin America).
- Total aggregate visitors to all sites from each of the five regions are then summed, leading to an overall percentage breakdown of aggregate visitors to a category of sites from each region (so, all visitors from Asia-Pacific to all bittorrent sites). This percentage is then combined with the total *unduplicated* visitors to bittorrent portals to provide a final figure for total unique unduplicated visitors from each region. This provides an estimate for the total universe of e.g. bittorrent users from each region.

Long-term analysis

- On a monthly basis between **July 2009** and **January 2013**, aggregate visitors to the twenty sites with most unique monthly visitors in each category – for instance, bittorrent portals – were analysed. Total aggregate visitors were calculated (unduplicated visitor data is not available for this longer period of time). This analysis is limited to twenty sites as long-term data for more than twenty could not be accurately sourced for all ecosystems under analysis.

2.4 Bandwidth data

Data on the use of bandwidth by different services, protocols, and sites was supplied by network monitoring company Sandvine. The data provided by the company covered three major regions of the world: **North America**, **Europe**, and **Asia-Pacific**. Data was gathered from a range of ISPs in which Sandvine's equipment

is installed. Detection monitored all traffic passing through the ISP over a sustained period of time and monitoring was performed during the first half of 2012 for Europe and Asia-Pacific and the second half of 2012 for North America. Bandwidth data from Sandvine for 2010 formed the focus of Envisional's 2011 technical report in this area, ensuring consistency in measurement across both pieces of research.

The overall bandwidth figures contained in this report are aggregate data reported by Sandvine for a combination of peak and off-peak use of both downstream and upstream bandwidth. Occasionally, use is made of a figure for downstream or upstream bandwidth only, but the report makes it clear when this occurs.

Sandvine does not have complete coverage of every ISP in a country or region. It is possible that the company's commercial focus means that gathered data will be biased to a particular country where the company has a larger installed base. As with comScore data, variations within countries where Sandvine may not have a commercial presence will not be included in their data collection. The omission of bandwidth data from Latin America and the Middle East and Africa is a regret given the believed differences in internet use between regions; as the Sandvine data used in this report demonstrates, there are significant variations between internet use in the regions covered in this report, for instance, and such difference is just as likely should data be located for bandwidth use in regions not covered in this report. The inability to obtain any complete bandwidth data representative of all regions of the world means that it was not possible to repeat the estimates made in Envisional's January 2011 report and produce a figure for infringing bandwidth use worldwide (estimated at 23.76% of all bandwidth in 2010). Instead, this report provides estimates for infringing bandwidth use in each of the three regions for which data was obtained from Sandvine (North America, Europe, and Asia-Pacific).

Additional data to support the bandwidth analysis contained in of this report was gathered from hardware manufacturer Cisco. Through its Visual Networking Index[8], Cisco provided an estimate of the overall growth of bandwidth use online between 2010, the point at which data was gathered for the earlier report, and 2012. The company records worldwide consumption of bandwidth growing by 109.0% during this two year period. In North America, overall bandwidth consumption grew by 105.0%; in Europe, 109.6%; and in Asia-Pacific, 111.2%. These are substantial increases over a relatively short period of time but the velocity of increase shows little sign of slowing: Cisco believe internet traffic will triple between 2012 and 2016. Bandwidth consumption also grew per individual internet user between 2010 and 2012.

According to Cisco, all main categories of bandwidth use showed an increase between 2010 and 2012, with video streaming increasing by 59.4% and file sharing by 21.2%. In North America, video streaming consumption rose by 59.3%; in Europe by 70.7%; and in Asia-Pacific by 50.0%. Clearly, the internet as a whole has consistently consumed a greater amount of bandwidth each year. The major categories of bandwidth consumption that are frequently used to obtain infringing content – such as file sharing and video streaming – also continued to grow.

[8] http://www.cisco.com/en/US/netsol/ns827/networking_solutions_sub_solution.html

Cisco is a hardware manufacturer focused on providing companies with equipment to enable them to better control and utilize data flows through networks. It is, of course, in Cisco's commercial interest to encourage ISPs and hosting providers to believe that internet use and data consumption is increasing as this meets their commercial goals. However, data to support the contention that bandwidth consumption is growing rapidly is available from ISPs and other internet entities, reducing (though not removing) this concern. For instance, TeleGeography estimated that bandwidth growth tripled[9] between 2010 and 2012 while IDC predicted a growth[10] of 50% year on year from 2010 to 2015.

2.5 Ecosystem structures

The following four sections of this report discuss a range of internet ecosystems typically used by internet users to locate and obtain infringing content: bittorrent (Section 3), other file sharing networks (Section 4), video streaming (Section 5), and direct download cyberlockers (Section 6).

In each section, an introduction highlights the different types of data available to size the number of users within each ecosystem, and the particular metric chosen for that ecosystem is justified. Data from comScore is used to outline the unique population of internet users that inhabit the ecosystem and an outline of historical trends is provided. Analysis of the content typically found in each ecosystem is produced together with an assessment of the proportion of that content which is infringing. **Unless otherwise stated, all figures displayed in charts or quoted in each section relate to visitors who accessed *infringing* content through each ecosystem during January 2013**. That is, non-infringing use of each ecosystem is accounted for and removed from the figures discussed. Section 8 outlines the methodology used to discount users who only access non-infringing use within each ecosystem.

Bandwidth data from Sandvine and Cisco is then employed to demonstrate the overall amount of bandwidth devoted to infringement within that ecosystem. A discussion of business models and revenue generation methods in each web-based ecosystem is also provided.

[9] http://www.ispreview.co.uk/index.php/2012/09/international-internet-capacity-growth-falls-as-bandwidth-climbs-to-77tbps.html

[10] http://www.ispreview.co.uk/index.php/2012/03/idc-predicts-global-broadband-internet-traffic-to-grow-50-each-year.html

3 BitTorrent

3.1 Introduction

BitTorrent was created in 2001, initially intended as an efficient method to share large non-infringing files such as distributions of Linux. Quickly co-opted for infringement, the protocol is now recognised as one of the fastest and simplest ways to transfer data between multiple users across the internet. Use of the protocol is heavy worldwide; for instance, data from Sandvine estimates that bittorrent comprised more than 21.7% of all internet traffic in Europe in the first half of 2012 (downstream and upstream), and more in Asia-Pacific.

The use of bittorrent by internet users tends to require two factors:

- a web site or portal such as ThePirateBay (see screenshot) or IsoHunt that offers links to content such as films or music that can be downloaded using a bittorrent client
- a 'swarm' of bittorrent users sharing a particular piece of content to which the bittorrent client can connect

Type	Name (Order by: Uploaded, Size, ULed by, SE, LE) View: Single / Double	SE	LE
Video (Movies)	Les Miserables - Os Miseráveis - 2012 - Legendado - RMVB Uploaded 02-26 08:53, Size 764.5 MiB, ULed by japanjim	61	13
Video (Movies)	Les.Miserables.2012.DVDSCR.NorSub-philipo Uploaded 02-08 15:52, Size 2.31 GiB, ULed by philipo	188	39
Video (Movies)	Les Miserables 2012 DVDSCR EDAW Uploaded 02-07 23:59, Size 2.31 GiB, ULed by UltraTorrents	481	72
Video (Highres - Movies)	Les.Miserables.1998.720p.BluRay.x264-EbP Uploaded 02-05 10:03, Size 6.4 GiB, ULed by maximersk	68	20
Video (Movies)	Les Miserables.scr 2012 (Hardcoded Dk subs) Uploaded 01-19 21:46, Size 1.89 GiB, ULed by Realuploads	48	5

The typical bittorrent download generally proceeds along the following lines: a user interested in an infringing copy of, say, the 2012 film *Les Miserables* visits a bittorrent portal site such as ThePirateBay. The user searches for the film title, and then chooses and clicks a link to download a version of the film. This link launches the user's bittorrent client which then enters the 'swarm' or network of bittorrent users actively sharing that film, and begins to download. As soon as the user's client has downloaded any part of the film, it can then share that part with others in the same swarm.

As the data in this section demonstrates, hundreds of millions of internet users employ bittorrent each month to share content and the vast majority of that usage is infringing, downloading pirated films, television episodes, games, software, books, and music. **Of all unique visitors to bittorrent portals in January 2013, it is estimated that 96.28% sought infringing content during the month, a total of 204.9m users**.

Determining universe size

There are four main pieces of data that can help provide an estimate of size for the overall bittorrent ecosystem (not the number of users who actively infringe using bittorrent):

1. Visitors to bittorrent portals in aggregate: internet users who visit a site such as ThePirateBay or KickassTorrents. Visitor analysis is performed over a month and focuses on unique monthly visitors to each site – in aggregate, the total visitors across all bittorent portals included in this research in January 2013 was 555.0m worldwide.
2. Unduplicated visitors to bittorrent portals: the total number of internet users who visit at least one bittorrent portal at least once during the course of a month. This ensures that a user who may visit

numerous bittorrent portals during a month is counted as a single member of the bittorrent ecosystem. In January 2013, this figure was 212.8m worldwide.

3. The bittorrent user population: NetNames collects data for the number of simultaneous users of bittorrent. This is information which shows the number of active bittorrent users at any single point in time and does not show the number of unique bittorrent users over the course of a month. During the final week of 2012, this figure was 12.2m simultaneous users worldwide.
4. The unduplicated number of unique users of individual bittorrent clients such as uTorrent and Vuze over the course of a month. This data is provided by comScore and in January 2013 was 266.3m worldwide.

The figure for **aggregate portal visitors** (1) counts more than once any user that visits more than a single bittorrent portal during the course of a month. This cannot be an accurate way to provide a unique size for a discrete population. In contrast, data on the **simultaneous network population for bittorrent** (3) provides a snapshot of active users only during isolated points in the month and cannot account for total users across the entire period. This leaves the choice of unduplicated portal visitors or unique client users as the best way to size the overall bittorrent universe.

The figure for unique or **unduplicated bittorrent client users** (4) provides a measure of the number of users who have had a bittorrent client in operation on their computer at some point during the course of a month. As a user cannot upload or download content on bittorrent without a client, this might appear as a suitable candidate for assessing a minimum number of users of the bittorrent universe. However, some users may run a bittorrent client without their knowledge – for example, clients are sometimes installed which load on startup and operate in the background of a computer. It is possible that a portion of users, though likely only a few, are unaware that a bittorrent client is operating on their computer. As a result, it is possible that this figure may overcount active and deliberate bittorrent users. Last, the data for client use is gathered by comScore; while this company's data on web site use has been audited by numerous organisations, it is unknown whether a similar inspection has examined app users.

Using the figure for **unduplicated portal visitors** (2) provides a minimum estimate for bittorrent users who have sought content on bittorrent at some point during a month. This limits the calculation to users who have made a deliberate attempts to access a portal providing links to bittorrent. The use of unduplicated portal visitors also allows consistency with the figures for the video streaming and cyberlocker ecosystems.

Given the above, this report estimates the overall bittorrent universe during January 2013 at **212.8m unique internet users worldwide**. Note that this figure says nothing about whether those users are seeking infringing or non-infringing content on the portals which they visit. The proportion of the bittorrent population who use the ecosystem for infringing reasons is determined using a methodology that is explained in Section 8. **This method determines the total number of bittorrent users who accessed infringing content on bittorrent during January 2013 as 204.9m users worldwide.**

3.2 BitTorrent: portal visitors

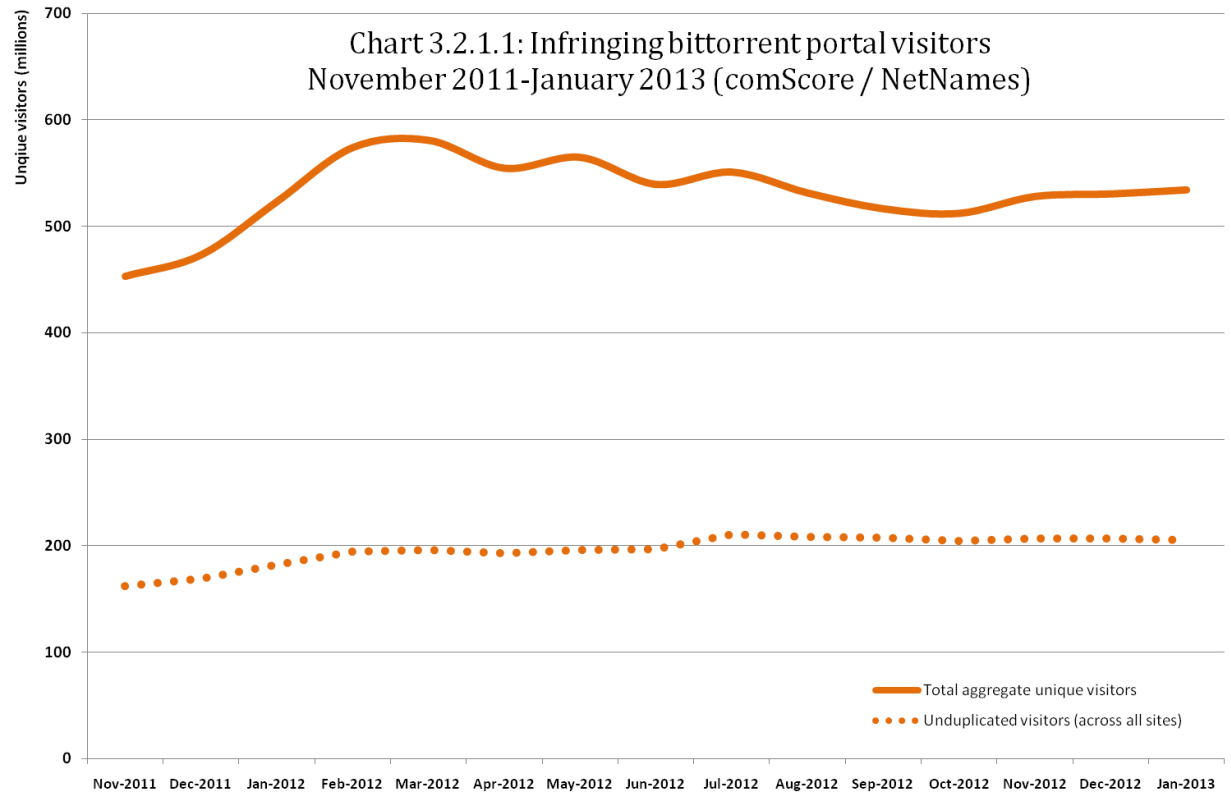
3.2.1 Short-term analysis

Analysis for this report collected over two hundred bittorrent portals that were live in January 2013, as well as data on additional sites that have existed at earlier points. Data was collected for worldwide monthly unique visitors to these sites from comScore for a fifteen month period (November 2011 to January 2013), as well as for those sites that may have been live at some point during this period but were not in January 2013.[11] Sites with more than 50,000 unique users each month were used as the basis for this short-term analysis. A longer-term analysis with a smaller sample of sites is found in Section 3.2.3.

This data was in two forms:

- aggregate unique visitors to each portal (internet users who visit each portal in the course of a month)
- unduplicated visitors to *all* portals (all internet users who visit at least one bittorrent site in the course of a month)

The first type of data provides an idea of all visitors to individual sites and gives a sense of scale for the overall use of bittorrent worldwide. The second type of data (unduplicated visitors) better shapes the size of the bittorrent universe by unique users as the figure only counts each visitor to *any* bittorrent portal over the course of a month once (someone who visits ThePirateBay, KickassTorrents, Torrentz, TorrentLeech, and

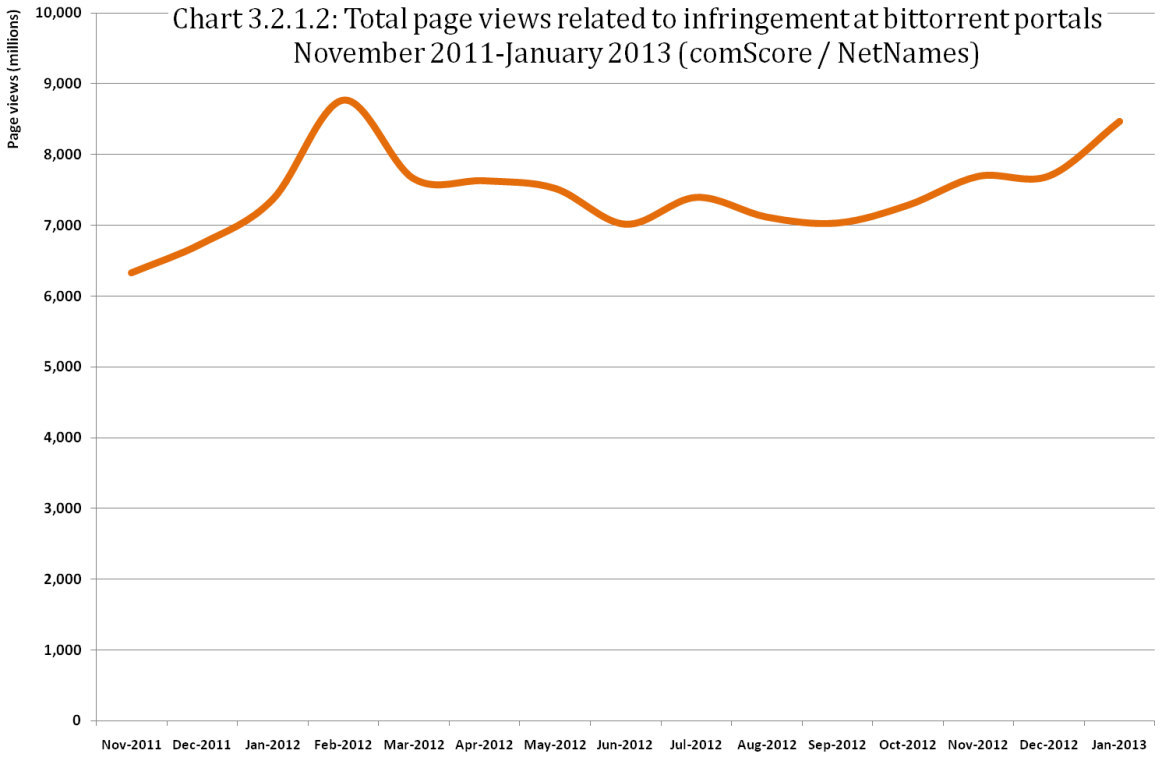


[11] For instance, btjunkie.org closed in January 2012. The site will be included in the visitor analysis up to the point that it closed.

IsoHunt in the same month will be noted as a single visitor only). Similar data is used for most other piracy ecosystems studied in this report. All visitor data gathered from comScore is then passed through a methodology which accounts for non-infringing use of the bittorrent ecosystem and is explained in detail in Section 8. **All figures displayed in charts or quoted in this section relate to visitors who accessed infringing content through bittorrent during January 2013.**

Chart 3.2.1.1 above shows both data points for each month from November 2011 to January 2013. Both figures increase over the period, reflecting the similar increase noted in the simultaneous network population seen in Section 3.3 below. The total aggregate infringing bittorrent visitor population increased from 452.8m visitors to 534.3m in January 2013, an increase of 18.0%. Unduplicated infringing bittorrent portal visitors, a more accurate measure of the total infringing bittorrent population, increased from 162.4m to 204.9m visitors in January 2013, an increase of 26.2%. The data means that each unique bittorrent visitor in January 2013 visited 2.6 different bittorrent sites on average during the month.

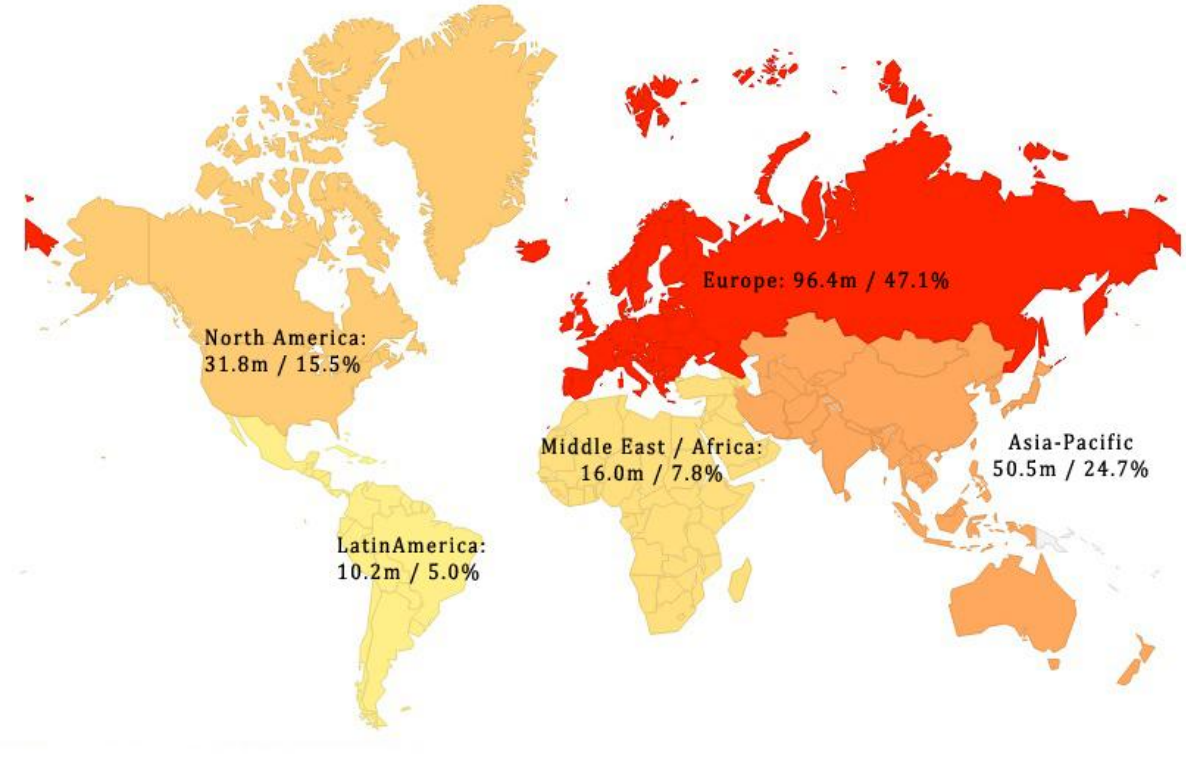
Data is also available from comScore on the total number of **page views** made across all bittorrent sites which related to infringing content. This also increased in the period shown, from 6.3 billion page views in November 2011 (an average of 40.0 bittorrent portal page views overall per visitor during the month) to 8.5 billion in January 2013 (an average of 41.3 page views per visitor). Page views peak in February 2012 as a consequence of the disruption seen in the cyberlocker ecosystem following the seizure and closure of MegaUpload and MegaVideo. Many cyberlocker users 'tasted' the bittorrent ecosystem during this period, testing new sites while seeking a new and reliable source of infringing material.



3.2.2 Regional breakdown

Chart 3.2.2.1 below shows the distribution and number of visitors to bittorrent portals on a regional basis. comScore data was used to analyse visitors according to five regions: North America; Europe[12]; Asia-Pacific; Latin and Central America; and Middle East and Africa. Analysis examined **unduplicated unique visitors** from January 2013, providing an illustration of those who have visited at least one bittorrent portal during the month from each region. In three key regions – North America, Europe, and Asia-Pacific – bittorrent portals had 178.7m unduplicated unique visitors in January 2013. This is an increase of 23.6% compared to 144.6m visitors in November 2011.

Chart 3.2.2.1: Regional breakdown of visitors to bittorrent portals (comScore / NetNames)

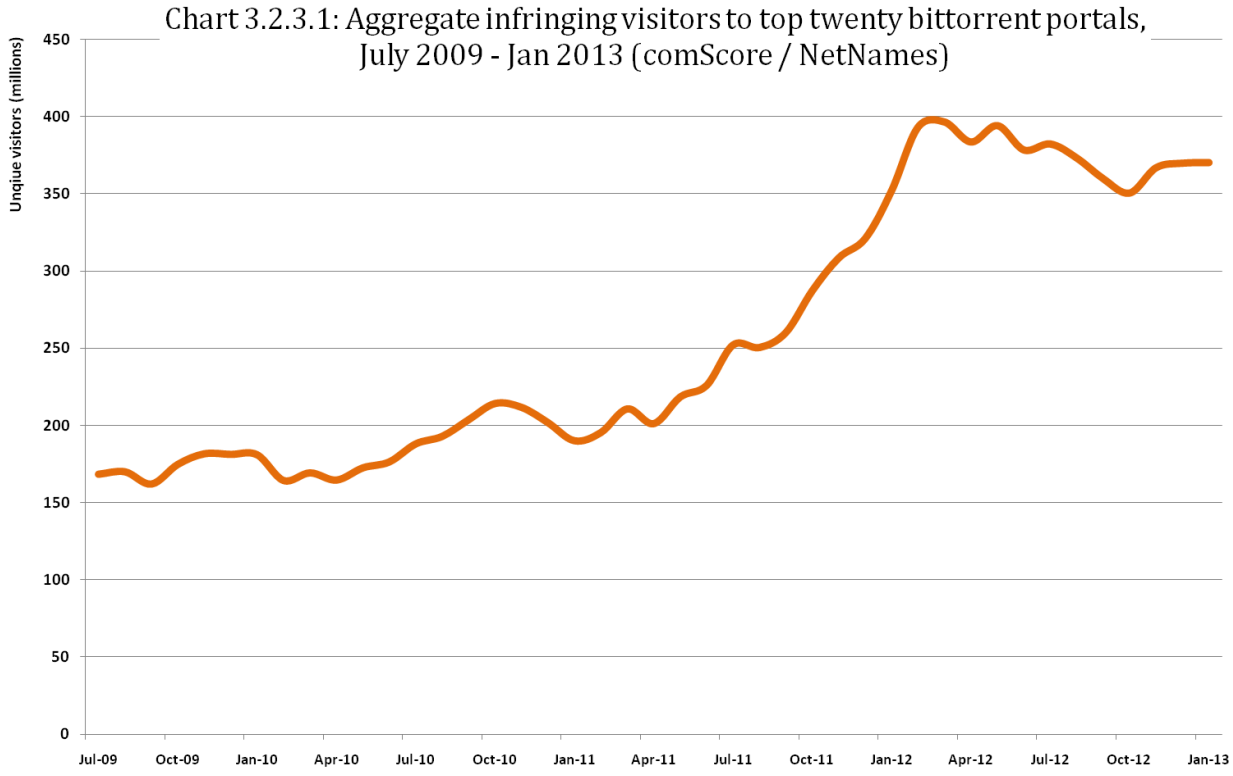


Analysis shows a clear concentration of bittorrent portal visitors in Europe – 47.1% or 96.4m visitors – with Asia-Pacific showing the next largest visitor population of 24.7% or 50.5m. In North America, there were 15.5% or 31.8m unduplicated visitors to bittorrent portals. Data on regional bandwidth use of bittorrent from Sandvine (see Section 3.4 below) broadly reinforces the distribution shown in the chart.

[12] Russia is regarded as part of Europe throughout this report.

3.2.3 Long-term analysis

Chart 3.2.3.1 places visitors to bittorrent portals in a longer-term context and shows that the current position seen in January 2013 is a significant increase on levels of popularity of just a few years ago. In July 2009 (the earliest date for which comScore data is available), comScore recorded 174.8m aggregate and infringing visitors to the most popular twenty bittorrent portals worldwide. By January 2013, this figure stood at 384.4m visitors, an increase of 119.9%.



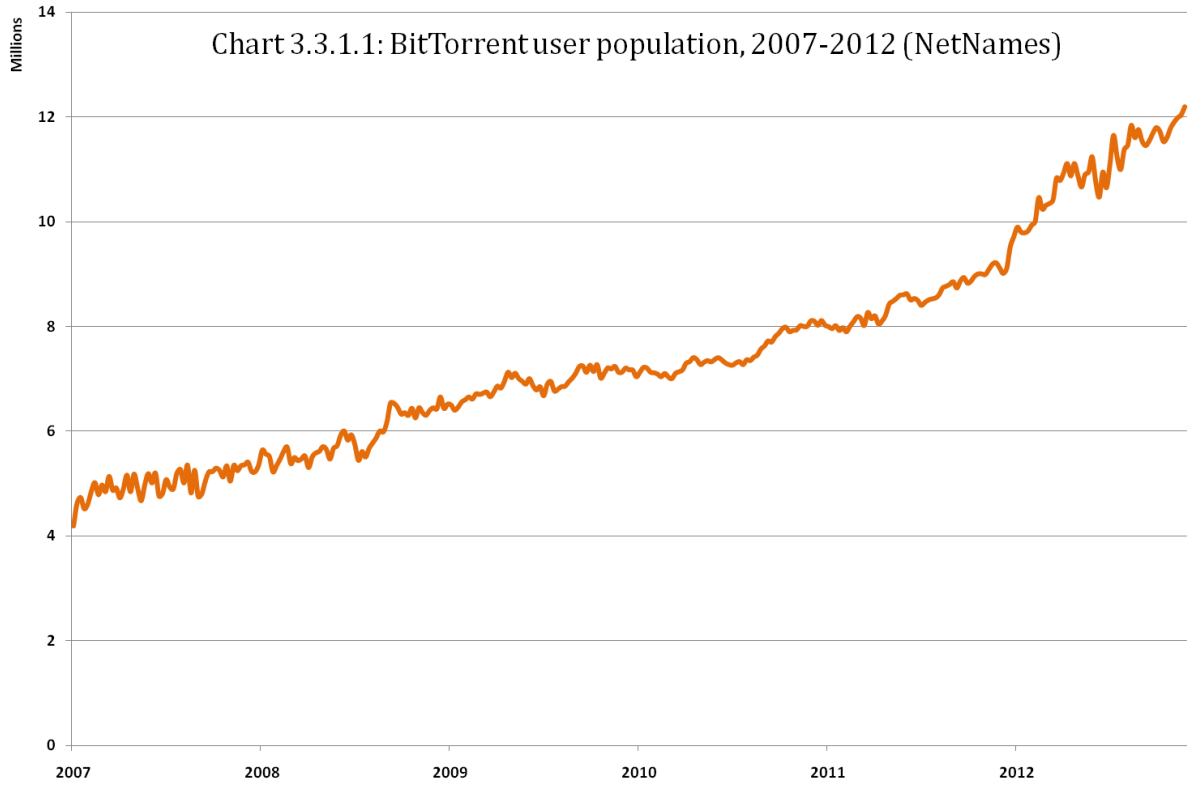
3.3 BitTorrent network population and client use

3.3.1 Network population

Chart 3.3.1.1 below displays the number of simultaneous bittorrent users online at any one time since the beginning of 2007 to the end of 2012. The continued increase in the user population is clear: from 4.2m simultaneous users at the start of January 2007, the network had 12.2m simultaneous users at the end of December 2012, an increase of 191.3% over the six year period. BitTorrent also grew at a faster pace during 2012 than at any other point in its history. To grow from 6m to 9m simultaneous users took almost three and a half years, from the middle of 2008 to the end of 2011. To add a further 3m users to reach 12m simultaneous users took only twelve months, from December 2011 to December 2012.

This recent spurt in the growth of bittorrent users was aided by disruption to other piracy ecosystems (most notably cyberlockers – see Section 6). BitTorrent itself has proved resilient to anti-piracy action in the past. Attempts to degrade the bittorrent experience by uploading fake content to bittorrent portals, sending takedown notices, or issuing warning notices to downloaders (prior to the introduction of graduated response systems) generally had little overall impact. Closures of popular bittorrent sites such as Mininova and Demonoid may have had a short-term impact on regular users of such sites but replacements were quickly located. This was not the case for anti-piracy action aimed at centralised resources on other peer to peer networks such as eDonkey (see section 4 below).

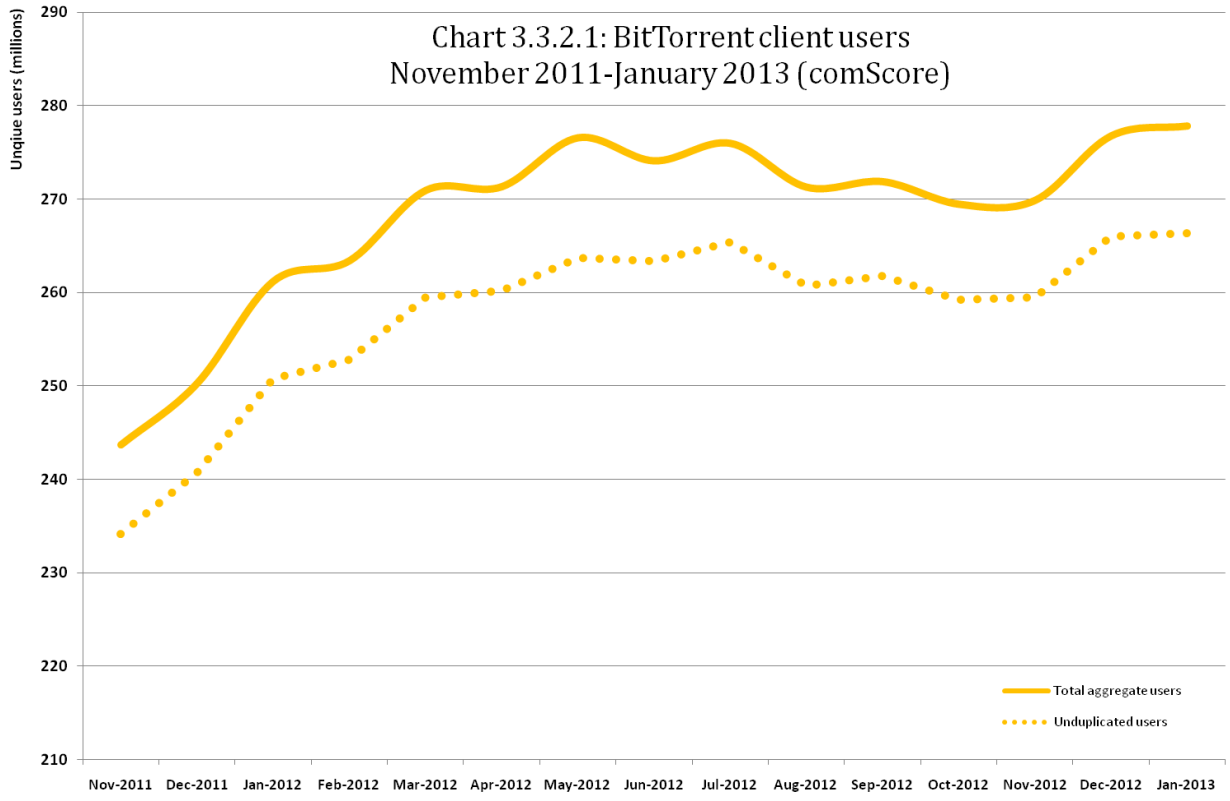
Chart 3.3.1.1 below shows the active users of bittorrent who are downloading or uploading material or part



of a bittorrent swarm of users at any one moment in time. It does not demonstrate the scale of bittorrent use overall which is better illustrated by examining usage data for bittorrent clients (the software tools used to download content via bittorrent) and bittorrent portals (the sites where links to content are located). Note that the figures shown in Chart 3.3.1.1 do not account for non-infringing use of bittorrent and represent a count of the total simultaneous bittorrent population.

3.3.2 BitTorrent client use

Chart 3.3.2.1 below examines use of the most popular bittorrent clients such as uTorrent and Vuze[13]. In January 2013, comScore recorded 277.8m aggregate users of bittorrent clients worldwide (an increase of 14% from 243.7m in November 2011) and 266.3m unduplicated users (an increase of 13.7% from 234.1m in November 2011). There is a much smaller difference between total aggregate users and unduplicated users for bittorrent clients than for bittorrent portals as users tend to employ only a single client. There is little point in having two bittorrent clients running at any one time, though some users may switch clients during a month. In contrast, users frequently visit more than one bittorrent portal to locate content during the course of a month.



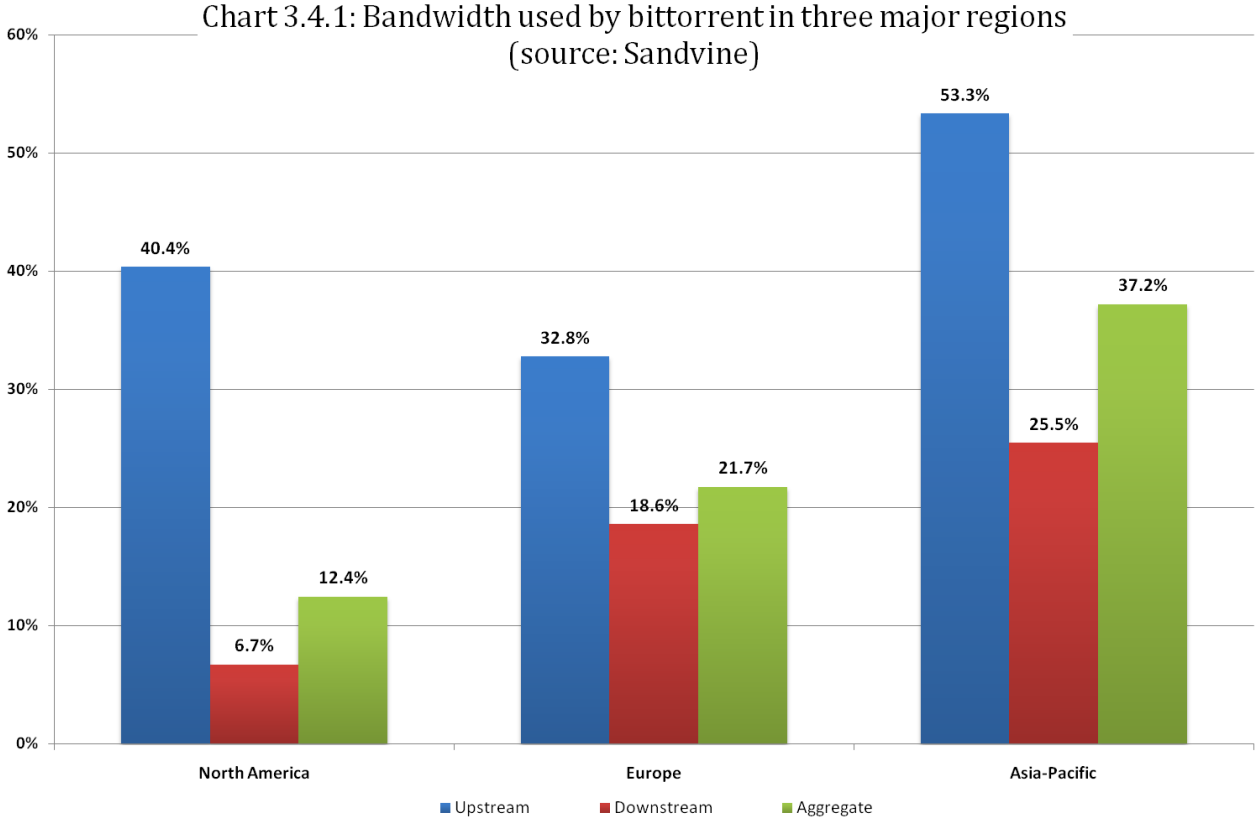
[13] Data includes nine bittorrent clients: uTorrent, BitTorrent, BitComet, Vuze, FrostWire, BitLord, Shareaza, BitSpirit, and ABC. The figures do not include the popular Chinese download manager Xunlei which is not tracked by comScore. The developers of Xunlei, which includes a bittorrent client as well as using a proprietary protocol for downloads, state that the client has more than 200m unique users each month.

3.4 BitTorrent bandwidth use

The BitTorrent protocol is one of the largest consumers of bandwidth worldwide. In some regions, more internet traffic flows over bittorrent than over any other single protocol. For instance, in the first half of 2012 Sandvine found that bittorrent was responsible for 21.7% of aggregate internet traffic in Europe (both downstream and upstream) and 37.2% in Asia-Pacific – more than YouTube and more than HTTP.

Chart 3.4.1 below shows bittorrent's share of upstream, downstream, and aggregate (overall) bandwidth in each of the three major regions for which data could be obtained from Sandvine – North America, Europe, and Asia-Pacific[14].

Chart 3.4.1: Bandwidth used by bittorrent in three major regions (source: Sandvine)



As a file sharing application, bittorrent has no equal on the internet. It is this efficient sharing architecture, which lets users upload content to others as soon as they have downloaded even a small portion of an individual file, that is one of the reasons why it dominates the upstream bandwidth category. In all three regions, bittorrent consumes more upstream bandwidth than any other single protocol – and by some distance: in North America, bittorrent is responsible for 40.4% of upstream bandwidth compared to 9.2% for HTTP; in Europe, bittorrent is 32.8% of upstream bandwidth with eDonkey contributing the next largest

[14] Data for North America is from H2 2012; data for Europe and Asia-Pacific is from H1 2012.

amount at 19.9%; and in Asia-Pacific the protocol accounts for more than half of all upstream bandwidth usage at 53.3% with the download manager Xunlei responsible for the next highest amount at 9.7%.

Downstream bandwidth might be considered a more important metric for rightsholders naturally concerned about the levels of infringement which take place over bittorrent as it is a better indicator of how frequently bittorrent is used to obtain infringing material. As the content analysis below demonstrates, bittorrent is overwhelmingly used to distribute infringing files, the largest portion of which is film and television content. In Europe (18.6% of downstream bandwidth) and Asia-Pacific (25.5%), bittorrent is the largest consumer of downstream bandwidth as it is for upstream bandwidth. However, in North America bittorrent's downstream consumption is dwarfed by other applications. Table 3.4.1 below shows the top five consumers of downstream bandwidth in each region.

Table 3.4.1: Top five downstream protocols (Sandvine)

North America		Europe		Asia-Pacific	
Protocol	**Percent**	**Protocol**	**Percent**	**Protocol**	**Percent**
Netflix	29.1%	**BitTorrent**	**18.6%**	**BitTorrent**	**25.5%**
YouTube	14.5%	HTTP	18.4%	YouTube	20.1%
HTTP	13.3%	YouTube	16.5%	HTTP	14.5%
BitTorrent	**6.7%**	eDonkey	7.7%	PPStream	4.4%
iTunes	3.3%	Flash Video	5.1%	Thunder	3.9%
Others	33.1%	Others	33.8%	Others	31.7%

The only real 'competitor' to bittorrent for the amount of downstream bandwidth consumed worldwide is YouTube which consumes more than twice as much downstream bandwidth as bittorrent in North America and a little less than bittorrent in Europe and Asia-Pacific. YouTube provides both user generated and (mostly) legitimate copyrighted content to users.

It is clear that the downstream landscape in North America is significantly different to the other two regions, dominated by the legitimate video streaming service Netflix which consumes 29.1% of downstream bandwidth in the region. It is also interesting to see that iTunes, another legitimate service, is the fifth placed individual protocol for downstream bandwidth consumption in North America.

No equivalent service to Netflix or iTunes appears in the top five protocols for either Europe or Asia-Pacific. This may be a consequence of the fragmentation of the media landscape within Europe and Asia-Pacific where services like the BBC iPlayer are popular within an individual country but often cannot be accessed by those outside the country. However, there is no indication from other published research that a service like

iPlayer consumes a similar amount of bandwidth to either bittorrent or Netflix within the UK alone and the situation is believed to be similar in other countries. At present, the North American (particularly United States) experience of Netflix is a very successful exception in the legitimate content distribution landscape but one that shows just how popular a well-designed and well-supplied video subscription service can quickly become.

3.5 BitTorrent content analysis

This section of the report examines the particular type of content being shared by users via bittorrent. The aim is to discover what proportion of all bittorrent content is taken up by, for instance, films, music, and games, and how much of that content is unauthorized. Analysis examined 12,500 torrent files in January 2013.[15]

Much of the communication on bittorrent takes place with the aid of a central server called a *tracker*. A tracker helps users on bittorrent find those who are already downloading or uploading the file or files in which they are interested. The tracker records the IP addresses of those actively involved in obtaining or distributing a particular file and then shares them with other bittorrent users when requested.[16] Trackers also record data on each **torrent or file** which they track: this data includes the 'hash' of that file (a unique code that identifies that file alone) as well as the number of **seeds** (users holding an entire copy of the file), **leechers** (users in the act of downloading), and (in most cases) total completed **downloads**. Trackers do not tend to record file names.

The largest tracker worldwide is the PublicBT tracker. At the point that this analysis was conducted, it held information on over 3.5m individual torrents. Launched in 2009, the tracker became the most-used tracker for bittorrent swarms during 2010. PublicBT is simple to use, open to any bittorrent user, and free. It has also proved very reliable during its life to date. PublicBT does not cover *every* file available on bittorrent: bittorrent users are free to create torrents using any trackers of their choice and some niche content – such as sport broadcasts or technical ebooks – may be more often found at private trackers which require registration. It is also important to note that there are numerous uses of the bittorrent protocol which would not be recorded by a tracker such as PublicBT. For instance, Facebook, Twitter[17], and eBay[18] deploy bittorrent to update software across their servers and gaming company Valve relies on a custom version of

[15] Data was gathered on every file tracked by the largest public bittorrent tracker worldwide, PublicBT. This data was then used in an attempt to estimate the amount of legitimate against illegitimate and copyrighted content carried by the tracker. On the day of analysis (a weekday in January 2013), PublicBT held information on 3.5m individual torrent swarms.

[16] Trackers are not the only way to obtain IP addresses: bittorrent clients can also communicate through a decentralised network overlay. Additionally, some clients will swap IP addresses of known downloaders or uploaders of a specific file in a transaction known as 'peer exchange', though they must have already managed to locate the other client in the first place. However, trackers are used as the first port of call in almost all torrent downloads and are likely to be the source of a significant proportion of the IP addresses gathered by a client.

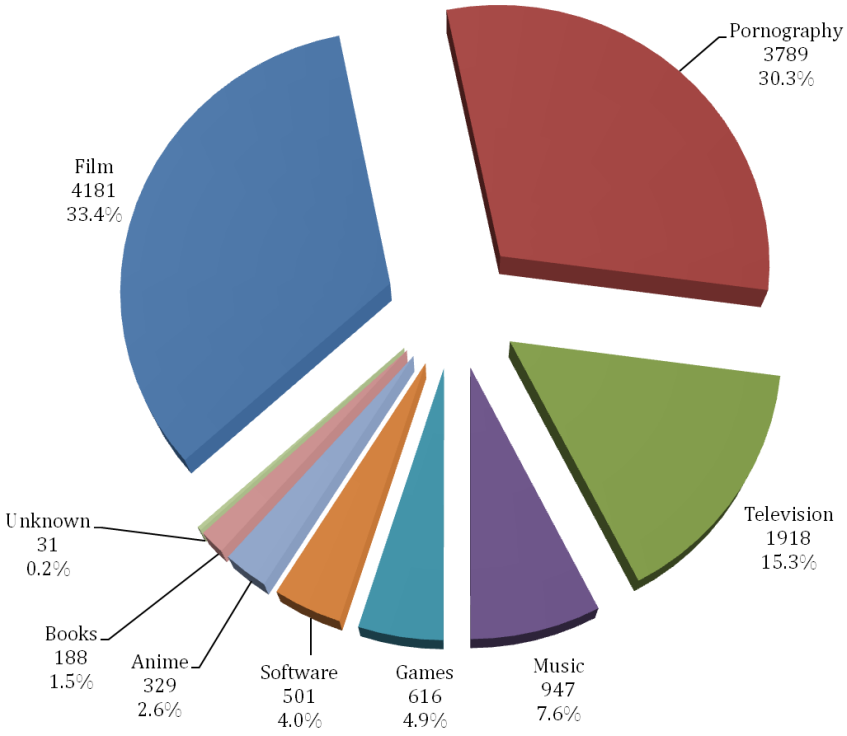
[17] http://engineering.twitter.com/2010/07/murder-fast-datacenter-code-deploys.html

[18] http://www.ebaytechblog.com/2012/01/31/bittorrent-for-package-distribution-in-the-enterprise/

bittorrent to help distribute content through its Steam service[19]. Data on the amount of content which flows through bittorrent within these areas is unavailable. However, many of these uses are intranet distributions of data (updating internal servers, for instance) and hence would not contribute to bandwidth consumption on the wider internet.

A detailed study was made of the 10,000 torrents managed by PublicBT that had the most active downloaders in order to better understand the make-up of the most sought-after content on bittorrent. In addition, a further 2,500 torrents from the long-tail of less popular torrents were also analyzed in order to provide data on the spread of content available on the network. This additional data helps to prevent the analysis of the infringing status of bittorrent files from being overly biased towards those pieces of data most in favor on the network. Chart 3.5.1 illustrates the different types of content located on the tracker.

Chart 3.5.1: Content type of 12,500 torrents, January 2013 (NetNames)



Analysis of these swarms found that three video-based content types – film, pornography, and television – were most popular with bittorrent downloaders. Also, with pornography excluded, **only two identified torrent files out of 12,500 torrents analyzed offered non-infringing content**. None of the most popular 10,000 torrent files were found to offer non-infringing content.

If this ratio of two non-infringing files in every 12,500 (excluding pornography) is extrapolated to all 3.5m files tracked by PublicBT, it means that only 560 files tracked by PublicBT represented non-infringing

[19] Though as the Steam service does not use the bittorrent protocol but a modified version of it, it can be ignored for the sake of this analysis.

content, just 0.015%. Thus out of all non-pornographic files located, **99.97% of content was infringing**. If pornography is included within the calculation – and ignoring the fact that a majority of that pornographic content may be infringing – a total of 69.67% of files were infringing.

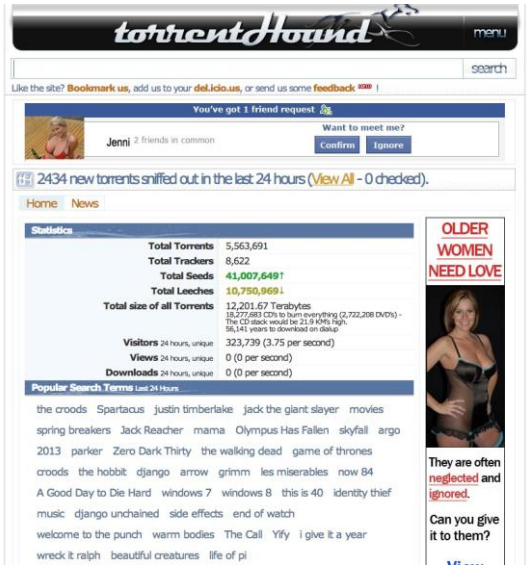
This overall figure for unauthorized use of bittorrent can then be combined with the figure provided by Sandvine for total bandwidth consumed by bittorrent in each region to produce statistics for **the amount of bandwidth that is used for the infringing (and non pornographic) transmission of content via bittorrent**. This is shown in Table 3.5.1.

Table 3.5.1: Infringing use of bittorrent bandwidth

Region	BitTorrent as percent of bandwidth	Infringing (non-pornography) bandwidth
North America	12.4%	8.7%
Europe	21.7%	15.1%
Asia-Pacific	37.2%	25.9%

In North America, **8.7% of all bandwidth** is consumed by unauthorized content on bittorrent (that is not pornography). In Europe, the figure is almost twice as high at 15.1% while Asia-Pacific has the highest figure of the three regions at 25.9%.

3.6 BitTorrent business models

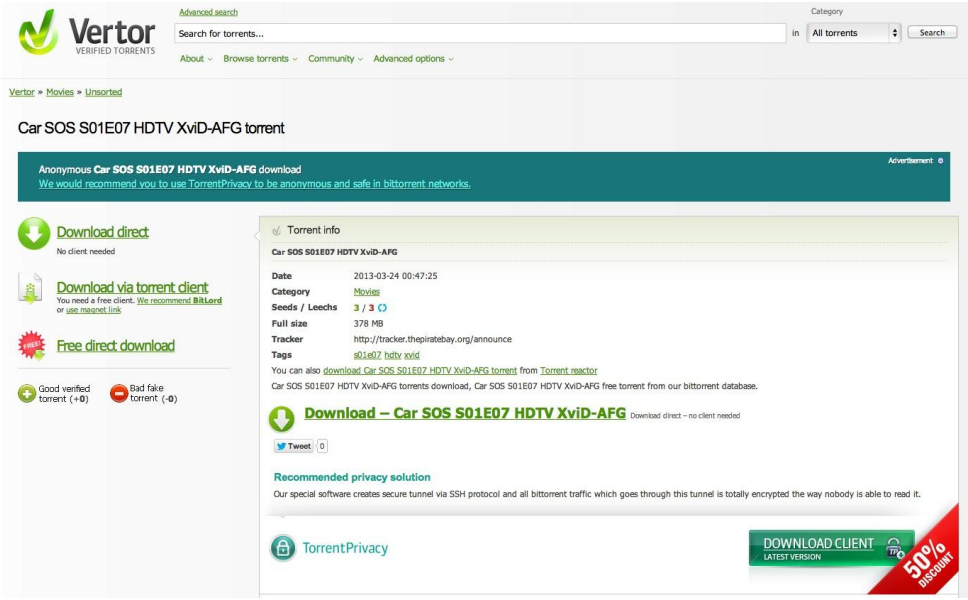


Almost without exception, every bittorrent site analyzed within this research was supported primarily by advertising and operated on a for-profit basis. A few sites – particularly private trackers such as TorrentLeech – also relied on donations from members (though donations often function as payments for additional benefits) but advertising was the principal form of support for bittorrent portals. Typically, sites featured banner advertisements of various shapes and sizes as well as pop-ups and pop-unders which often launched when a search was made or a link on the site was clicked. The advertisements were often for adult sites, dating services, or online gambling. The screenshot to the right from the site TorrentHound is typical: an advert dressed up as a Facebook friend request led to a site for "Russian dating beauties" while the banner advert on the right hand side led to adult dating site Xdating. A pop-up browser window for a gambling site launched when the user clicked any link on the homepage.

Some bittorrent sites also generate revenue through affiliate agreements which are often tied to the main function of the site. For instance, Torrentz.eu promoted 'BTGuard', a proxy and VPN service billed as "the only

way to download torrents securely". TorrentReactor advertised its own TorrentPrivacy service, another VPN, and other sites such as Vertor linked to the same service through affiliate links.

Often, torrent sites promoted other sites which ostensibly offered ways to download content – most often films – for a fee, though often led to 'scam' download sites or malware-infested applications. Such links were frequently highlighted on the bittorrent site in an attempt to confuse users and obfuscate the real torrent link. For instance, the screenshot below shows a page from torrent site Vertor. There were three download links for a new television episode in the left-hand menu and one link in bold text in the main window. Those marked 'Download direct', 'Free direct download', and 'Download – Car SOS…' redirected the user to a site which automatically launched a software download that, if installed, was supposed to provide access to free television channels but was also bundled with a number of pieces of malware which infected the user's machine.[20] The only link on Vertor which actually led to the correct bittorrent download was marked 'Download via torrent client' in the left-hand menu.

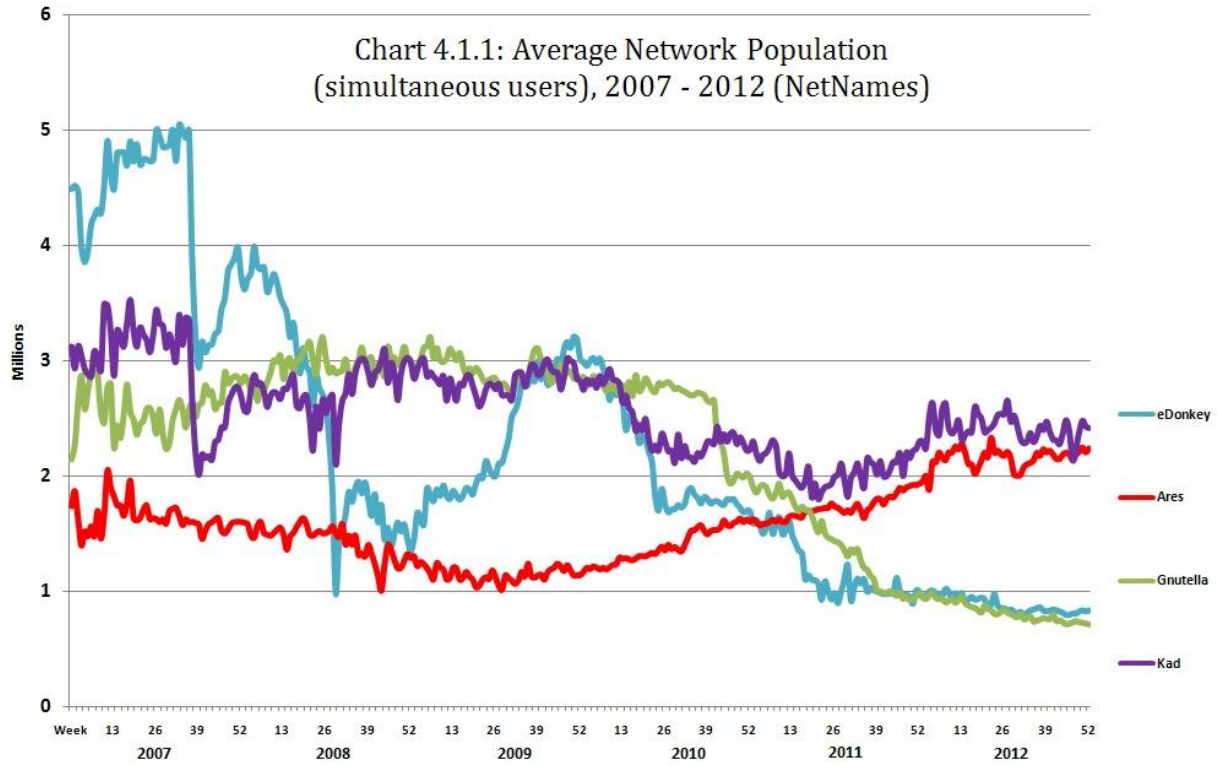


[20] See http://forums.anvisoft.com/viewtopic-45-2137-0.html, for instance.

4 Other file sharing networks

4.1 Introduction

With the exception of bittorrent, most peer-to-peer networks have declined in use over recent years. The popularity of many peer-to-peer networks has been affected by a degraded user experience, due both to clients which have failed to innovate and, in some cases, to successful anti-piracy action. User numbers have dropped for almost all peer-to-peer networks as Chart 4.1.1 below demonstrates.



At the start of 2007, eDonkey vied with bittorrent as the most popular single peer-to-peer network. Since that date, the network has suffered from a series of anti-piracy operations aimed at important central servers on the network. The sudden dips in 2007 and 2008 reflect these points. More recently, a lack of development of the main client used on the network (eMule) and a much lower number of available servers has seen many users leave the network for a simpler and more user-friendly experience using bittorrent or web-based download ecosystems such as cyberlockers and video streaming. Between the start of 2007 and the end of 2012, the simultaneous eDonkey population declined by 81.4% from 4.5m users to 0.8m.

Kad, a sister network to eDonkey which operates through decentralised means, also suffered from the difficulties that faced the eDonkey network but has survived in slightly better health. Kad has also lost users

during the five year period shown on Chart 4.1.1 but not as many as eDonkey, declining by 22.6% from 3.1m to 2.4m users.

The Gnutella network has recently been hit harder by anti-piracy action than any other network. Legal cases against the owners and developers of the main Gnutella client, LimeWire, eventually led to a ban on distribution of the client and the activation of a 'kill switch' that stopped many versions of LimeWire connecting to Gnutella. The sharp fall in Gnutella users that followed this point in time began midway through 2010 and by the start of 2013, the network was little used. Between the start of 2007 and the end of 2012, Gnutella lost 66.8% of users to fall from 2.1m to 0.7m.

The Ares network is the only one of the four peer-to-peer networks shown on Chart 4.1.1 to stand in a better position at the end of 2012 than it did at the start of 2007. Heavily used in Latin America, use of Ares declined through 2008 and most of 2009 as developer inattention meant users dealing with an increasingly buggy and difficult client. A new version of the client helped return some users to the network and the population stabilised during 2012 at a simultaneous population of around 2.2m users, an increase of 28.9% on the number of users at the start of 2007.

Determining universe size

As with similar data for bittorrent, the populations reported in this section are snapshots of user numbers at one point in time rather than figures demonstrating the total universe of users over the course of a month. Determining the overall size of each network's unique monthly userbase is a more difficult task for peer-to-peer applications which have little reliance on web site portals for content links. While some, but only a few, eDonkey portals still exist, the primary method for locating content on eDonkey, Gnutella, and Ares is by searching within one of the different clients available for each network. Combined with the lack of other relevant data, this means that this report takes estimates of the total eDonkey, Gnutella, and Ares populations from comScore's figures for unique and unduplicated client users for each networks in January 2013. These are shown in Table 4.1.1. A similar method to that employed for bittorrent is used to estimate the proportion of that population which used each network for infringing use at least once during January 2013. This is explained more fully in Section 8. The calculations found that almost every user of eDonkey and Ares is likely to have obtained infringing content through the networks during January 2013 and so the total infringing populations are almost identical to the unduplicated client users.

Table 4.1.1: Unduplicated client users for each network, January 2013 (comScore)

Network	Client users
eDonkey	9.4m
Gnutella	2.3m
Ares	66.6m

Estimating worldwide use of **Usenet**, the final ecosystem considered in this section, is more complex. comScore records data for users of only one Usenet application, named UseNext. Other pieces of software known to be popular for Usenet access, such as NewsLeecher, Newsbin, and Unison, are not tracked by comScore and commercial providers of Usenet software do not release user figures for unique users or client downloads. Further, visitors to the web sites of Usenet access providers such as Giganews do not correspond to Usenet users as once a user has signed up to a Usenet account, there is usually little need for them to visit the web site of their access provider. comScore recorded 1.3m unique users of the Usenext application during January 2013. Conservatively comparing the popularity of the Usenext web site with those of others and the software's believed share of the Usenet market leads to a deliberately cautious estimate of 5.0m unique Usenet users worldwide. This is very likely an under-estimate but will be used. Any future reports examining this area will attempt to find more accurate and detailed sources for data on the Usenet population. Calculations to estimate the proportion of total users which use Usenet for infringement found that almost all users did so at least once during January 2013 (99.99%).

4.2 eDonkey

In addition to the fall in users of the eDonkey network noted in Section 4.1 above, a decline was also noted in use of two eDonkey clients monitored by comScore. Unique monthly users of eMule and eMule AdunanzA[21] fell from 17.9m in November 2011 to 9.4m in January 2013, a drop of 47.5%.

Sandvine found very low use of eDonkey in North America and Asia-Pacific, particularly when compared to bittorrent: eDonkey accounted for just 0.5% of bandwidth in Asia-Pacific and slightly under 0.4% in North America. However, the protocol still had a significant legacy use in Europe: 10.4% of all bandwidth was recorded as consumed by eDonkey in Europe, slightly less than half of that consumed by bittorrent (21.7%) but still a significant amount (apart from bittorrent, only HTTP and YouTube consumed more bandwidth within Europe).

Analysis of the level of infringing content on eDonkey and Kad used a similar methodology to that employed in earlier research. A series of searches were made for pieces of content which infringe on copyright (new and catalogue film and television titles, games for the PC and consoles, music, books, and so on) and a similar number of searches for content which is legitimately available on file sharing networks (content actively distributed under a Creative Commons license, for instance). The number of complete sources for each piece of named content were then analyzed. Obvious fake files were discounted. The amount of content shared legitimately was low at 0.8% of all files located. This is in line with real-world experience of how eDonkey and Kad are used online.

[21] An eDonkey client heavily used in Italy.

It is important to note that the methodology above does not include pornographic content of any kind in the searches and such content is widely available on eDonkey. It might be assumed that the level of pornographic files on eDonkey might be similar to that found on bittorrent (30.3%). If this assumption is made, 69.7% of all content on eDonkey is non-pornography and 0.8% of that is non-infringing. This leaves a total of **68.9%** of content on eDonkey and Kad that is infringing and not pornography.

A recent paper by Carra *et al.* found that video content was the most popular when analyzing files located when crawling the Kad network. Of the sixteen most popular keywords found during their research (such as 'avi', 'xvid', 'mp3'), 70.7% of located files related to video content; 17.7% to music content; 6.5% to images; and 5.1% could not be assigned to any particular category of content.[22]

The table below shows the amount of bandwidth used by eDonkey in the three different regions analyzed as reported by Sandvine. The overall amount of bandwidth then used for infringing and non-pornographic content in each region on eDonkey is shown, using the assumption that 68.9% of that bandwidth is used for the distribution of infringing content.

Table 4.2.1: Infringing bandwidth use on eDonkey (Sandvine / NetNames)

Region	Overall internet bandwidth used by eDonkey / Kad (Sandvine)	Estimate of internet bandwidth for infringing content (NetNames)
North America	0.4%	0.28%
Europe	10.4%	7.17%
Asia-Pacific	0.5%	0.35%

4.3 Gnutella

Despite the significant drop in Gnutella users over the last two years (comScore recorded a fall of 76.8% in users of the Limewire client between November 2011 and January 2013, from 10m monthly users to 2.3m), the network is still used to locate and download some infringing material. Older versions of Limewire remain able to connect to the Gnutella network and other Gnutella clients do exist. However, the network is now overrun with fake content and malware. Without Limewire's team of developers working to keep the network clean of 'bad' files, distributors of polluted content are now able to take advantage and ensure that their own files are pushed to users.

[22] Carra, D., Steiner, M., Michiardi, P., Biersack, E., Effelsberg, W., and Taofik, E., *Characterization and Management of Popular Content in KAD*, Submitted to IEEE Transactions on Parallel and Distributed Systems, 2012. See http://profs.sci.univr.it/~carra/.

It is difficult to put a precise figure on the true amount of unauthorized content present on the Gnutella network given the prevalence of spam and malware but research indicates that it remains still non-trivial. However, bandwidth consumption by Gnutella is now extremely low: in Europe and Asia-Pacific, Sandvine measured just 0.01% of bandwidth as consumed by Gnutella and in North America only 0.02%. Given this, it may be safe to assume that the amount of unauthorized content held on Gnutella (that is not pornography) is similar to that found on bittorrent and eDonkey – just over two-thirds[23]. Such an assumption will have little influence on a figure for the overall amount of bandwidth used for infringing material even if the decision to equate Gnutella with eDonkey is incorrect.

Table 4.3.1: Infringing bandwidth use from Gnutella (Sandvine / NetNames)

Region	Overall internet bandwidth used by Gnutella (Sandvine)	Overall bandwidth used for infringing content (NetNames)
North America	0.02%	0.014%
Europe	0.01%	0.007%
Asia-Pacific	0.01%	0.007%

4.4 Ares

Ares is a peer-to-peer file sharing network that is primarily used in Latin America and Spain. Due to this specific regional focus, Ares did not appear as a named protocol in the data supplied by Sandvine for this report. The protocol is believed to take up to 8% of downstream traffic in Latin America but significantly less elsewhere in the world. Analysis indicates that the amount of infringing material present on Ares is close to that of other file sharing networks such as eDonkey. comScore data found 66.6m unique unduplicated users of an Ares client during January 2013.

4.5 Usenet

One of the oldest forms of communication on the internet, Usenet today is mainly used for the transmission of files (known as 'binaries') rather than text messages. While some ISPs still offer a modicum of Usenet service, this tends to be limited to text-based groups which consume little bandwidth. Users who wish to gain access to the binary groups and the wealth of content they carry – which is commonly unauthorized – must generally pay for a commercial service. According to Alltopia, the amount of content posted to Usenet each day comprised 9.3TB in January 2012. Giganews, one of the most respected Usenet access providers, currently stores over 12 petabytes of Usenet content.

[23] Analysis of search queries made across the Gnutella network by NetNames reinforces this belief.

User figures are difficult to obtain for Usenet, but Sandvine found Usenet's bandwidth consumption to be 0.45% in North America and 0.47% in Europe but just 0.09% in Asia-Pacific – small overall compared to bittorrent and eDonkey but not inconsequential. comScore measure users of one Usenet client, Usenext, which had 1.35m unique monthly users in January 2013, all of which were from Europe. Usenext is believed to be one of the more popular clients used to access Usenet but it is difficult to make an estimate of what proportion of the Usenet population is captured by the Usenext client: it is possible that overall monthly users of Usenet for infringement might total anywhere between 5m and 25m.

Within the Usenet ecosystem, the web site NewsAdmin collects Usenet statistics[24] and these clearly demonstrate the popularity of groups which carry files as opposed to those which carry simple messages. For instance, analysis of unique visits over a week-long period in 2012 to the top 100 'binary' (file-carrying) newsgroups against the top 100 text-only newsgroups found that 96.9% of all visits were to the binary groups rather than the text-only groups. Further, the top 100 newsgroups in terms of the size of content posted each day are all binary groups which means that while visits are heavily skewed towards binary groups, the amount of content downloaded (and hence bandwidth consumed) leans even more heavily towards the binary groups.

For this report, analysis was made of the last 20 complete files or messages posted to 50 newsgroups from the most accessed according to NewsAdmin (25 binary, 25 text only), making 1,000 posts in all. Each post was examined for the category of the content posted (for instance, film, pornography, television, book, text, etc) as well as the copyrighted status of this content. The size of each file or post was also recorded and this was then combined with the number of unique accesses recorded by NewsAdmin to the newsgroup in which it was posted to produce an estimate of the amount of bandwidth consumed by that post overall.

Table 4.5.1 below shows the results of this analysis for each category of content. While the 'Other / text only message' category had by far the highest number of individual posts (just over half of all posts including all of those to the text-only newsgroups), this category takes up a tiny amount of overall bandwidth (0.19%) as the standard text post to Usenet is only 2-3kB in size, compared to a collection of posts that might comprise a full film at 740MB and often well over 1GB.

On this analysis, unauthorized copyrighted content consumes 71.8% of all Usenet bandwidth, excluding pornography. With most of the pornography content also likely copyrighted (as with bittorrent, this area was left uninvestigated), the overall figure could be much higher.

[24] http://www.newsadmin.com/usenet.asp

Table 4.5.1: Content types on Usenet (NetNames)

	Posts found		Copyrighted		Amount of bandwidth	
Content type	**#**	**%**	**#**	**%**	**Total**	**Copyrighted**
Films	142	14.20%	141	99.30%	41.36%	41.07%
Pornography	101	10.10%	n/a	n/a	30.35%	n/a
Television	85	8.50%	85	100.00%	16.18%	14.94%
Music	64	6.40%	59	92.19%	2.01%	5.79%
Games	19	1.90%	19	100.00%	4.87%	5.31%
Software	31	3.10%	22	70.97%	3.12%	2.90%
Books / Audio books	49	4.90%	41	83.67%	1.92%	1.74%
Other / text only post	509	50.90%	0	0.00%	0.19%	0.01%
Total	**1,000**	**100.0%**	**720**	**72.0%**	**100.00%**	**71.76% (excluding pornography)**

Table 4.5.2 below shows the overall figures for amount of bandwidth consumed by the sharing of unauthorized content on Usenet across each of the three major regions studied in this report. This ranges from a low of 0.29% in Asia-Pacific to 1.68% in Europe.

Table 4.5.2: Infringing bandwidth on Usenet (NetNames)

Region	Overall bandwidth used by Usenet (Sandvine)	Overall bandwidth for infringing content (NetNames)
North America	0.42%	0.30%
Europe	0.47%	0.34%
Asia-Pacific	0.09%	0.07%

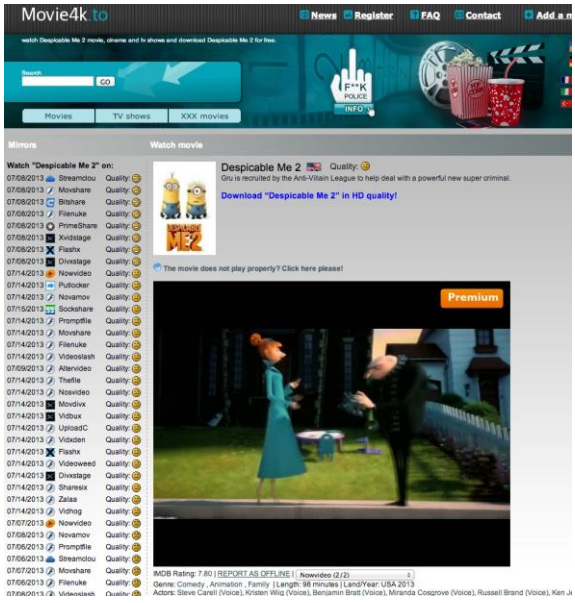
5 Video streaming

5.1 Introduction

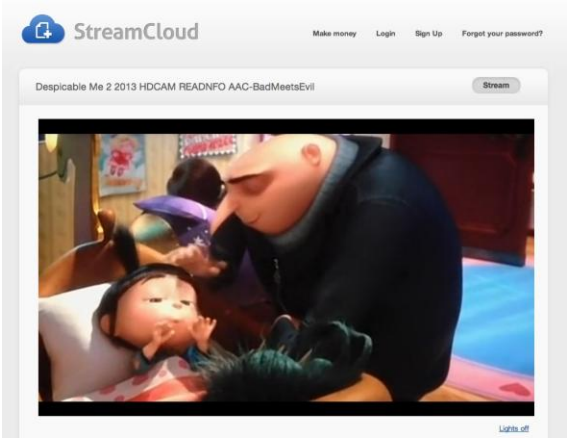
Streaming video has become one of the most popular online activities. Data from Sandvine shows that more internet bandwidth is used for video streaming in North America than for any other activity and much of this is from legitimate video streaming services such as Netflix, YouTube, and Amazon Instant Video.

However, an illicit video streaming ecosystem also exists. This ecosystem mainly consists of two types of site that jointly participate to present infringing video content to visitors. The first type of site provides **links** to content and is typically known as a video streaming link site; the second type of site **hosts** the streaming video, usually displaying it to the user in a Flash-based or HTML5 video player. Video streaming hosts are often called 'streaming cyberlockers' as they replicate some of the functions of direct download cyberlockers: a user can upload content but the sites themselves are rarely searchable – instead, a user is provided with a link which can then be shared and circulated online by the user.

For example, a video streaming link site like Movie4k (below) indexes a large range of film and television titles. For each piece of content, the site displays a choice of different video streaming hosts – in the screenshot below, well over forty different streaming hosts for *Despicable Me 2* are available in the left-hand menu. For some of the streams, as the screenshot shows, the video player from the streaming cyberlocker host is embedded in the page, though it can be made full-screen if required.



On other occasions, the links on sites like Movie4k direct the user straight to a video streaming cyberlocker such as StreamCloud (see below) where the video can be played and watched.



There are two advantages to video streaming against a peer to peer download method such as bittorrent. First, videos start to play almost immediately – unlike bittorrent, the user does not need to wait for their download to complete before the content can be viewed. Second, the video streaming process is simple and familiar to almost all internet users. Video players are present on thousands of sites, from YouTube to BBC

News. There is no need to download a separate client or learn the basics of a new technology.

However, the quality of the video is not usually as high as it is typically when obtained through bittorrent. The user experience is also often degraded by the large number and type of advertisements that are common on many video streaming linking and video streaming sites (see Section 5.6 below).

Determining universe size

Unlike bittorrent and the file sharing networks analysed in Section 4, video streaming is an entirely browser-based operation: link sites and video streaming cyberlocker sites are all web-based entities and there is no need for a user to leave their browser in order to access the streamed video. This fact means that the decision on how to most accurately size the infringing video streaming universe is focused on two choices: between aggregate and unduplicated data; and between choosing visitors to video streaming link sites or visitors to video streaming cyberlocker sites.

For the same reasons as for bittorrent, it is believed that the unduplicated visitors to sites provide the most accurate analysis of a unique universe as this data counts each single video streaming user once only each month rather than on multiple occasions. The choice between link sites and hosting sites is more complicated. Counting video streaming cyberlocker site views might be thought to be the most accurate option but this data is affected by the way in which streamed video is actually accessed by users. For instance, many linking sites embed video players within their own site – as shown with the screenshot for *Les Miserables* shown above. In this instance, the user has loaded a page from Movie4K into their browser and this page then embeds and loads the video from the hosting site. In this scenario, comScore tracks only the visit to the linking site. It does not count the embedded video as a 'visit' to the streaming cyberlocker site. This issue means that using visitors to streaming video cyberlocker sites that are focused on piracy may miss a portion of the total infringing video streaming audience.

For this reason, this report adopts total unduplicated visitors to video streaming link sites as the best estimate for the video streaming universe. In January 2013, this figure stood at **112.5m** unique and unduplicated internet users as the data below in Section 5.2 illustrates. The proportion of this population who used the video streaming ecosystem for infringement is determined using a methodology that is explained in Section 8 to discount users who *only* accessed non-infringing or pornographic content. **This method determines the total number of video streaming users who accessed infringing content through video streaming link sites during January 2013 to be 112.0m users.**

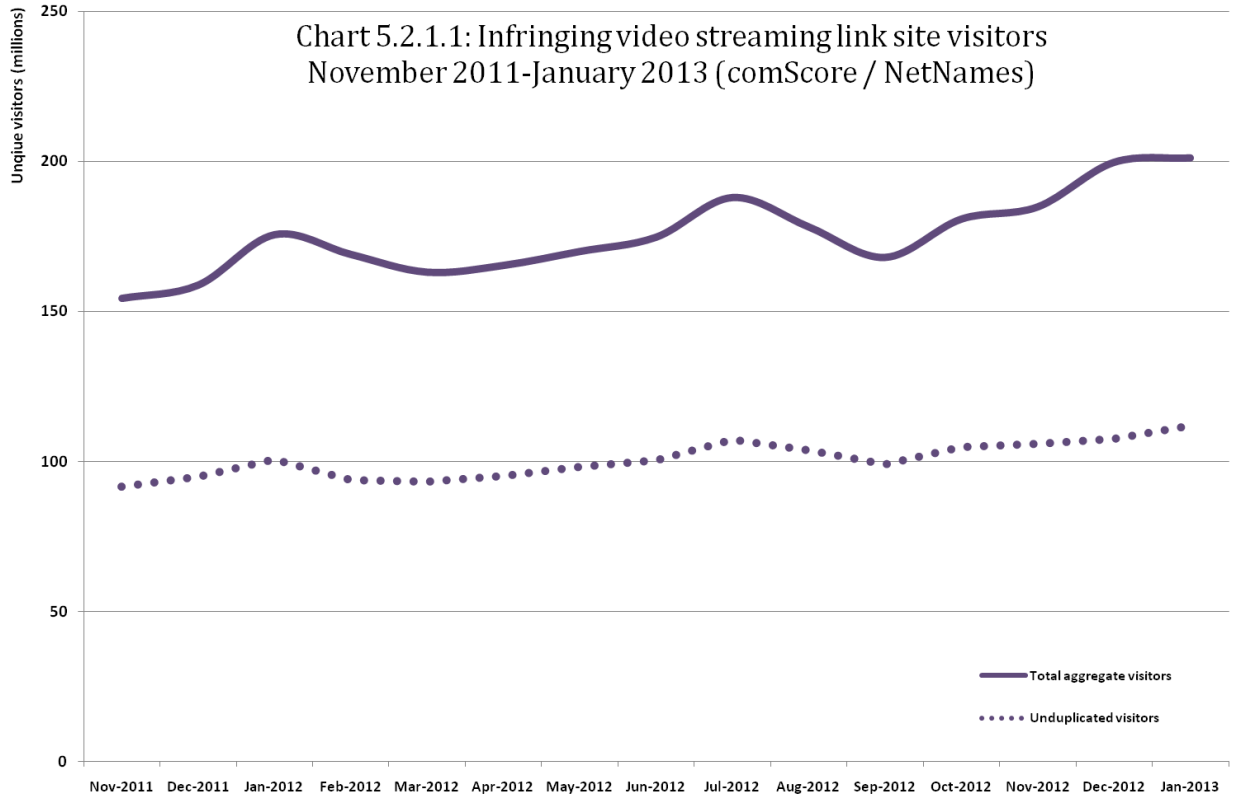
5.2 Video streaming link site visitors

5.2.1 Short-term analysis

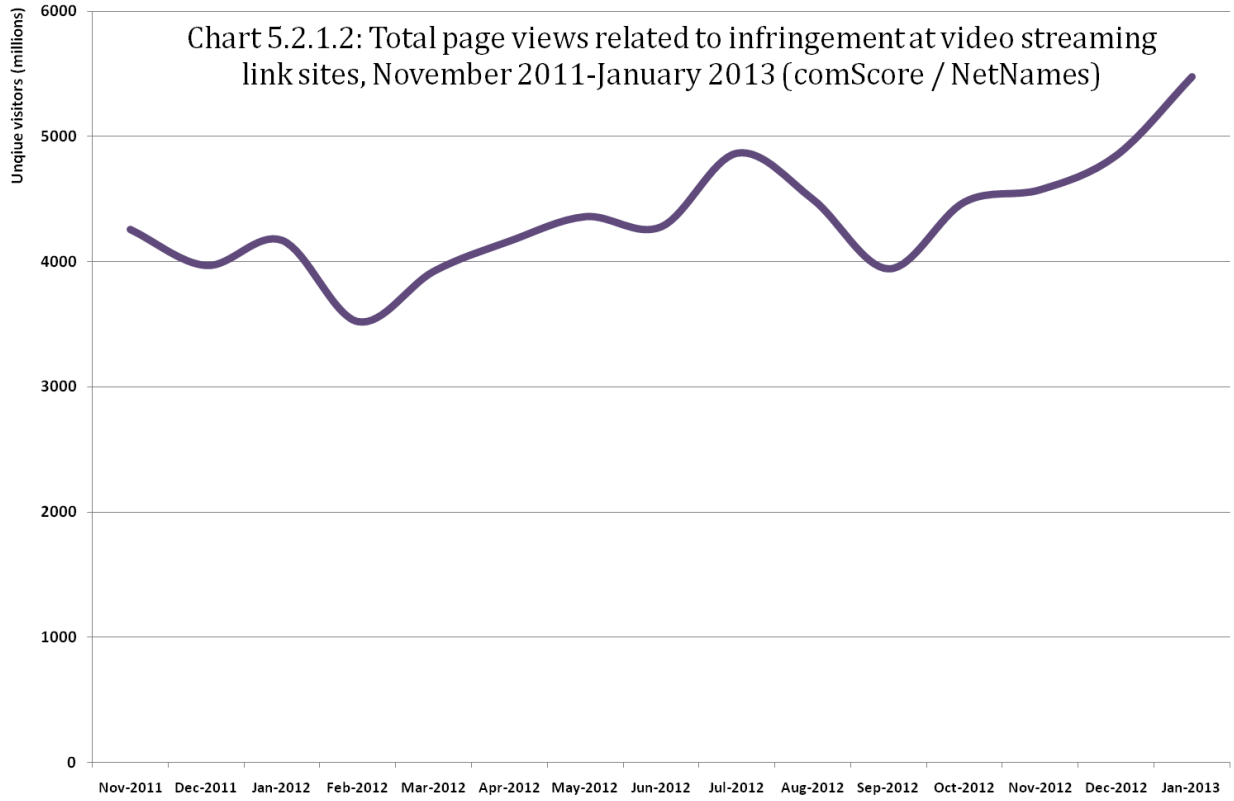
Analysis collected over one hundred video streaming link sites that were live in January 2013 and which had over 50,000 monthly unique visitors each. The most popular site was Movie2k.to with 23.1m unique monthly users. (Movie2k subsequently closed at the end of May 2013). Chart 5.2.1.1 illustrates visitors to these sites from November 2011 to January 2013.

Aggregate infringing visitors to all video streaming link sites totalled 201.1m in January 2013, an increase of 30.4% from 154.2m since November 2011. The figures for unduplicated visitors indicate that this increase was at least partially from users visiting more sites each month: in November 2011, each unique video streaming link site user visited an average of 1.68 sites each month; in January 2013, this figure was 1.80 – a small absolute increase but enough to make a difference. This suggests that users may have found it more difficult to locate working versions of the streaming content in which they were interested and were visiting additional link sites to try and meet their needs.

Unduplicated visitors to the video streaming link sites were 112.0m in January 2013, an increase of 22.2% on 91.6m unduplicated visitors in November 2011. This was around 90m fewer unique users than visited bittorrent portals in January 2013: despite the ease of use of video streaming, the range and quality of content available on bittorrent attracts a significantly larger number of users.



Total **page views** devoted to infringement (shown in Chart 5.2.1.2) across video streaming link sites also increased during this period, from 3.8 billion in November 2011 to 4.9 billion in January 2013, an increase of 28.6%. Page views per user also increased, from 41.8 page views per unduplicated user to 44.0 views.

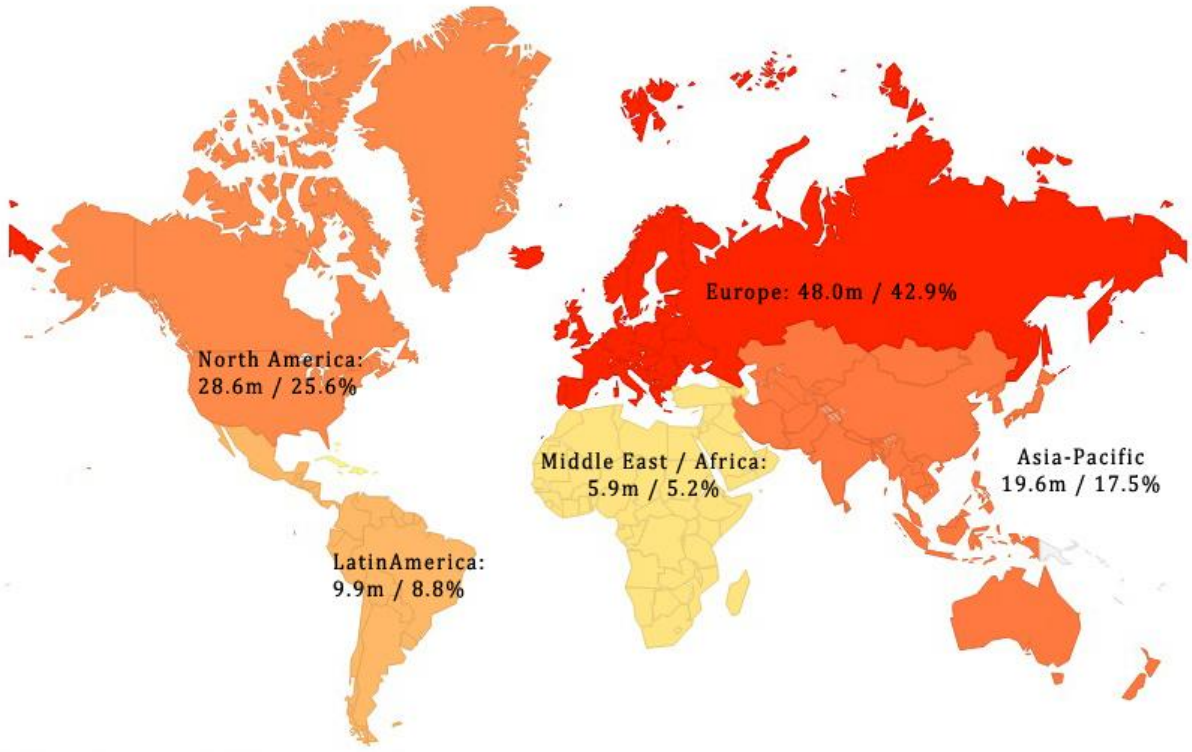


5.2.2 Regional breakdown

As in the section for bittorrent, comScore data was used to analyse visitors according to the same five regions using unduplicated unique visitors from January 2013. Across the three largest regions – North America, Europe, and Asia-Pacific – there were 96.3m unduplicated unique users to video streaming link sites, an increase of 27.7% from 75.4m users in November 2011.

Europe again contributes the highest proportion of visitors to video streaming link sites at 42.9% or 48.0m visitors but there is significant interest in this method of infringement in North America (25.6% or 28.6m) and in Asia-Pacific (17.5% or 19.6m visitors).

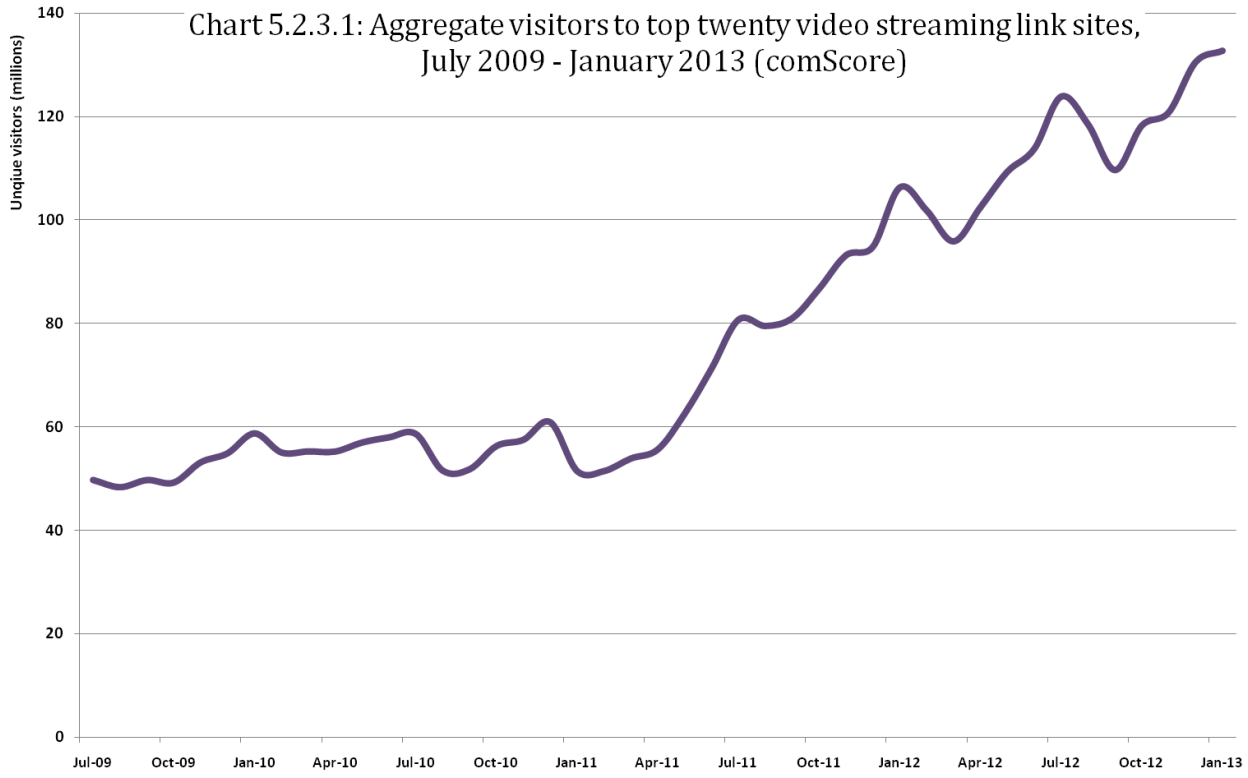
Chart 5.2.2.1: Regional breakdown of visitors to video streaming link sites (comScore / NetNames)



5.2.3 Long-term analysis

Chart 5.2.3.1 looks at visitors to the most popular video streaming link sites over a longer time period. comScore data is used to track aggregate visitors to the twenty most popular video streaming link sites from July 2009 and NetNames analysis determined the proportion of these visitors which were infringing (see Section 8).

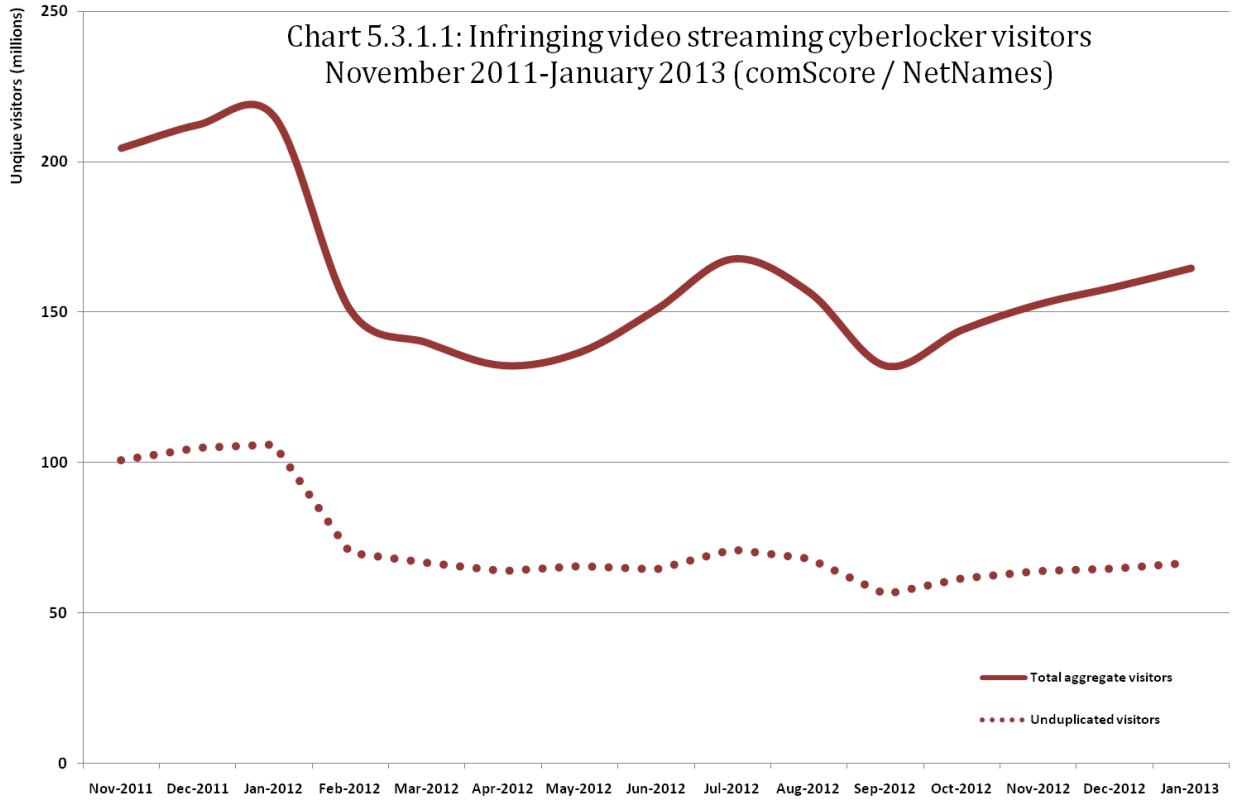
The chart displays 49.8m aggregate visitors to the most popular twenty video streaming link sites worldwide in July 2009. This had increased by 166.5% to 132.7m by January 2013.



5.3 Video streaming cyberlocker sites

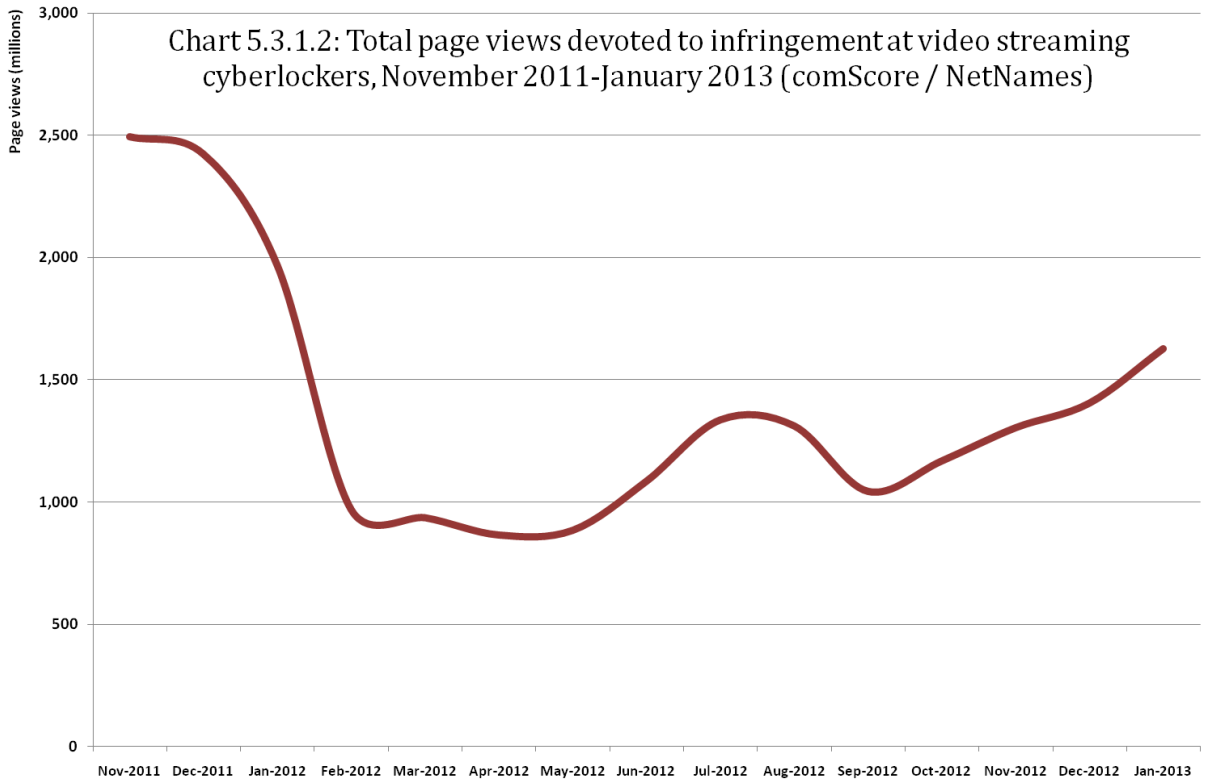
5.3.1 Short-term analysis

Chart 5.3.1.1 below shows an overall decline in visitors to video streaming cyberlocker sites during the period between November 2011 and January 2013. Total infringing aggregate visitors fell by 19.5% from 204.5m users in November 2011 to 164.6m while unduplicated users across all sites fell by 33.8% from 100.7m to 66.7m.



The sharp drop in both aggregate and unduplicated visitors to video streaming cyberlocker sites after January 2012 followed the seizure by US law enforcement of the MegaVideo streaming cyberlocker site in the same operation that closed the MegaUpload direct download cyberlocker. In December 2011, comScore recorded 39.9m unique visitors to MegaVideo and it was the most popular video streaming cyberlocker commonly used for infringing content. The closure of MegaVideo led to further disruption in this ecosystem and other major video streaming cyberlockers such as VideoBB and Videozer also closed. Yet as 2012 progressed, video streaming use showed signs of recovery with visitors attracted to new video streaming cyberlockers such as PutLocker and StreamCloud which offered a good quality streaming experience and wide variety of content. While total visitors to streaming cyberlocker sites in January 2013 remained significantly lower than at the end of 2011, visitor numbers have increased since September 2012 and seem likely to continue to do so without further anti-piracy action against sites in this ecosystem.

Page views to video streaming cyberlocker sites also fell during this period, from 2.5 billion in November 2011 to 1.6 billion in January 2013, a fall of 34.8%. The effect of the loss of MegaVideo and other similar sites in January and February 2012 is illustrated in Chart 5.3.1.2. Again, though, a recovery is noted from September 2012 onwards.



It is interesting to note that the number of unduplicated visitors to video streaming cyberlocker sites (Chart 5.3.1.1) is significantly lower than that for visitors to video streaming *linking* sites (Chart 5.2.1.1): 66.7m for video streaming sites against 112.5m for video streaming linking sites. It might be thought that these figures should be relatively similar as the two types of site often work in concert: a user visits a video streaming linking site to locate a stream for a particular site and is then directed on to a video streaming cyberlocker to watch the content. However, the figures show a much higher level of visitors at the first stage of this process (the link sites) than the second (the streaming).

There may be a number of reasons for this. First, users may simply be unable to find links for the film or television episode they are seeking. Research has shown that the piracy-free window between worldwide theatrical release and first pirated release on the internet has been gradually extended over the last few years to more than a week. It is possible then that some users visit a video streaming linking site anticipating links to a new film only to go away disappointed because a pirated version is not yet available.

Second, the sometimes poor video streaming ecosystem user experience may dissuade some users from continuing – for instance, if they are bombarded with advertisements. Third, and perhaps most important, comScore's tracking in this area does not account for all streaming activity: for instance, some video streaming link sites directly embed streaming video players in their own pages so that a user does not actually visit the streaming cyberlocker site. In this case, comScore does not record a visit to the streaming site at all.

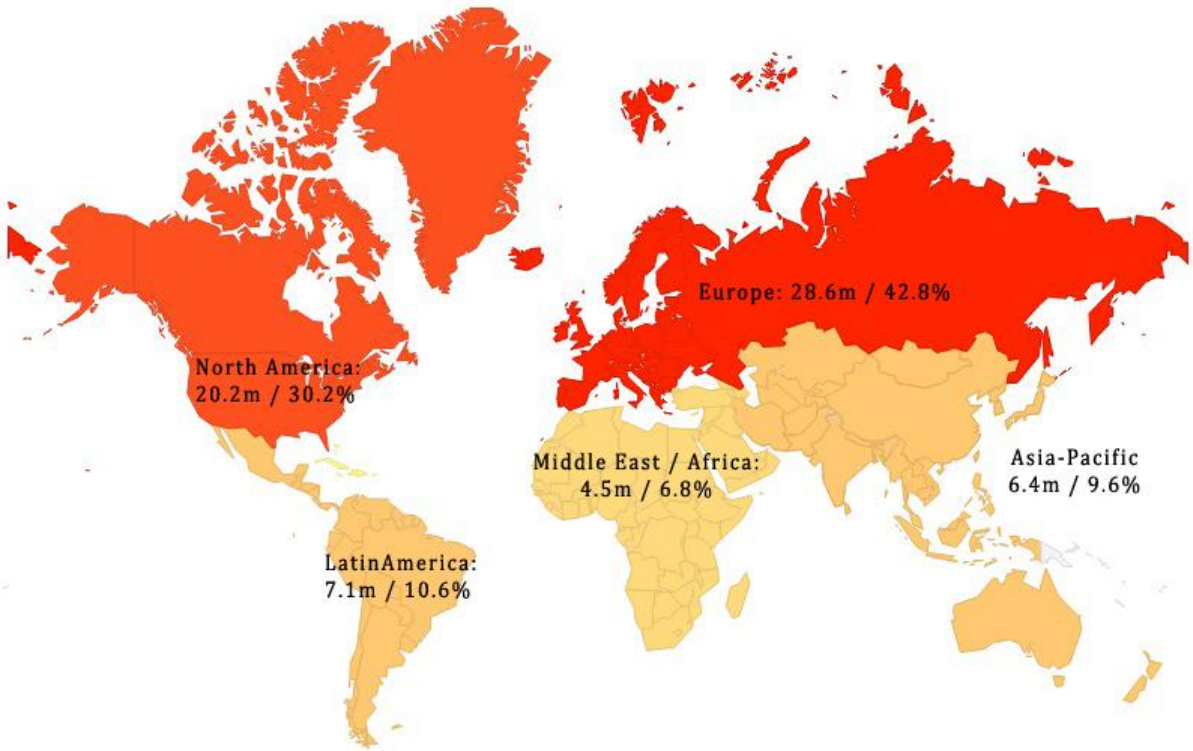
Last, some link sites employ popular video hosts such as YouTube and DailyMotion which are not included in the visitor analysis of streaming hosts above. The proportion of infringing content on major user generated content sites such as YouTube is far outweighed by the amount of benign and legitimate material they hold. Analysis shows that major streaming sites such as YouTube are sometimes used by link sites focused on anime or Indian content rather than Western content such as Hollywood films.

Visitors to video streaming cyberlocker sites tend to visit more such sites each month than visitors to video streaming link sites. On average, a user of piracy-facilitating video streaming cyberlockers visited 2.5 such sites in January 2013 compared to only 1.8 video streaming link sites. Given that visitors to video streaming link sites are highly likely to funnel through to video cyberlocker sites if they locate the video for which they are looking, this is unsurprising and demonstrates the smaller pool of video streaming cyberlocker sites compared to video streaming linking sites. A video streaming cyberlocker requires a more complex, expensive, and bandwidth-heavy hosting infrastructure than a site which simply aggregates links to content held on video streaming cyberlocker sites. Further, hosting infringing content is likely seen by site owners as a riskier operation from a legal standpoint.

5.3.2 Regional breakdown

The regional analysis of video streaming cyberlocker visitors as seen in Chart 5.3.2.1 is broadly similar to that for video streaming link sites: in January 2013, Europe was again the main player at 42.8% or 28.6m visitors, while North America contributed 30.2% or 20.2m visitors.

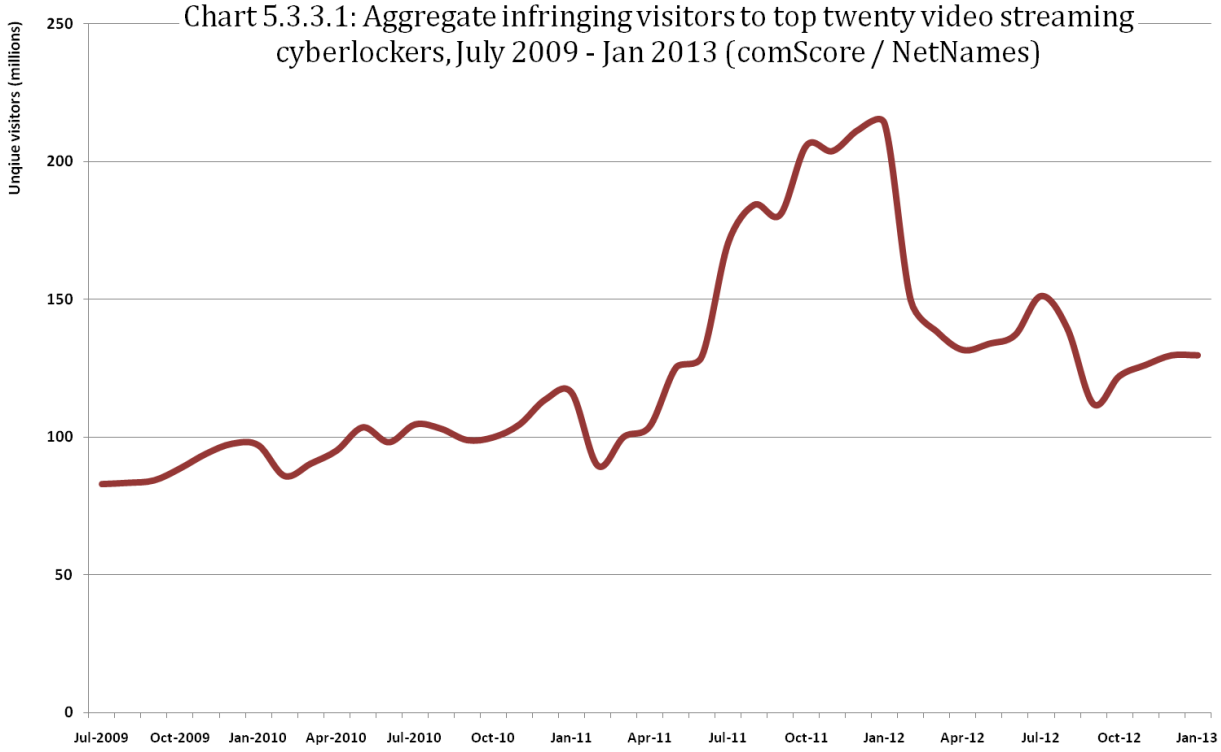
Chart 5.3.2.1: Regional breakdown of visitors to video streaming sites (comScore / NetNames)



5.3.3 Long-term analysis

comScore recorded 82.8m aggregate visitors to the most popular twenty video streaming cyberlockers worldwide in July 2009. This had increased by 56.5% to 130.2m by January 2013, though this represented a significant decrease on the historical high of 213.8m visitors in January 2012, the month that the very popular MegaVideo video streaming cyberlocker was closed.

Chart 5.3.3.1: Aggregate infringing visitors to top twenty video streaming cyberlockers, July 2009 - Jan 2013 (comScore / NetNames)



5.4 Video streaming infringing bandwidth use

Analysing the overall bandwidth consumption of video streaming as a whole is relatively simple. In North America, Sandvine estimated that 62.3% of all downstream bandwidth was in the category 'real-time entertainment' which covers both streaming audio and video, with the latter making up by far the highest proportion. Real-time streaming of content is the fastest growing area of bandwidth use in many regions worldwide and by the end of 2012 had become the largest consumer of downstream bandwidth in North America and Asia-Pacific. However, analysing the *infringing* use of that bandwidth is more difficult.

Table 5.4.1 shows the percentage use of downstream bandwidth by different streaming video protocols which appeared in the top twenty downstream protocols for North America in the second half of 2012. Those marked with an asterisk (Netflix, Hulu, and Ooyala) only offered legitimate content and can be discounted for any attempt to determine infringing bandwidth use. The amount of infringing content consumed on YouTube is likely only very small relative to the amount of bandwidth consumed by the site overall.[25]

Table 5.4.1: Bandwidth used by streaming video in North America (Sandvine, 2012)

Protocol	Percent
Netflix *	29.1%
YouTube	14.5%
Flash Video	2.8%
MPEG	2.6%
RTMP	1.6%
Hulu *	1.2%
Ooyala *	0.5%
Shockwave Flash	0.5%
HTTP Live Streaming	0.5%

The video streaming cyberlocker sites outlined in Section 5.3 which are commonly used for infringement – such as PutLocker or Streamcloud – use general video protocols such as Flash and RTMP that are listed in Table 5.4.1 but which are also utilised on many sites across the wider internet. Millions of internet locations use protocols to transmit video, most of them offering non-infringing material, from news web sites to small community organisations to commercial enterprises. Separating the non-infringing from the infringing in this environment is difficult and certainly much harder than it might be for bittorrent, for instance, where the type of material that crosses the network can be readily analysed by looking at major trackers and the largest portal sites. While the major video streaming link sites which offer infringing content and the major video streaming cyberlocker sites which tend to host infringing video can be located and the numbers of visitors to such sites analysed (as Sections 5.2 and 5.3 demonstrate), their total contribution to overall streaming video bandwidth is a fraction of that consumed by legitimate streaming.

[25] This is not to say that infringing material is not available on YouTube. While many full length movies, television episodes, and other copyrighted content are often detected by YouTube's ContentID protection system, some copies do slip past the detection methods involved. Also, some content owners may not employ the ContentID system and rely on other methods to detect or locate copyrighted material on the site. However, there are numerous indications that the overall proportion of infringing material on YouTube is a very small slice of a very large overall pie.

Methodology to determine infringing use

In an attempt to determine infringing use of video streaming bandwidth, this report repeats and updates the methodology used in a previous report by Envisional.[26] The most accurate approach to the area was deemed to be one which compared the popularity of linking sites used to locate infringing video streaming content with portal sites used to locate infringing material available via bittorrent.

ComScore provides data on the average number of daily visitors to bittorrent portals such as ThePirateBay, IsoHunt, and Torrentz, the main sites from which the vast majority of bittorrent users find links to the pirated content that they ultimately download using the bittorrent protocol, and that then results in the large amount of bittorrent traffic seen in the usage studies. In the same way, users of video streaming sites use portals such as Movie2K and 1Channel to locate links to pirated content they wish to access, clicking through to the video streaming hosts where the content is hosted. By comparing the number of daily visitors to bittorrent portals with the same data for video streaming link sites, a rough estimate of pirated usage may be possible (assuming that the usage pattern of each ecosystem is similar).

For each of the three major regions for which Sandvine provided bandwidth data, the average number of monthly unique video streaming link site visitors between November – January 2013 was compared to the same figure for bittorrent portal visitors. In all three regions, there were more visitors to bittorrent portals than video streaming link sites, though the difference varied between region: in North America, total video streaming link site visitors were 72.2% of total bittorrent portal visitors while in Asia-Pacific the figure was 27.0% of bittorrent portal visitors.

Assuming that the end result of a visit to a bittorrent portal is the same as a visit to a video streaming link portal – that a user locates and downloads or streams the content in which they are interested – then the total data which is then transferred must also be considered in this analysis. The amount of data required to consume a file via a video streaming site is usually significantly less than when downloading a film or television episode from bittorrent. The file size is smaller and the final quality of what the user views is often poorer. This helps reduce the overall bandwidth footprint of each streaming site and thus lower their costs (many video streaming hosts place a limit on the maximum file size that can be uploaded – for example, PutLocker will not allow uploads above 1GB for most users).

Twenty links for recent films posted to a range of video streaming link sites were analysed and the streaming video file to which the link pointed was measured for file size. On average, the streamed video content was 441.3MB in size. The twenty most popular films currently listed on ThePirateBay bittorrent portal were also analysed, with the average file size of these films 1,187.2MB. On this estimate, each film streamed via a video streaming site results in 37.2% of the bandwidth for a film downloaded via bittorrent.

[26] *An Estimate of Infringing Use of the Internet*, January 2011.

These figures can then be used to help provide a figure for infringing video streaming for each of the three regions included in this report. Table 5.4.2 below shows the final figure for each of the three regions: 1.8% of all bandwidth in North America is used for infringing video streaming; 2.9% of all bandwidth in Europe; and 2.6% of all bandwidth in Asia-Pacific.

Table 5.4.2: Video streaming bandwidth use calculations

Methodology steps	North America	Europe	Asia-Pacific
A. Amount of all internet traffic measured as video streaming of any kind (less legitimate services such as Netflix – sourced from Sandvine) [27]	14.71%	13.63%	18.02%
B. Amount of all internet traffic measured as bittorrent (sourced from Sandvine)	6.71%	18.58%	25.45%
C. Video streaming link site visitors as a percentage of bittorrent portal visitors in each region (see above)	72.21%	41.53%	26.95%
D. Average streamed file size from video streaming link sites (441.3MB) as a percentage of average film file size downloaded via bittorrent (1187.2MB) (see above)	37.17%	37.17%	37.17%
E. Estimated infringing data usage of video streaming link sites as a percentage of all bittorrent internet traffic (C * D)	26.84%	15.44%	10.02%
F. Estimated infringing data usage of video streaming link sites as a percentage of *all* internet bandwidth in each region (B * E)	**1.80%**	**2.87%**	**2.55%**
G. Estimated infringing data as a percentage of all video streaming bandwidth (less legitimate services) (F / A)	**12.24%**	**21.05%**	**14.15%**

It is also important to mention the contribution of pornography to bandwidth consumption in this area. Streaming video distribution is one of the most popular ways in which users consume pornography online. For instance, figures supplied in April 2012 by the second largest pornography site worldwide, YouPorn, showed that the site served almost 1 petabyte of content each day to internet users with peak traffic of 100 gigabytes per second[28], an amount estimated by the site to be 1% of the total amount of data transferred across the internet each day.

With many adult studios extremely concerned about the level of unauthorised distribution of their content on such streaming sites – often in clips rather than full movies[29] – a measurement of the amount of unauthorised streaming that takes place via pornography streaming sites would likely put the total level of infringing video

[27] This data is taken from Sandvine figures for video streaming bandwidth. Sandvine is able to detect certain legitimate video services – such as NetFlix, Hulu, or BBC iPlayer – within the overall category of video streaming. As there is no content on these services which infringe copyright, the proportion of bandwidth consumed by each can be removed from the estimates of infringing video streaming bandwidth before any other calculations take place.

[28] http://www.extremetech.com/computing/123929-just-how-big-are-porn-sites/2

[29] http://www.lvrj.com/business/adult-industry-executives-fret-over-piracy-l-a-condom-ordinance-137635038.html

streaming much higher. This is not an area where, like bittorrent, adding in pornography would take the amount of infringing content close to 100% of the total level of bandwidth use for that type of distribution – UGC sites like YouTube and DailyMotion and the wide use of video by news sites and others means that there is a significant amount of non-infringing use of streaming video – but there is certainly an amount of infringing video that would be accounted for were it to be included in the figures. However, doing so is beyond the scope of this study.

5.5 China

It is important to separately discuss the video streaming ecosystem in China compared to the rest of the world and to the rest of the Asia-Pacific region. China has a distinct online landscape which makes significant use of a wide range of video streaming protocols, ranging from direct streaming at major UGC sites such as Youku and Tudou to live video streaming apps such as PPS and PPLive to peer to peer based on-demand streaming such as QVOD.

A few years ago, the biggest Chinese UGC sites were frequently used to store and distribute infringing copies of titles belonging to rights holders, particularly from the West. However, state pressure and an increased number of partnerships with legitimate content owners have seen infringing material hugely reduced on sites like Youku and Ku6. The locus of video streaming infringement has shifted to peer to peer based technologies such as QVOD and Baidu Player as well as legacy use of live streaming services like PPS.

comScore recorded 65.9m unique monthly users of the PPS app in January 2013, the video streaming software developed by PPStream. The ppstream.com web site itself (also accessed at pps.tv) received 51.9m unique monthly visitors, the vast majority of which are from China. PPTV.com, the web site for the PPLive video streaming application, received 70.0m unique visitors in January 2013. While visitor numbers can be uncovered for such streaming sites, it is much more difficult to make an accurate estimate on the amount of consumption that is infringing, particularly for domestic Chinese material. Western content can be located on many of these services and despite some of the largest Hollywood studios establishing partnerships with video hosting web sites in China to provide legitimate access to popular films and television, research conducted by NetNames found that pirated material is available. However, the majority of content available through these different Chinese video streaming services such as PPS and PPLive is domestic and untangling the ownership status of this content and attempting to determine whether material has been uploaded legitimately or not is an area which any individual outside China and without an expert knowledge of the Chinese rights landscape would find difficult to accurately assess.

However, previous analysis of the Chinese video streaming landscape by NetNames indicated that the vast majority of use of the QVOD and Baidu Player clients was infringing. There are numerous portal sites in China such as tom365.com which offer links to a wide range of infringing content – both domestic and international

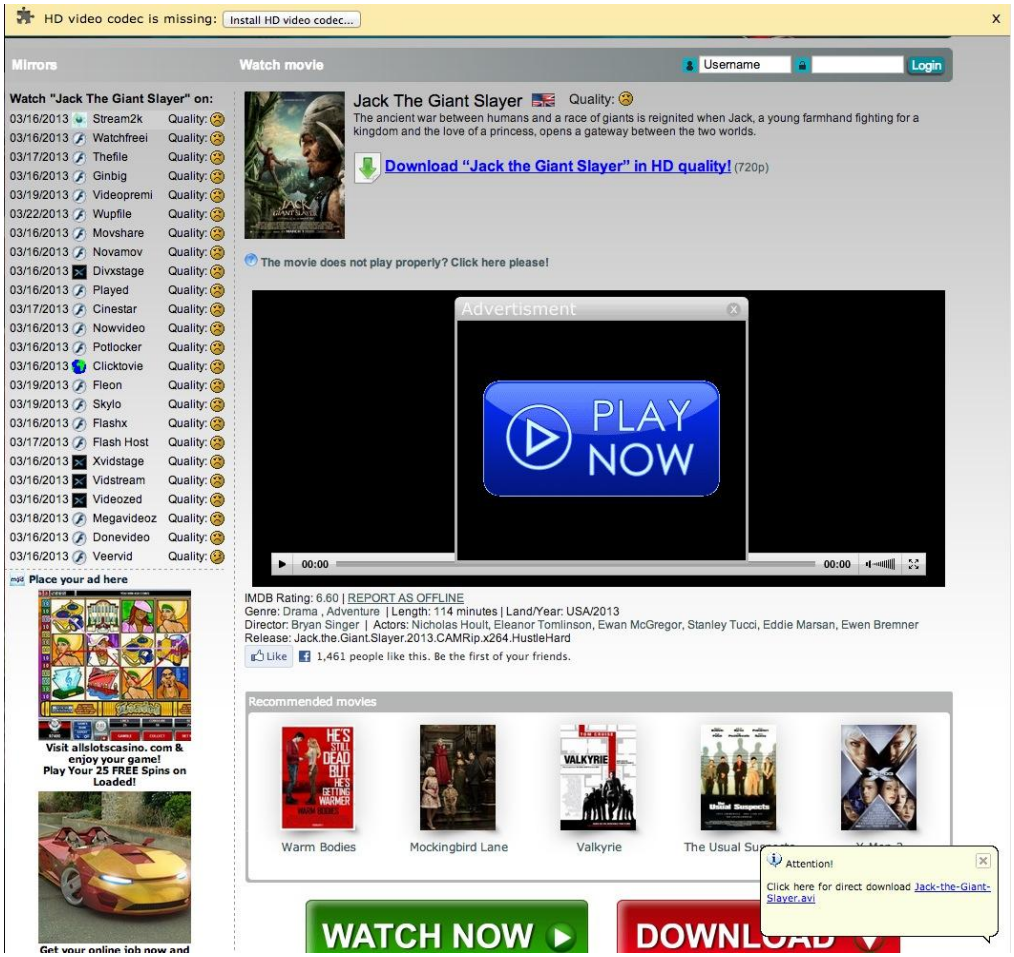
– that can be consumed using QVOD and/or Baidu Player (and many others such as Yyets.com which offer QVOD links amidst numerous other ways of downloading). Indeed, it is rare to find links to material for the two clients that are *not* illegitimate.

Sandvine record 3.9% of all Asia-Pacific bandwidth as consumed by QVOD (the company did not track Baidu Player). In addition, another Chinese streaming video client with a similar usage pattern, Funshion, consumes 1.2% of all bandwidth. Given this data, it would not be foolhardy to assume that between 4-5% of bandwidth in the region is infringing content consumed by users of QVOD and Funshion (with a further unspecified amount of infringing content also consumed by Baidu Player and smaller amounts by live streaming clients such as PPS and PPLive). Taking into account the 2.55% of infringement recorded for video streaming bandwidth for Asia-Pacific in Section 5.4 above, it is estimated that between about 6.55% - 7.55% of all Asia-Pacific bandwidth is taken up with infringing video streaming.

5.6 Business Models

Revenue generation for video streaming link sites and video streaming cyberlockers is based around three areas: online advertising (for both types of sites), affiliate programs (for video streaming link sites), and premium accounts (for video streaming cyberlockers).

Advertising was featured across all video streaming link sites. The screenshot below from Movie2k.to is an example. While Movie2k closed in May 2013, the advertising model used on the site is typical of many video streaming link sites.



The following adverts or affiliate links are found on this page:

- a banner across the top of the screen tells the user that an "HD video codec is missing", mimicking the style of a browser warning window[30]. The link leads to what pretends to be a video codec pack but is most likely a piece of malware.

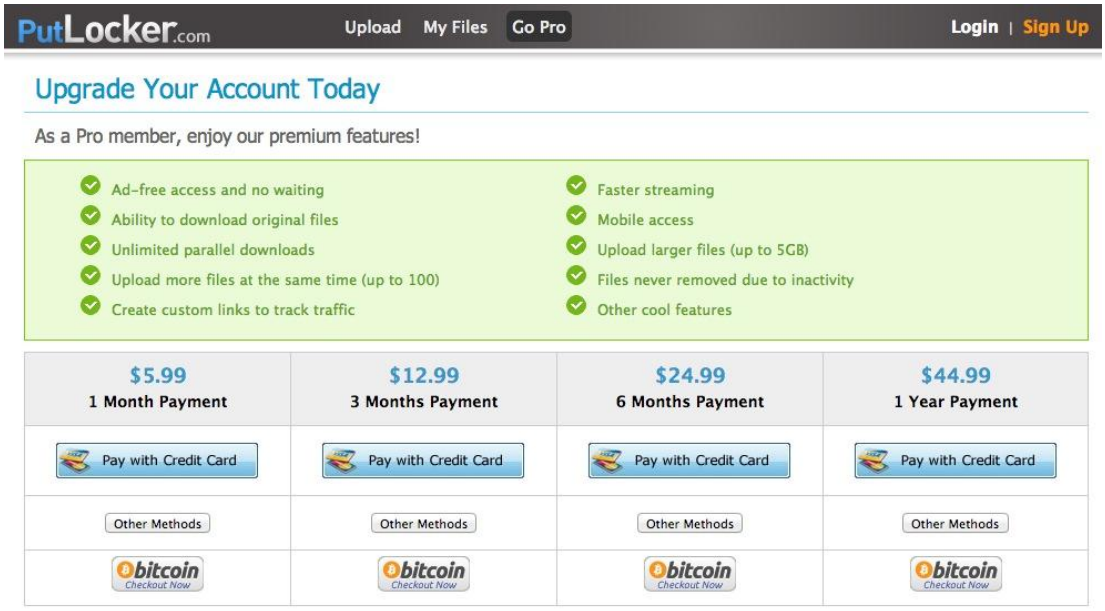
[30] http://support.mozilla.org/en-US/questions/950060

- a bold blue link tells the user to "Download 'Jack the Giant Slayer' in HD quality", leading to a site that requires a payment to access films and television. Online reports state that the site does not provide what it promises.
- a large blue square across the middle of the video window stating "PLAY NOW". This link leads to the same site as the previous link.
- below the video, large red and green buttons stating "WATCH NOW" and "DOWNLOAD" which again lead to the same site.
- to the left of the video window, advertisements for an online casino and a 'work from home' scheme.
- a dialogue window which states "Click here for direct download Jack-the-Giant-Slayer.avi" which is an affiliate link to a pay-to-download movie site.

Similar advertisements are found on video streaming cyberlocker sites. The screenshot from streaming cyberlocker MovShare shows an adult dating site, two advertisements promoting "Flash Player HD" which are designed to mimic Adobe's own Flash Player update messages, and a smaller "Download" and "Play now" advert which leads the user to a software download. Clicking on the video window to start the film player pushes a pop-up browser window advertising a gambling site.

Premium accounts

In addition to advertising, many video streaming cyberlocker sites – similar to direct download cyberlockers – also offer paid 'premium' or 'pro' accounts. These typically remove advertising on streaming cyberlockers and also allow uploaders to streaming sites to add larger files to the sites. Premium accounts commonly cost between $5 and $10 per month. The advantages of the PutLocker premium account are listed in the screenshot below for a cost of $5.99 per month.



Recently, payment processors such as Visa, Mastercard, and PayPal – under pressure from rightsholders and law enforcement – have become less willing to allow streaming cyberlocker hosts like PutLocker to use their payment facilities. Sites have been forced to locate other methods of payment. For instance, PutLocker does allow payment with Visa and Mastercard but through a small and little known payment processer named E-Merchants. The site also offers payment through the decentralised payment mechanism BitCoin and, for users in some countries, premium SMS payments and prepaid bank cards. Recent NetNames research found that each of the ten most popular streaming cyberlockers worldwide offered an average of 8.6 payment methods for premium accounts.[31]

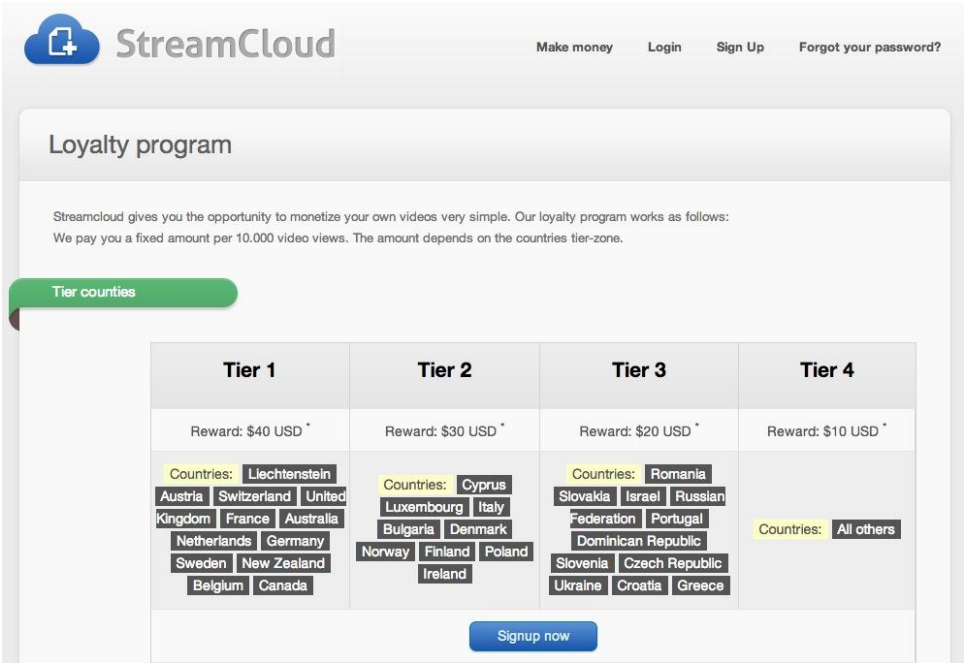
Affiliate schemes

One major difference between the bittorrent ecosystem and that of video streaming cyberlockers (and also direct download cyberlockers) is the use in some instances of affiliate schemes which reward uploaders for the content they add to the hosting site or the number of users which pay for a premium account after

[31] *And how would Sir care to pay for his cyberlocker membership?*, NetNames Scrutiny article, 7 August 2013.

clicking on a link to an uploader's file. During 2011, direct download cyberlocker sites such as FileSonic and FileServe offered uploaders in excess of $40 every time 1,000 users downloaded one of their files or up to 60% of the cost of a premium account. However, affiliate schemes were reduced in number and in generosity following the seizure by law enforcement of MegaUpload and its sister video streaming cyberlocker MegaVideo in January 2012. While MegaUpload did not operate an affiliate or rewards scheme at the time of the seizure, the allegation that such a process encouraged copyright infringement on the site in the past formed one of the main planks of evidence against the owners of the site. During 2012, many video streaming cyberlockers and direct download cyberlockers abandoned affiliate schemes or reduced payouts to uploaders.

Some sites still offer rewards and it is noticeable that sites that have launched since the seizure of the MegaUpload and MegaVideo sites are often more willing to promote a rewards program. In the video streaming ecosystem, for instance, streaming cyberlocker Streamcloud.eu operates a 'loyalty program' which pays up to $40 per 10,000 views of content (or $4 per 1,000 views) to streams. NowVideo.eu pays up to 60% for each premium account sold.



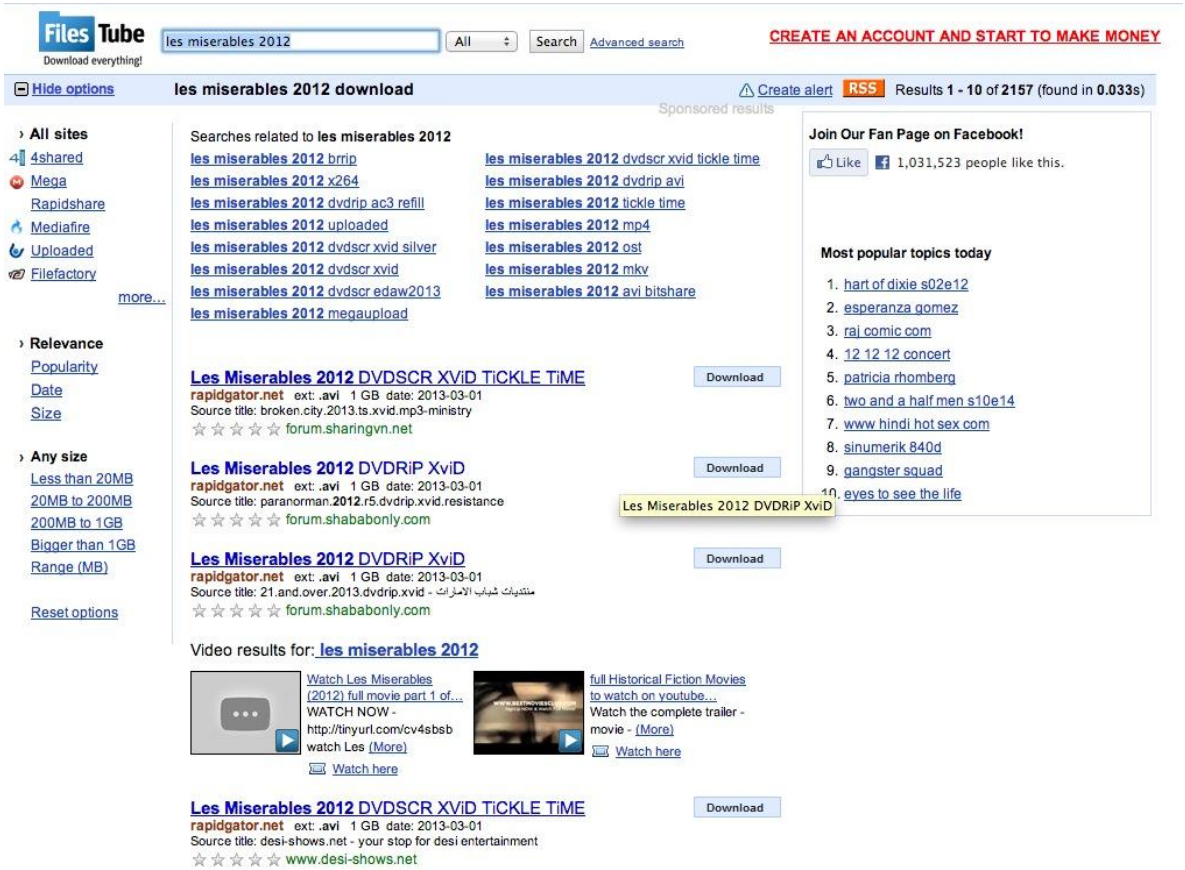
These programs are generally successful in their aims: by encouraging uploaders to provide content to their site, the video streaming host draws in visitors who will generate advertising revenue and perhaps pay for premium accounts. In turn, the uploaders receive monetary rewards – which further entices them to provide more content. Unsurprisingly, the most popular content is infringing copies of new films and television episodes and so uploaders turn to this type of material to draw in as much profit as possible.

6 Direct download cyberlockers

6.1 Introduction

Direct download cyberlockers offer online storage for user files, providing a link to each file which can be shared with others to facilitate downloads across a wider community (or the entire internet). As with video streaming, the direct download cyberlocker ecosystem typically operates in a two-stage process. First, a user locates a link to a file on a direct download cyberlocker link site. These range from metasearch sites such as FilesTube (see screenshot below) and FileCrop to dedicated forums such as Warez-BB or Peb.pl. Second, the user clicks through to download the file from the direct download cyberlocker hosting site.

As the data below demonstrates, the direct download cyberlocker ecosystem was significantly affected by the seizure of the MegaUpload direct download cyberlocker in January 2012 and the arrests of its main executives. A number of other popular direct download cyberlockers voluntarily closed following the enforcement action against MegaUpload (such as FileSonic and FileServe) and others have since changed their operating style. For instance, many direct download cyberlockers used to offer monetary rewards to the uploaders of the most popular content but after the closure of MegaUpload, the practice has become less common.



Determining universe size

In a similar fashion to video streaming, the direct download cyberlocker ecosystem is browser-based. Assuming that unduplicated visitors are preferred to aggregate users, the primary choice in attempting to determine the size of the direct download cyberlocker universe is between unduplicated users for link sites against those for cyberlocker hosting sites. In this instance, it seems sensible to rely on the figure for visitors to direct download cyberlocker hosting sites – that is, the sites from which users download any content which they seek. This allows the estimate for the direct download cyberlocker universe to incorporate users from the long tail of direct download cyberlocker link sites – for instance, the many blogs or smaller linking sites which do not feature in the list of direct download cyberlocker linking sites analysed in Section 6.2 below.

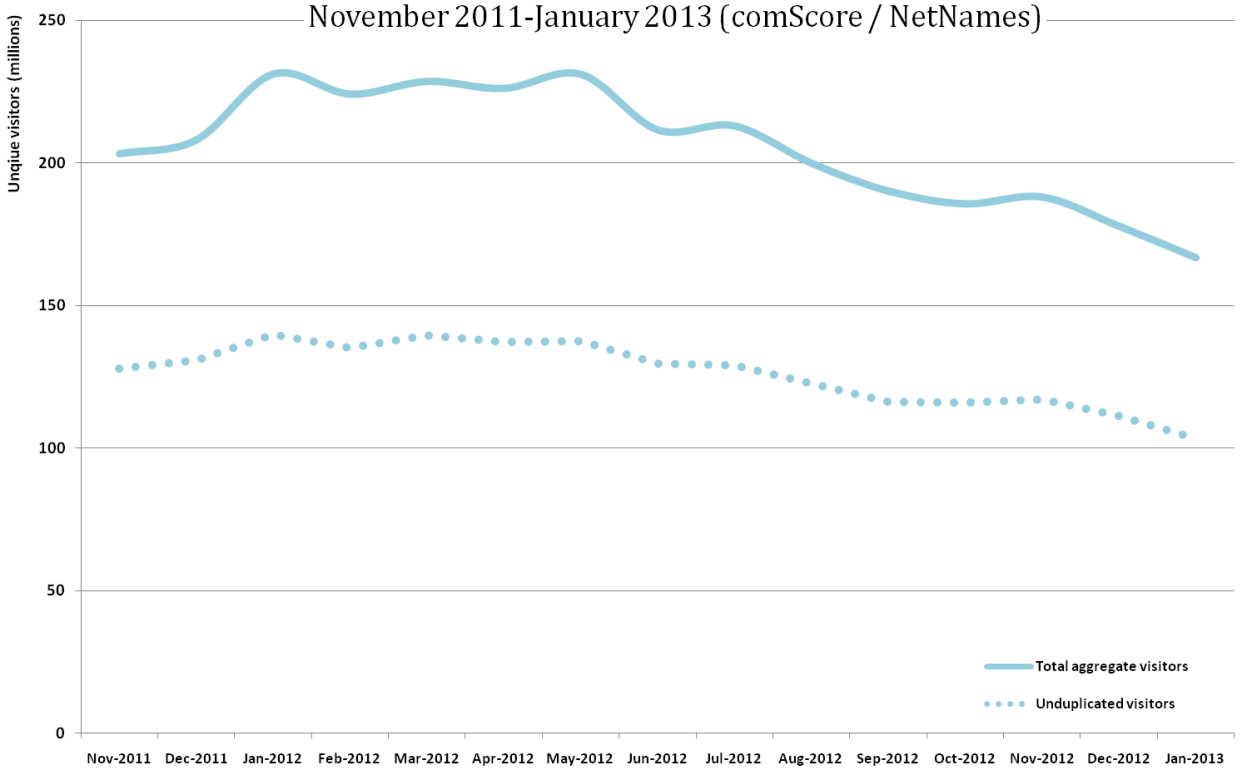
In January 2013, comScore recorded **228.8m** unique and unduplicated internet users of direct download cyberlocker hosting sites. The proportion of this population who used the direct download cyberlocker ecosystem for infringement is determined using a methodology that is explained in Section 8 to discount users who *only* accessed non-infringing or pornographic content. **This method determines the total number of direct download cyberlocker users who accessed infringing content through direct download cyberlocker sites during January 2013 to be 210.6m users.**

6.2 Direct download cyberlocker link sites

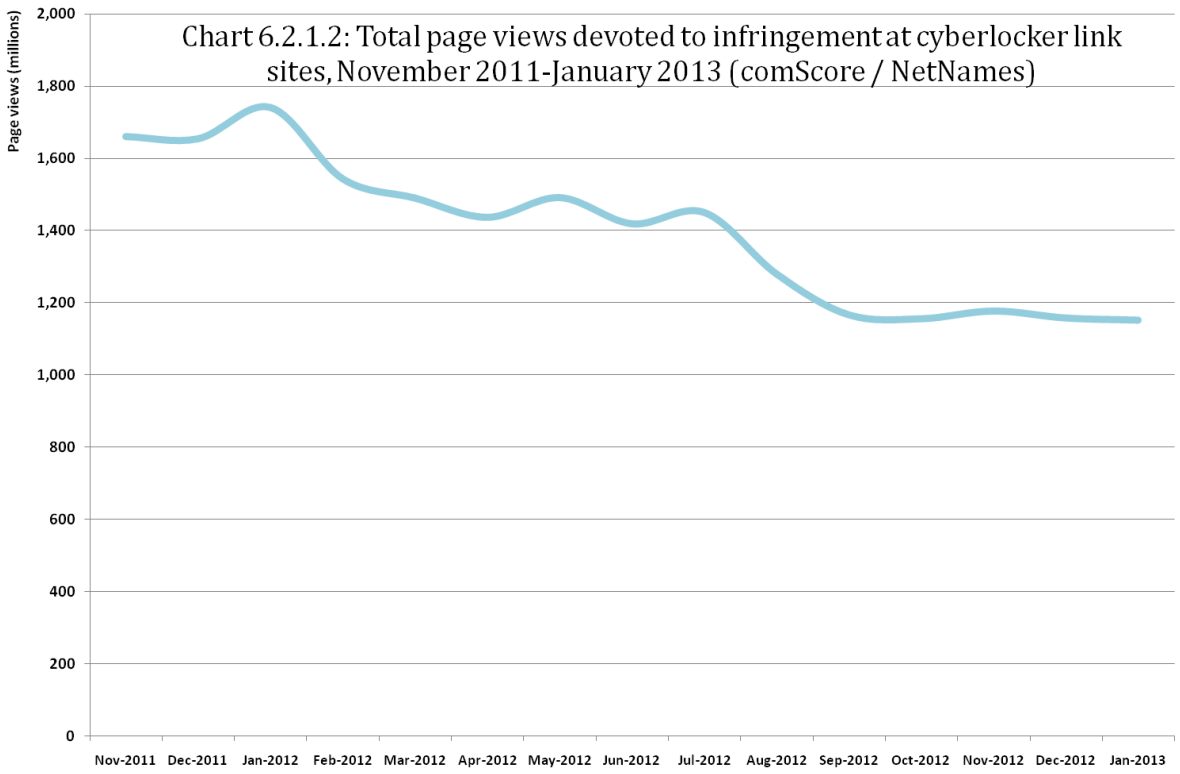
6.2.1 Short-term analysis

Chart 6.2.1.1 below shows the decline in the popularity of direct download cyberlocker link sites since November 2011. The drop is clear for both aggregate visitors and unduplicated visitors, particularly from January 2012 when MegaUpload was seized. Infringing aggregate visitors to direct download cyberlocker link sites dropped by 17.9% in the twelve months following the disappearance of MegaUpload from the internet, from 203.2m to 166.8m. Unduplicated visitors dropped by a slightly higher proportion, falling by 19.2% from 127.9m to 103.4m. In effect, one in five direct download cyberlocker link site users from January 2012 no longer visited any such site in January 2013. The analysis in section 6.3 below suggests an even larger decline in visitors to direct download cyberlockers themselves.

Chart 6.2.1.1: Infringing cyberlocker link site visitors November 2011-January 2013 (comScore / NetNames)



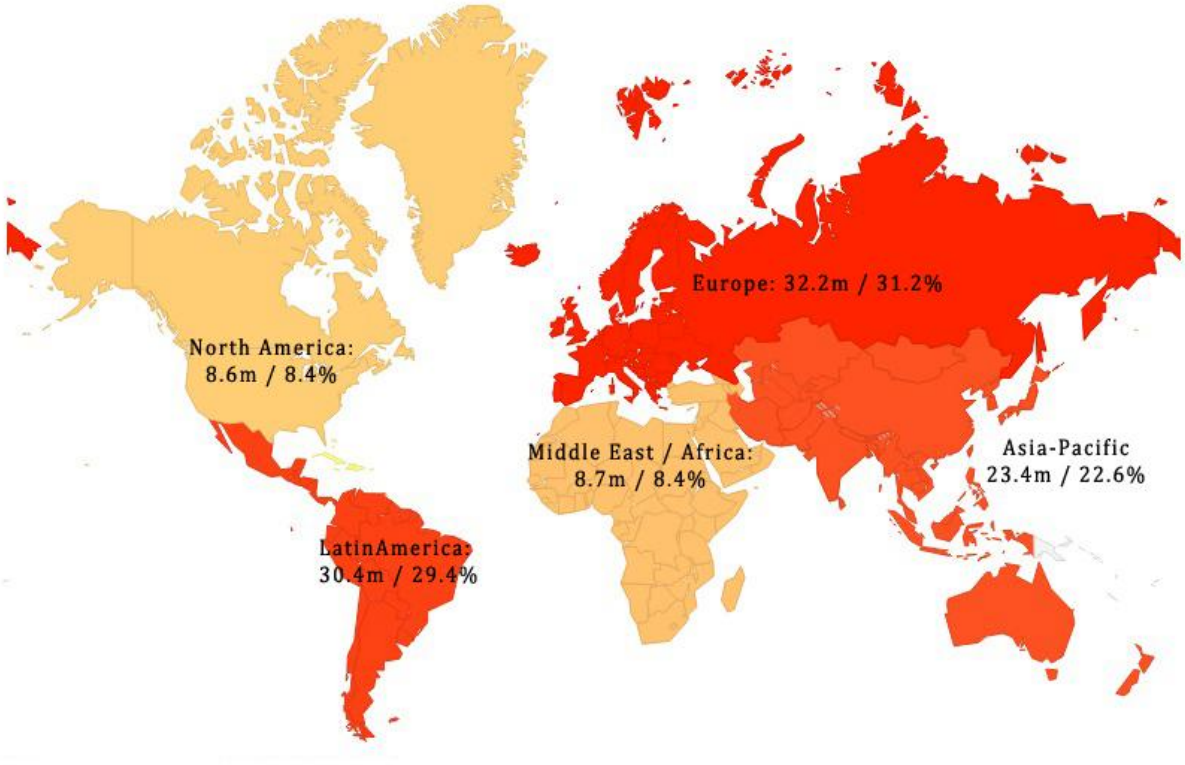
Data from comScore on **total page views** also supports the view of a substantial decline in direct download cyberlocker popularity during this period, as Chart 6.2.1.2 shows. In January 2013, 1.2 billion pages devoted to infringement were viewed across direct download cyberlocker link sites, a large drop of 30.7% compared to 1.7 billion page views in November 2011.



6.2.2 Regional breakdown

The relative popularity of direct download cyberlocker link sites in both Latin America and Asia-Pacific is notable on Chart 6.2.2.1 below. Latin America contributes almost the same percentage of visitors to direct download cyberlocker link sites as Europe, at 30.4m or 29.4%, helped by the popularity of linking sites such as ArgentinaWarez and GratisPeliculas in the region. Anime linking sites like Anime-Sharing.com and JPddl.com contribute to the large share of visitors to link sites from Asia-Pacific.

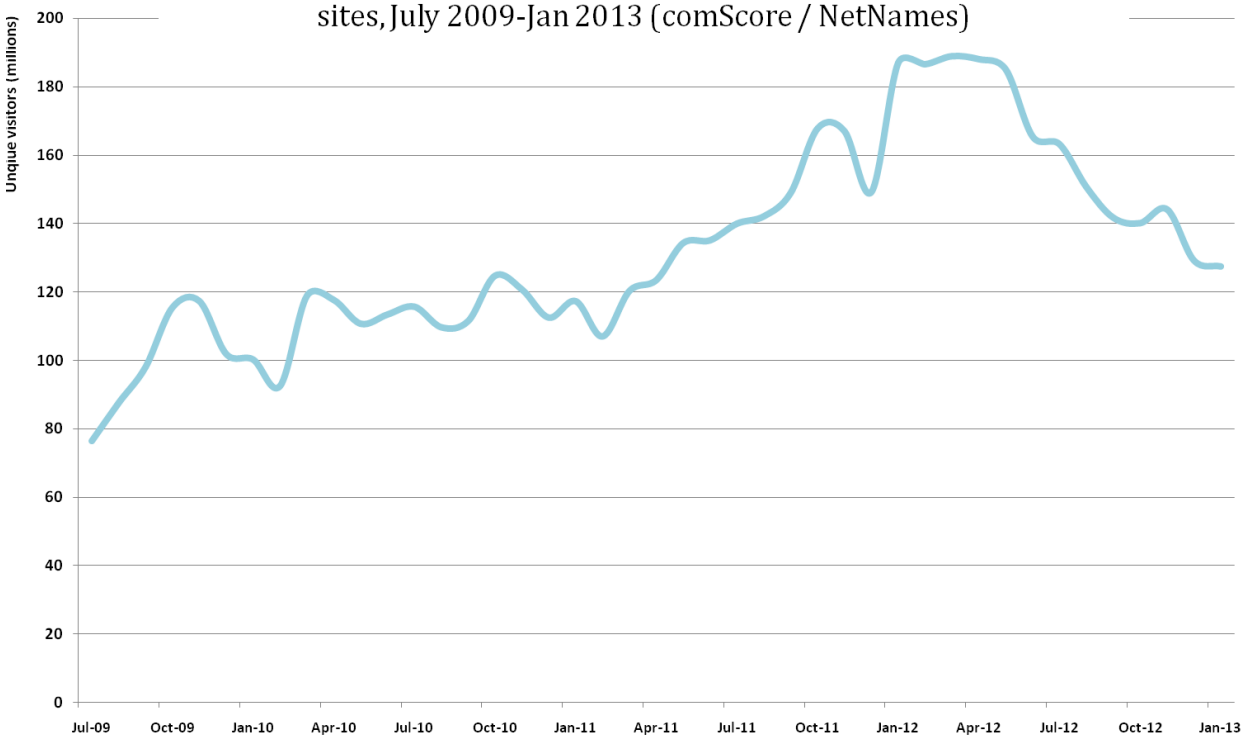
Chart 6.2.2.1: Regional breakdown of visitors to cyberlocker link sites (comScore / NetNames)



6.2.3 Long-term analysis

A longer-term view of visitors to direct download cyberlocker link sites (Chart 6.2.3.1) also shows the popularity of such sites declined during 2012 in light of the degradation of the direct download cyberlocker ecosystem caused by the seizure of MegaUpload and the subsequent voluntary closure of other direct download cyberlockers. Until this point, comScore believed that direct download cyberlocker link sites were gradually increasing in popularity.

Chart 6.2.3.1: Aggregate infringing visitors to top twenty cyberlocker link sites, July 2009-Jan 2013 (comScore / NetNames)

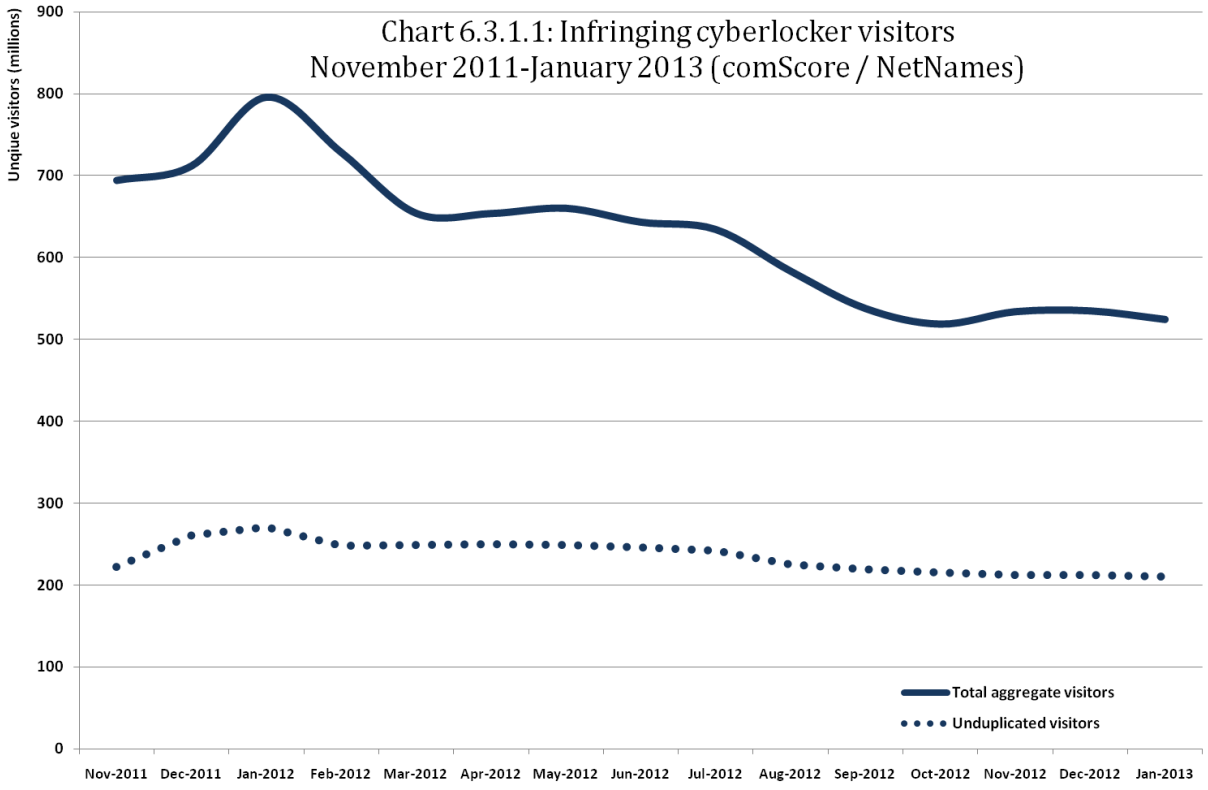


6.3 Cyberlocker visitors

6.3.1 Short-term analysis

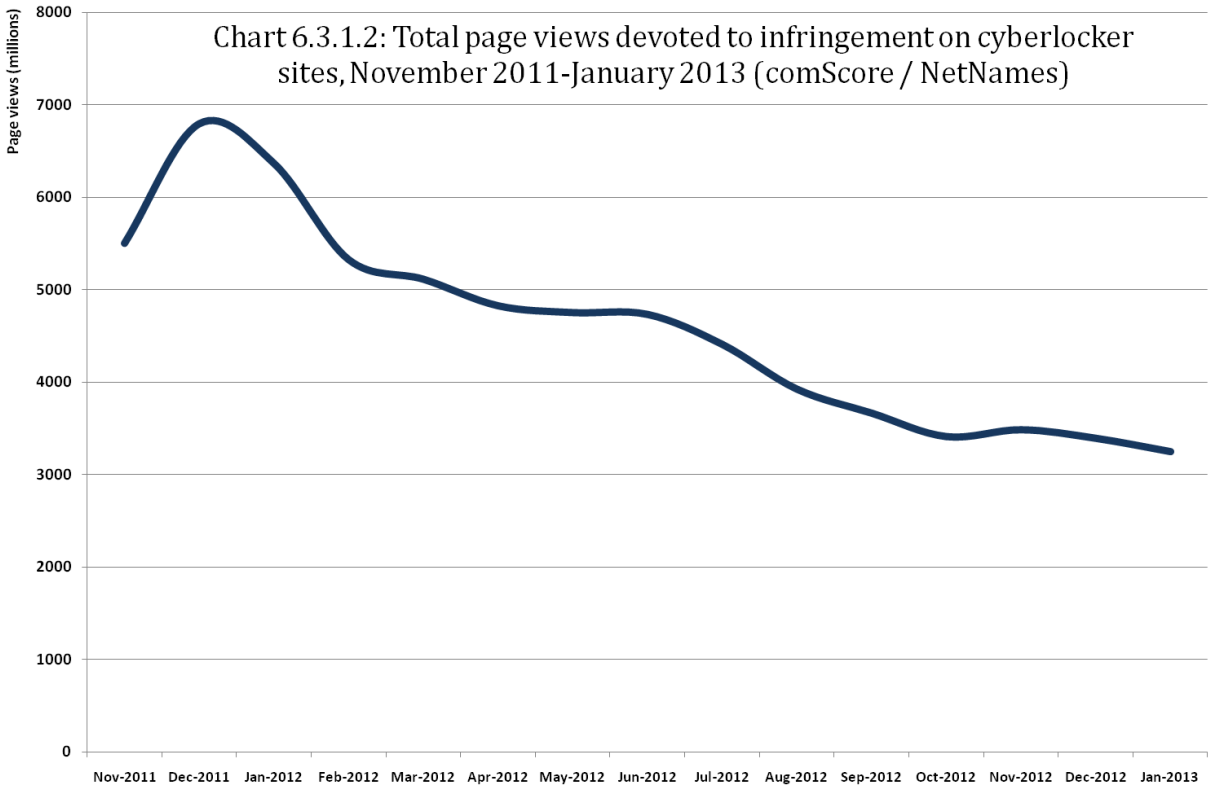
The events of January 2012 had an even larger effect on direct download cyberlockers than on linking sites. The sudden fall in infringing aggregate visitors – and to a smaller extent, in unduplicated visitors – following the MegaUpload seizure in January 2012 is clear in the chart. In the twelve months since January 2012, aggregate unique monthly visitors to direct download cyberlockers fell by 34.1% from 796.0m aggregate unique visitors to 524.2m in January 2013.

Unduplicated visitors, a better measure of the total cyberlocker universe, also fell. In January 2012 there were 271.2m infringing unduplicated visitors to direct download cyberlockers with this total dropping by 22.4% to 210.6m in January 2013.

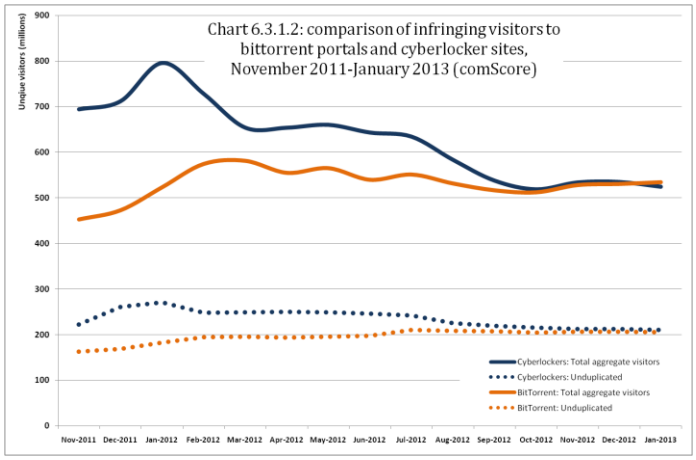


Data for **total page views** devoted to infringement across direct download cyberlockers is also available and is shown in Chart 6.3.1.2. A clear and sustained fall is obvious. In January 2013, a total of 3.2 billion pages devoted to infringement were viewed across all direct download cyberlockers, an average of 15.4 per cyberlocker user (unduplicated users). However, this is a large decrease compared to November 2011 when 5.5 billion pages were viewed across direct download cyberlockers, an average of 24.8 per direct download cyberlocker user. In the opposite situation to bittorrent (see Section 3), there are both fewer infringing direct download cyberlocker users overall and each one of those infringing direct download cyberlocker users is

viewing fewer pages each month, again illustrating the overall decline in direct download cyberlocker use worldwide.



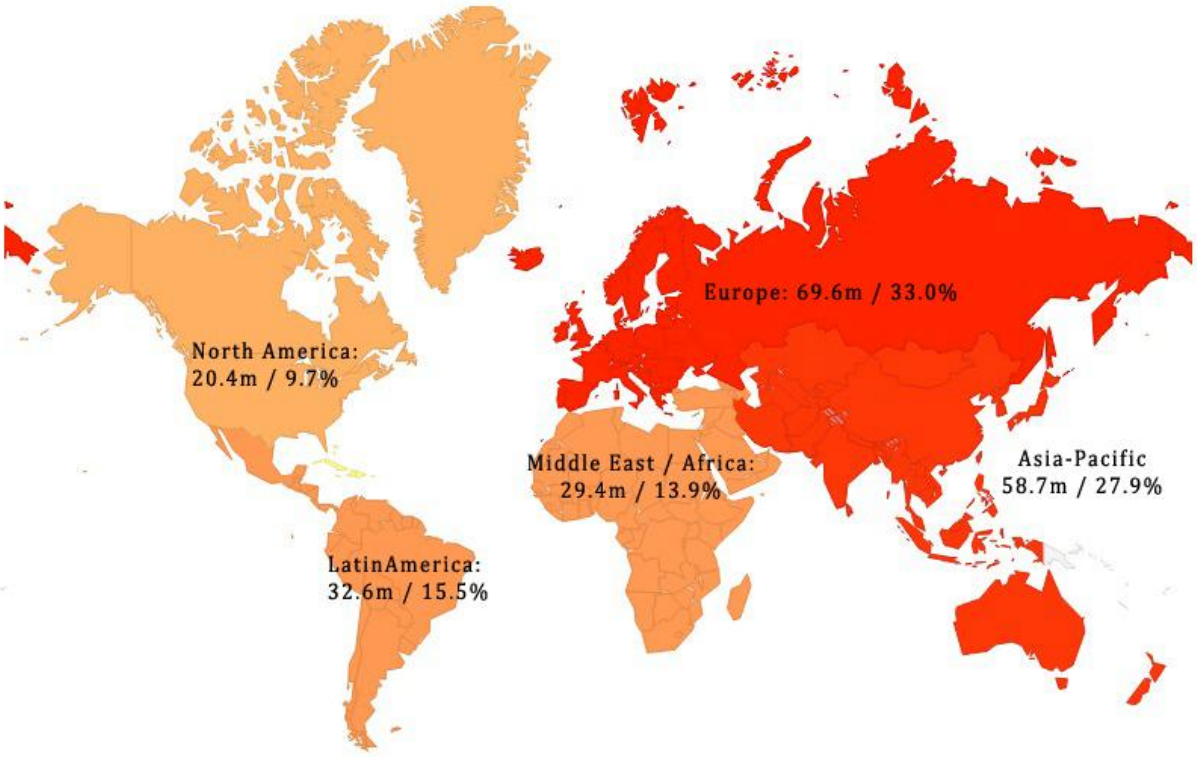
It is also instructive to examine the decline in infringing visitors to direct download cyberlockers shown above against the increase in infringing visitors to bittorrent portals during the same period. The narrowing gap between both aggregate visitors and unduplicated visitors is plain on Chart 6.3.1.2. Analysis indicates that the direct download cyberlocker ecosystem is on a continued decline in use worldwide. Many of those who regularly used direct download cyberlockers appear to have moved to bittorrent since January 2012, making the peer to peer protocol increasingly important in discussions of infringement.



6.3.2 Regional breakdown

In three major regions – North America, Europe, and Asia-Pacific – visitors to direct download cyberlocker sites comprised 148.6m users in January 2013, a fall of 7.7% from 161.0m in November 2011. The individual regional analysis of direct download cyberlocker sites again shows Europe to be the dominant user of such sites with Asia-Pacific reporting a similar percentage of users as for direct download cyberlocker link sites. However, there is a slightly higher percentage use of direct download cyberlockers compared to direct download cyberlocker link sites from North America and Middle East / Africa and slightly lower for Latin America.

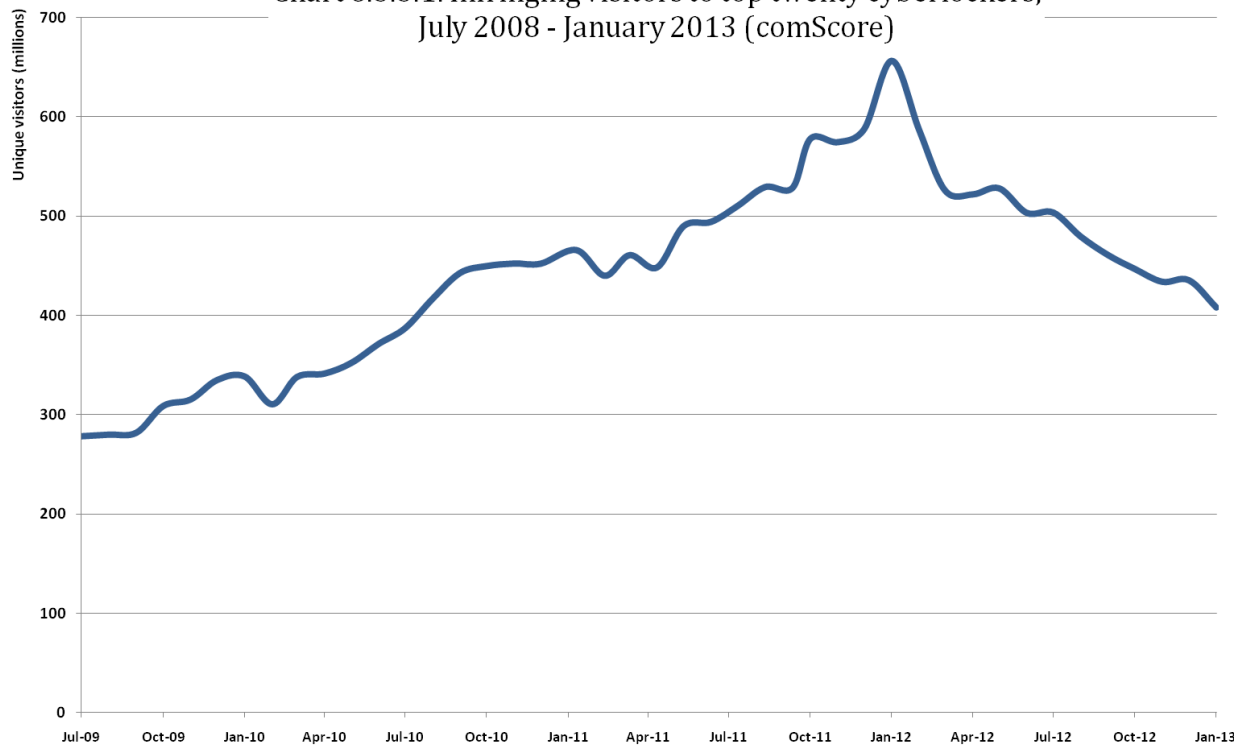
Chart 6.3.2.1: Regional breakdown of visitors to direct download cyberlocker sites (comScore / NetNames)



6.3.3 Long-term analysis

Chart 6.3.3.1 shows unique aggregate visitors to the top twenty direct download cyberlockers according to comScore. The long-term increase in visitors to the peak visible in January 2012 is very clear in this chart. The publicity that surrounded the seizure of the MegaUpload direct download cyberlocker and the need for many users to locate alternatives produced a sharp increase in visitors to direct download cyberlockers during that month. The decline in popularity of direct download cyberlockers in the months following these dramatic events is also illustrated.

Chart 6.3.3.1: Infringing visitors to top twenty cyberlockers, July 2008 - January 2013 (comScore)



6.4 Direct download cyberlocker bandwidth use

Despite the many millions of visitors to direct download cyberlockers and direct download cyberlocker link sites outlined above, bandwidth data indicates that the direct download cyberlocker ecosystem consumes a much smaller amount of overall internet bandwidth than a protocol such as bittorrent.

For instance, Sandvine categorises direct download cyberlocker sites on which infringing content is frequently located and accessed as 'Storage' (previously 'Storage and Backup') which includes online backup solutions such as Dropbox that are almost never used for the mass distribution of infringing material. This category as a whole – all sites and services, not only direct download cyberlockers – consumes only 1.8% of all bandwidth in North America, 2.9% in Europe, and 0.9% in Asia-Pacific (compared, for example, for 21.7% on aggregate for bittorrent in Europe).

Sandvine provides some limited data on the bandwidth consumed by individual direct download cyberlockers in the three regions where the individual site is responsible for more than 0.01% of overall bandwidth. These are shown in Table 6.4.1 below. This is not an exhaustive list as Sandvine only tracked visits to a select number of direct download cyberlockers. However, given that 4Shared, Rapidshare, and DepositFiles were three of the five most popular direct download cyberlockers during the monitoring period, the data strongly suggests that the total bandwidth consumption of direct download cyberlockers is far lower than bittorrent or video streaming.

Table 6.4.1: Bandwidth consumption of major direct download cyberlockers (Sandvine)

North America		Europe		Asia-Pacific	
Protocol	**Percent**	**Protocol**	**Percent**	**Protocol**	**Percent**
4Shared	0.02%	Rapidshare	0.27%	Rapidshare	0.21%
Rapidshare	0.07%	DepositFiles	0.18%	Hotfile	0.13%
Hulkshare	0.01%	Hotfile	0.04%	4Shared	0.09%
		4Shared	0.03%	DepositFiles	0.04%
Estimated bandwidth across all cyberlockers	**0.39%**	**Estimated bandwidth across all cyberlockers**	**1.90%**	**Estimated bandwidth across all cyberlockers**	**1.63%**

The low percentages for each of the direct download cyberlockers make it difficult to confidently extrapolate total bandwidth consumption across all direct download cyberlockers in each region but an estimate can be

made based on visitors to each direct download cyberlocker. Using this methodology[32], direct download cyberlockers consume 0.39% of all bandwidth in North America, 1.9% in Europe, and 1.6% in Asia-Pacific. Assuming a level of infringing content of 66.6% on cyberlockers (see Section 6.5 below), this means an estimate of infringing direct download cyberlocker bandwidth consumption of 0.26% in North America, 1.27% in Europe, and 1.08% in Asia-Pacific.

6.5 Cyberlocker content analysis

6.5.1 Background

During 2012, NetNames' Discovery Engine technology – an automated internet search, retrieval, and categorisation system – was used to crawl the internet looking for links to files held on nine direct download cyberlockers.[33] Crawling began at major search engines such as Google and used all two letter or longer words from the Dale/Chall simple word list as initial 'seeds'[34]. Each of these words were sent to search engines in combination with the names of the direct download cyberlockers included in the research. For instance, some sample search terms were 'afternoon 4shared', 'aunt depositfiles', and 'ache mediafire'. This helped ensure that the searches performed were agnostic and unbiased towards any particular type of content.

Each page returned to the Discovery Engine was automatically examined for any links that may be available for any of the nine direct download cyberlockers. Each direct download cyberlocker link was then automatically followed to the direct download cyberlocker and the filenames of the content located on the direct download cyberlocker was recorded. Classification of each file located was then made on the basis of the filename. Files were not downloaded or further analysed. The files were placed into generic categories such as 'film', 'music', 'software', and so on (see table below).

For each direct download cyberlocker, a sample of each category of file was then analysed for its likely copyrighted status (except for those files which could not be identified)[35].

[32] The methodology takes the figures for bandwidth consumption from Sandvine for the cyberlockers listed in each region and extrapolates total bandwidth consumption based on a comparison of unique visitors to each cyberlocker for January 2013. For instance, the four cyberlockers listed for Europe consumed 0.52% of all bandwidth according to Sandvine. Total unique visitors to these cyberlockers were 27.3% of all cyberlocker visits in Europe. From this, the assumption is made that if 27.3% of cyberlocker visits are responsible for 0.52% of all bandwidth, then 100% of cyberlocker visits will be responsible for (0.52%/27.3)*100 = 1.90% of all bandwidth.

[33] The Discovery Engine collected and analysed links between 24th March 2012 and 24th April 2012. Additional analysis of content type and copyrighted status was then performed during May and June 2012.

[34] See: http://rfptemplates.technologyevaluation.com/dale-chall-list-of-3000-simple-words.html. The list was used in an attempt to provide a neutral starting point for search.

[35] At least fifty files from each category were analysed for each cyberlocker for copyrighted status. If the sample of 50 was less than 10% of the total number of files in that category, then 100 files were sampled. If less than 50 files were found for a particular category, all the files would be analysed.

6.5.2 Content analysis results

Table 6.5.2.1 below shows the overall results. The number of files located for each category of content is shown together with the number sampled and, of those, the number which were available commercially and believed to be infringing. In total, 13,614 files were located across the nine direct download cyberlockers. Of these, 2,785 or 20.5% were further analysed and 1,854 or 66.6% were found to be commercially available and therefore likely to be infringing.

The content analysis finds that music is more popular on direct download cyberlockers than on bittorrent. On direct download cyberlockers, 35.2% of all files located were music against a figure of 7.6% amongst the most popular bittorrent files. A large proportion of the music located was single tracks rather than albums which may be one reason for the higher number of music files found as it is typical to find music albums shared on bittorrent rather than single tracks. Film (15.6%) and television episodes (9.7%) were the next most popular content types. There was significantly less pornography located on direct download cyberlockers than on bittorrent.

These results may be affected by the data collection methods involved: for instance, direct download cyberlocker links held on sites which require registration (forums such as Warez-BB, for instance) will not have been uncovered. Further, the word list used for initial seeding will bias the results towards English-language content.

Table 6.5.2.1: Analysis of content held on nine direct download cyberlockers (NetNames)

Type	Number of files	Percent	Sampled	Commercially available	Percentage	Extrapolated commercially available
Book	809	5.9%	263	104	39.4%	319
Film	2,121	15.6%	334	320	95.8%	2,032
Games	558	4.1%	263	188	71.4%	398
Image	651	4.8%	170	0	0.0%	0
Mobile	346	2.5%	238	136	57.3%	198
Music	4,792	35.2%	508	446	87.9%	4,211
Music Video	283	2.1%	195	157	80.7%	228
Unknown / Other	1,074	7.9%	100	0	0.0%	0
Software	825	6.1%	241	139	57.5%	474
TV	1,316	9.7%	276	271	98.0%	1,289
Pornography	842	6.2%	200	95	47.3%	398
	13,614	**100.0%**	**2,785**	**1,854**	**66.6%**	**9,547**

In February 2012, Dr Richard Waterman completed research into the content held on the Hotfile direct download cyberlocker as part of a legal case by the MPAA against the owner of the site.[36] The study analysed downloads recorded by the direct download cyberlocker for a number of randomly chosen days in January 2011. While this study did not explicitly break down the type of content located, it found that:

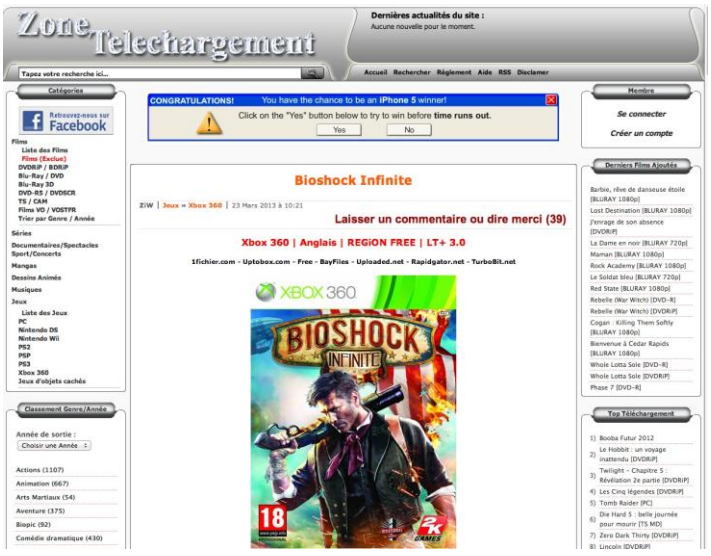
> *approximately 90.2% of all daily downloads of files on Hotfile were downloads of infringing or highly likely infringing content; approximately 5.3% of the downloads of files per day on Hotfile were downloads of non-infringing files; and the remaining approximately 4.5% of the downloads of files per day on Hotfile were downloads of files whose copyright status could not be reliably determined in the time allowed.*

The Waterman study analysed downloads of files while the research discussed above focused on availability. However, there is no contradiction between the fact that while the Envisional / NetNames research found that 66.6% of content held on direct download cyberlockers was infringing, the Waterman research found that 90.2% of *downloads* of files held on a typical direct download cyberlocker were of infringing material. Most infringing files are typically more popular than most non-infringing material, leading to higher rates of downloading.

6.6 Business models

The revenue generation models adopted by direct download cyberlockers are similar to those in the video streaming ecosystem: advertising on both linking and hosting sites; premium accounts; and affiliate or rewards schemes. All direct download cyberlockers operated on a for-profit basis.

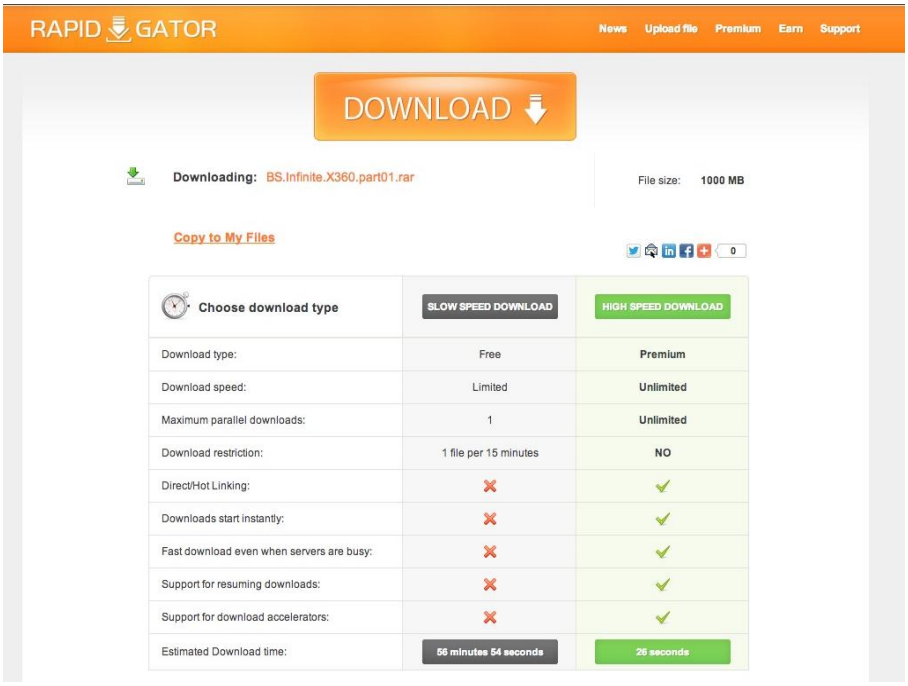
For instance, the screenshot below shows a page from the French language direct download cyberlocker link site Zone-Telechargement which offers links for a download of the game *Bioshock: Infinite* from a number of direct download cyberlocker sites. A banner advert is shown at the top of the page and further advertisements appear further down the page (not shown). When any link is clicked on the page, a pop-up browser window launches that advertises a gambling site. The vast majority of link sites



[36] A public version of the document entitled 'Declaration Of Dr. Richard Waterman In Support Of Plaintiffs' motion For Summary Judgment Against Defendants Hotfile Corp and Anton Titov' can be found at http://www.scribd.com/doc/84380009/90-Percent.

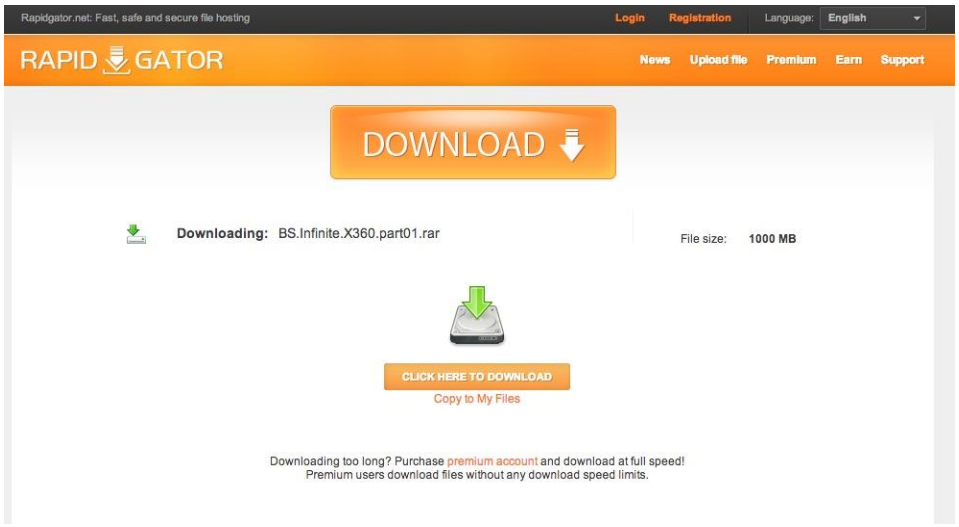
are supported through advertising like this. Very few require any kind of payment before users can access links.

Clicking through to one of the direct download cyberlockers from the links provided on Zone-Telechargement demonstrates the typical advertising-heavy download process for free users. The screenshot below from RapidGator shows two options to the user: a “slow speed download” which is free but has a limited download speed and other restrictions or a “high speed download” available only to premium customers. However, some users will be distracted by the large orange “DOWNLOAD” button at the top of the screen (deliberately designed to mimic RapidGator’s own design) which, when clicked, actually launched a new browser window advertising a dating site.



Choosing the ‘slow speed’ free download link launches another advertisement (for a pornography site) before showing a screen requiring a captcha with an advertisement for an online game.

When the answer to the captcha is submitted, another pop-up advertisement is launched (for another pornography site) before the download of the actual file can be started. When this is clicked, a final pop-up advertisement is shown (for a betting site).



It is possible for users to bypass all of these screens and avoid all of the advertisements by committing to a RapidGator premium account. This is typical operating procedure for direct download cyberlockers: users that purchase a premium account can download multiple files instantly from that site at a higher speed in comparison to non-premium users who have to go through the advertising-supported process. The screenshot below shows the benefits to the user of the RapidGator premium account at a cost of $12.99 per month.

RapidGator also offers an affiliate program which, similar to that for Streamcloud in the video streaming ecosystem, pays those who upload popular content to the direct download cyberlocker or who persuade other users to pay for premium accounts with the site. RapidGator currently offer $40 per 1,000 downloads of content (ten times more generous than the $40 per 10,000 downloads available from Streamcloud) and 50% of the cost of any premium accounts bought.

These offers encourage uploaders to add content that will be attractive to downloaders to the direct download cyberlocker. As with video streaming sites, the most popular content is generally infringing, such as pirated copies of games, films, music, books, and so on. By providing a financial incentive to drive downloaders to their site, direct download cyberlockers can play a vital role in facilitating the distribution and circulation of infringing material.

As noted earlier in this report, the closure of MegaUpload and the arrest of its major executives led to some direct download cyberlockers cancelling any affiliate programs in place (and prompted others that had been amongst the most liberal in their rewards such as FileServe and FileSonic to cease operations completely as public-facing cyberlockers). The ability of uploaders to generate revenue from direct download cyberlockers in this manner was certainly degraded during 2012 but many of the most popular direct download cyberlockers and a significant number of new entrants to the field still offer affiliate schemes. These form a core part of the direct download cyberlocker ecosystem and help ensure that infringing content is distributed around the system as quickly as possible by those seeking to profit from the piracy of copyrighted material.

7 Mobile infringement

7.1 Introduction

The growth of internet-enabled mobile devices across the world in recent years has proceeded at an astonishing pace. Smartphones have been adopted at a faster rate than any other piece of technology in history. More than 50% of the population in the US, Canada, Spain, UK, France, Italy, and Germany owned smartphones at the end of 2012 and this proportion continues to rise. In China, more than 200m smartphones are already in operation and CNNIC predict that this figure will pass 700m in the next three years. A recent report from NPD[37] found that smartphones and tablets outnumbered PCs in the US for the first time during Q1 2013.

The availability of new devices changes online consumption habits. For example, 80% of mobile smartphone minutes are consumed by apps rather than the web. comScore has found that in maturing mobile economies, more than one-third (37%) of digital media consumption – films, television, books, and so on – takes place on mobile devices. Usage patterns for mobile devices peak during the morning commute and, particularly for tablet use, in the evening. Some types of device lean more towards one kind of activity than another: more than half of all tablet owners have watched a video or read a book on their device, for instance. Mobile habits also differ according to country. For example, Nielsen data finds mobile music, film, and television consumption high amongst smartphone owners in China and South Korea and YouTube viewing particularly popular in the US. Driven by apps such as Pandora and Spotify, US consumers now spend more time consuming music on mobile devices than on PCs or laptops. However, according to app monitoring company Flurry the majority of time spent on mobile devices is consumed playing games (43%) and using social networks (26%)[38].

The bandwidth and speeds available to mobile consumers are also increasing. The US recorded 57m 4G users[39] as of March 2013, an increase of 50% from 38m subscribers just five months earlier in December 2012. 4G availability is spreading throughout many other countries, encouraging the consumption of streaming video through services such as Netflix but also through infringing services. Strategy Analytics predict well over one billion 4G subscribers worldwide by 2018[40].

This is not to paint a picture of a world enamored with smartphones and the mobile internet. The more basic feature phone remains the most popular device in many countries such as India, Russia, and Brazil, where high operating costs and poor mobile infrastructure limit the attraction of sophisticated devices. Yet the

[37] *Connected Home Report*, NPD Group, March 2013 (http://www.connected-intelligence.com/).

[38] http://blog.flurry.com/bid/92105/Mobile-Apps-We-Interrupt-This-Broadcast

[39] http://www.4gamericas.org/index.cfm?fuseaction=pressreleasedisplay&pressreleaseid=4542

[40] http://www.strategyanalytics.com/default.aspx?mod=reportabstractviewer&a0=8091

future is clearly one with increasingly advanced mobile devices using increasingly larger amounts of bandwidth worldwide.

7.2 Infringement on mobile

While methodologies of tracking and monitoring traditional computer-based infringements have developed and matured in the last decade, the mobile space remains an area of relative obscurity. Consumer surveys indicate that mobile devices are heavily used for the consumption of content but there is limited information available on what kinds of content are being consumed and using what methods.

It is possible to make certain assumptions. For instance, more limited storage space on mobile devices compared to traditional computing machines means that *downloading* content – for instance, through bittorrent or from cyberlockers – is less likely to be pursued on mobile devices than an activity which does not result in a completed download, such as streaming music or video. If downloads are sought, users are more likely to pursue smaller sized files and content suited for consumption on a mobile device such as music or books.

Analysis of the most popular apps available on various marketplaces show that streaming appears to be the most popular way to obtain infringing content online. For instance, a search on the Google Play store for "MP3" finds a large number of apps which help the user locate free and in the majority of cases infringing music files online. The app Mp3 Music Download Pro has recorded over 10m installations from Google Play, as has Music Download Paradise. In the UK, the live television streaming app TVCatchUp has recorded over 1m downloads on Android and is frequently listed as one of the most popular iOS apps in the country.

Different mobile operating systems such as iOS and Android can also restrict the ability of developers to produce versions of traditional download-based file sharing clients for mobile devices, while marketplace rules can prevent some apps from appearing at all. For example, while BitTorrent Inc has used its development resources to produce versions of the popular uTorrent and BitTorrent clients for Android, bittorrent clients have so far been banned from Apple's iOS App Store[41], though some clients are available for jailbroken iOS devices.

7.2.1 China

The suitability of mobile devices for video streaming and the high level of mobile ownership in China (the country is now the largest market for smartphones worldwide) mean that the country is a natural arena for

[41] Apps that allow the remote control of bittorrent clients running on desktop computers are available but not dedicated bittorrent clients which run on the iOS platform.

infringement using smartphones and tablets. Recent research from NetNames into the smartphone market in China – where the Android operating system dominates – found that rogue marketplace stores were common, offering pirated versions of legitimate apps as well as other apps which encouraged the consumption of infringing content.

For instance, the QVOD streaming video client is available for both Android and iOS devices and has recorded over thirty million downloads from different marketplace stores in China. It is used in a very similar way to the desktop client with portal sites offering links to a vast range of infringing material. A mobile version of the Funshion client is also available, as well as clients for PPS and PPLive (though infringement is less common on the latter two clients).

7.3 Bandwidth data

A limited set of bandwidth consumption data for mobile devices was obtained from Sandvine which focused on the North America region only. On average, mobile users consumed 317MB of data per month compared to 51.3GB per month through fixed line connections. The top traffic categories are shown in Table 7.3.1.

Table 7.3.1: Mobile bandwidth consumption in North America (Sandvine)

Traffic category	Percent bandwidth
Real-Time Entertainment	51.2%
Web Browsing	15.9%
Tunnelling	9.7%
Social Networking	9.2%
Marketplaces	5.0%
Communications	5.0%
Gaming	1.2%
Administration	1.2%
Filesharing	1.2%
Storage	0.6%

One point which immediately stands out from the table is the low proportions of bandwidth consumed by the Filesharing and Storage categories. The former includes applications such as bittorrent and eDonkey and the latter includes sites such as cyberlockers. Only 1.2% of mobile bandwidth is consumed by filesharing (on average, 3.7MB of data per month) including 0.8% of bittorrent use. This compares to 14.6% of all North American bandwidth consumed by file sharing on fixed lines, including 12.4% used by bittorrent. Even less bandwidth is taken up by storage applications (0.6% or an average of 1.7MB per month), though it is unknown how much of this bandwidth is consumed by cyberlockers specifically.

The bulk of mobile bandwidth is consumed by real-time entertainment, just as it is for fixed line connections. However, the make-up of this category is different on mobile devices. On mobile, YouTube dominates in North America, responsible for 25.6% of aggregate bandwidth, compared to Netflix which consumes just 2.4% of all bandwidth (compared to 24.7% on aggregate for fixed line connections). Other specific applications or sites which consume a large proportion amount of mobile bandwidth are Facebook (6.8%) and Pandora streaming radio (5.8%). The two main mobile app stores are also responsible for significant

bandwidth consumption: Google Play consumes 2.6% of mobile bandwidth in North America and iTunes a further 1.3%, reflecting the higher use of Android compared to iOS in the North American market[42].

7.4 Summary

Mobile infringement is an area where further and more detailed research is vital, though that research depends on data availability. This is sorely lacking beyond a general idea of use cases for broad categories of utilisation. The application-based operating systems of Android and iOS provide challenges in monitoring behavior while the large and rapidly growing mobile device installed base is already affecting digital life and will continue to do so. NetNames plans to focus on this area during 2013 and hopes to issue a dedicated report examining infringement on mobile devices in early 2014.

[42] comScore data records Android with a 53.4% market share amongst smartphones in the US in December 2012 and Apple's iOS with 36.3%. http://www.comscore.com/Insights/Press_Releases/2013/2/comScore_Reports_December_2012_U.S._Smartphone_Subscriber_Market_Share

8 Summary

8.1 Sizing the piracy universe

The first goal of this research was to provide an estimate for the number of internet users worldwide who access infringing content online. This section draws together some of the findings of earlier sections of the report to offer an overall figure for the piracy universe.

The introductory section for each ecosystem which was discussed in Sections 3 to 6 – bittorrent, other file sharing networks, video streaming, and direct download cyberlockers – examined the different sources of data available which might be used to size each ecosystem. The specific figure that will be the base of calculations used in this Section to determine the overall use of each ecosystem for infringement was outlined. For bittorrent, this figure was decided as best represented by the total number of unduplicated visitors to bittorrent portals during January 2013 (212.8m). For the video streaming ecosystem, this figure was taken to be best represented by the total number of unduplicated visitors to video streaming link sites during January 2013 (112.5m). For the direct download cyberlocker ecosystem, the number of unduplicated visitors to cyberlocker sites during January 2013 was decided to be the best representation (228.8m). For the eDonkey, Ares, Gnutella, and Usenet networks, this figure was best represented by unique client users during January 2013 (9.3m for eDonkey, 66.6m for Ares, 2.3m for Gnutella, and 5.0m for Usenet).

As outlined, it is essential to then **account for visitors who use each ecosystem exclusively for non-infringing use** (which in this research includes pornography). This section of the report details the methodology used to account for non-infringing use and to produce a final figure for total infringing users across all ecosystems; that is, the total number of internet users who downloaded or viewed at least one piece of infringing content using at least one of the ecosystems during January 2013. As outlined in the executive summary, this method provides an ultimate worldwide total for the piracy universe in January 2013 of **432.0m internet users**.

8.1.1 Accounting for non-infringing use

Any assessment of internet use that analyses activity within ecosystems that are typically used for piracy purposes must take account of the fact that all online methods for sharing content are also used for non-infringing purposes. For purposes of this report, the term ‘non-infringing’ includes pornography. The main reason for this is that it is significantly more difficult to account for the infringing nature of a pornography film located online than, for instance, a new Hollywood release. As such, all obviously pornographic content encountered during content analysis was placed in the ‘non-infringing’ category.

This is not to suggest that infringement does not affect the adult industry: far from it, many adult studios and web sites which specialise in catering to those seeking pornography have been deeply affected by the online piracy of pornography. However, this research is focused on mainstream copyrighted content rather than adult material. Discounting pornography in this way will inevitably produce a smaller figure for the overall size of the piracy universe but it is believed that this figure will be more reliable as a result.

The content analyses conducted in Sections 3 to 6 of this report showed that on most of the ecosystems analysed, somewhere around two-thirds of all located content was infringing and not pornography – typically infringing versions of films, television, music, games, software, and books. This does not mean that two-thirds of all *downloads* from or two-thirds of all activity within each arena was infringing – or that two-thirds of all users only accessed non-infringing content. Some content is typically far more popular than others and this content is almost always infringing. For instance, the bittorrent content analysis in Section 3 found that films newly released on DVD or Bluray and new television episodes were particularly popular, for example, all of which were found to be infringing. A quick scan of ThePirateBay's "Top 100" most popular torrents[43] at almost any point in time displays a dominance of infringing films and television episodes with tens of thousands of seeds and leechers each, as well as a smaller number of infringing games, music, and software applications. Similarly, Dr Richard Waterman's analysis of the Hotfile direct download cyberlocker found that 90.2% of downloads from the direct download cyberlocker were of infringing material even though infringing material did not represent that amount of content stored on Hotfile.

In addition, internet users frequently visit sites more than once during the course of a month to obtain content: each unique visitor to ThePirateBay visited the site 4.56 times in January 2013, for instance, while the Movie2k video streaming link site was visited 5.73 times by each unique user[44]. Given the large amount of infringing content that is widely available, extremely popular, and heavily promoted on such sites, it might be easy to simply assume that the typical visitor to a bittorrent portal sought some kind of infringing content at least once during January 2013 – but that would be inaccurate. Instead, this report applies probability theory to data collected during this research to quantify the likelihood that a user sought infringing content from a site at least once during January 2013 and hence should be included in the estimate of the total piracy universe.

[43] http://thepiratebay.se/top/all

[44] comScore defines 'visits' as the number of times a person "accesses content within a Web entity with breaks between access of at least 30 minutes". See http://www.comscore.com/Insights/Press_Releases/2007/03/comScore_Announces_Visits_Metric

Probability of a user accessing infringing content

It is possible to use probability theory to work out the likelihood that a visitor to, say, a bittorrent portal will visit that site at least once to obtain infringing content over the course of a month – in this case, January 2013. This calculation uses data on the number of visits to a site made by a unique user during the month.

In order to estimate the number of, say, bittorrent users who accessed infringing content in that month and who should be included in a calculation of the total piracy universe for January 2013, it is necessary to rule out any users who did *not* do so – that is, users who *only* used bittorrent to access non-infringing or pornographic content. In January 2013, comScore recorded that each unique user of ThePirateBay visited the site **4.56 times** over the course of the month. Thus, for a user *not* to be counted in the calculation of the total bittorrent piracy universe, each one of the 4.56 visits made by the average user to ThePirateBay during January 2013 must have resulted in a user obtaining non-infringing or pornographic content. If a user accessed infringing content during any of those visits, then that user is included in the estimate of the total piracy universe.

It is assumed that the probability of each of those visits to the site resulting in the user downloading *non*-infringing content or pornography is 0.3033 – that is, as the percentage of non-infringing or pornographic content found on bittorrent overall is 30.33% (see Section 3.5), the assumption is made that the probability of a visit to ThePirateBay locating non-infringing or pornographic content is 0.3033. For this particular site, this probability actually seems quite high given the popularity of infringing material on the site (as shown in the screenshot above). However, this estimate is used as it provides a practical ceiling for the popularity of non-infringing content and pornography on bittorrent. It also minimises the chance that this report might exaggerate the infringing material available on each ecosystem.

The probability of a user only locating non-infringing or pornographic content is defined as:

$p = n \wedge v$, where:

p = probability

n = likelihood of obtaining non-infringing or pornographic content

v = number of visits

As such, a single visit (v) to a bittorrent portal such as ThePirateBay has a likelihood (n) of 0.3033 of resulting in the access of non-infringing or pornographic content. In this case, the overall probability is $n \wedge 1$ which is, simply enough, 0.3033.[45]

However, two separate visits by the same user to a bittorrent portal (thus v=2) have a probability of n^v or $n \wedge 2$ (0.3033 * 0.3033) of resulting in non-infringing or pornographic content, an overall probability of 0.092, a

[45] Another way of thinking about is to say that if 10,000 unique users visited ThePirateBay once each during the course of one month, one could expect that 3,033 of them would *only* access non-infringing or pornographic content.

much lower probability than for one visit. Three visits have a probability of n^3 (0.3033 * 0.3033 * 0.3033 = 0.028) which is an even lower probability; and so on.

According to comScore, the average user visits ThePirateBay 4.56 times each month, so the calculation is as follows:

$p = n \wedge v$

$p = 0.3033 \wedge 4.56$

$p = 0.0043$

So, as each visitor to ThePirateBay accessed the site on 4.56 different occasions in January 2013, the probability that each one of those visits resulted in the user accessing non-infringing or pornographic content – and hence, that *none* of those visits resulted in the user accessing infringing content – is $n^{\wedge 4.56}$ (or 0.3033 ^ 4.56) = 0.0043.

According to this calculation, **the overall probability of an average user accessing non-infringing or pornographic content *only* on ThePirateBay during January 2013 is thus 0.0043**. To put it in a more easily understandable way, just under half of one percent (0.43%) of all unique visitors to ThePirateBay over the course of January 2013 accessed *only* non-infringing or pornographic content during the month.[46] The obvious corollary of this is that **99.57% of unique visitors accessed infringing content through ThePirateBay** at least once during January 2013.

The same calculation was then repeated for each bittorrent portal included in this analysis, using data provided by comScore for the number of visits to each portal by the average user during January 2013 (for instance, the average Isohunt.com user visited the site on 3.03 occasions during the month but the average Rutor.org user visited that site on 7.1 occasions). Across all bittorrent portals included in this analysis, the probability of a user visiting any one site and obtaining *only* non-infringing or pornographic content is 0.0372. This means that a maximum of 3.72% of unique visitors were found to visit portals only for non-infringing or pornographic content during January 2013. The obverse of this is that **96.28% of visitors to the bittorrent portals included in this analysis downloaded at least one piece of infringing content during the month of January 2013**.

The total number of unduplicated bittorrent users was 212.8m in January 2013 (see Section 3). Combining this with the percentage of users who accessed infringing content in the same month provides a final size for the bittorrent piracy universe of **204.9m users** (212.8 * 96.28%).

The same analysis was then performed for each of the other ecosystems commonly used to obtaining infringing content that are considered in this report. For the video streaming and direct download cyberlocker ecosystems, the average number of visits made by each user to each site was combined with the

[46] Or, to repeat the explanation in the previous footnote, if 10,000 unique users each visited ThePirateBay 4.56 times during the course of one month, one could expect that only 43 of them would *only* access non-infringing or pornographic content on the site during that month.

probability that each visit resulted in the user obtaining non-infringing or pornographic content only. The results showed that in January 2013, 0.41% of users in the video streaming ecosystem and 7.95% of users in the direct download cyberlocker ecosystem visited sites *only* to obtain non-infringing or pornographic material. To put it another way, 99.57% of users in the video streaming ecosystem obtained at least one piece of infringing content during January 2013 and 92.05% of users in the direct download cyberlocker ecosystem obtained at least one piece of infringing content during the same month.

For the eDonkey, Ares, and Usenet ecosystems, the total number of days in which each client was used by a user during January 2013 was combined with the likelihood that each of those usage days would result in the user seeking only non-infringing or pornographic content.

8.1.2 Total piracy universe

Table 8.1.2 below displays the overall results of this analysis. The first column shows the total unduplicated users in each ecosystem before any attempt is made to account for the proportion of users accessing infringing content. The final row of this column shows a total aggregate user population of 635.0m users. However, this does not take account of users who may have used more than one ecosystem during January 2013 – obtained content through bittorrent and through a direct download cyberlocker, for instance. The total **unduplicated population** across all ecosystems – that is, the number of unique individual internet users who used one or more of these ecosystems during January 2012 – is **450.9m**.

Yet as noted above, there is a proportion of these users who used each ecosystem only to access non-infringing or pornographic content during January 2013. Section 8.1.1 was dedicated to showing how this portion of users were calculated. The second column outlines the percentage of infringing content found on each ecosystem. The third column shows the probability that a user of the ecosystem accessed infringing content within that ecosystem in January 2013. The final column shows the total number of users in each ecosystem who accessed infringing content at least once during January 2013 according to the probability calculations outlined above in Section 8.1.1.

Aggregating the total number of infringing users in each ecosystem provides a figure of 608.4m users. However, these users must be unduplicated to account for those involved with more than one ecosystem during January 2013. Assuming the same proportion of unduplicated to aggregate users as for the total users in the first column produces **an estimate of the current piracy universe of 432.0m users** who used at least one piracy method to access infringing content once or more during January 2013.

Table 8.1.2: Total piracy universe (comScore / NetNames)

Ecosystem	Unduplicated users in each ecosystem (m)	Percentage of infringing content found on each ecosystem	Probability of each unique user accessing infringing content at least once in January 2013	Total number of unique users who accessed infringing content (m)
BitTorrent	212.8	69.7%	0.9628	204.9
Video streaming	112.5	90.0%	0.9959	112.0
Direct download cyberlockers	228.8	66.6%	0.9205	210.6
eDonkey	9.3	68.9%	0.9999	9.3
Ares	66.6	68.9%	0.9999	66.6
Usenet	5.0	72.0%	0.9999	5.0
Total	**635.0**	n/a	n/a	**608.4**
Unduplicated users *	**450.9**	n/a	n/a	**432.0**

Numbers may not add up due to rounding.
* Unduplicated unique visitors / users of: bittorrent portals; eDonkey clients; Ares clients; Usenet clients; video streaming link sites; and direct download cyberlockers.

Notes on the table

- **BitTorrent**: uses comScore data for unduplicated unique bittorrent portal users during January 2013.
- **Video streaming**: uses comScore data for unduplicated unique visitors to video streaming link sites deemed to focus on providing links to infringing content during January 2013. Visitors to video streaming cyberlocker sites (such as PutLocker) are not included as video views from such sites are not always counted by comScore (for instance, if a video hosted on PutLocker is embedded in a link site). The proportion of infringing non-pornographic content available on linking sites is extremely high and close to 100%. To continue with the conservative approach in this area, the figure for the availability of infringing content is discounted by 10% in the low estimate to 90% to more than account for any non-infringing or pornographic material which may be present on such sites.
- **Direct download cyberlockers**: uses comScore data for unduplicated unique visitors to direct download cyberlocker sites during January 2013.
- **eDonkey**: uses comScore data for unduplicated unique users of an eDonkey client during January 2013.
- **Ares**: uses comScore data for unduplicated unique users of an Ares client during January 2013. Formal content analysis was not performed on Ares for this report but previous analysis has found that the network holds infringing and non-pornographic material at a similar proportion to eDonkey.
- **Usenet**: with the Usenext app – one method of access to Usenet – reporting 1.3m unique users each month, a conservative estimate of 5.0m unique Usenet users is employed, though this figure may be as high as 25.0m.

8.1.3 Piracy universe in three major regions

Three regions make up the majority of the internet world: North America, Europe, and Asia-Pacific comprise 82.6% of all internet users according to comScore and 95.1% of all bandwidth consumed according to Cisco. It is possible to outline the distinct size of the piracy universe in each of these three regions.

Table 8.1.3 shows similar data to that portrayed in Table 8.1.2 above for each of these three regions, separately and combined. The left-hand side of the table shows the total unduplicated users in each ecosystem in each region in January 2013 (so for North America, there 33.0m unique and unduplicated bittorrent users compared to 100.1m in Europe).[47]

The right-hand side of the table shows the total number of these unduplicated users who employed each ecosystem to access infringing content. The right-hand side is determined in the same way as the far right-hand column in Table 8.1.2 but using visitor figures for the specific region rather than the worldwide visitor figures.

Table 8.1.3: Piracy universe in three regions (comScore / NetNames)

	Total unduplicated users in each ecosystem (m)				Total number of unique unduplicated users who accessed infringing content (m)			
Ecosystem	North America	Europe	Asia-Pacific	**Combined**	North America	Europe	Asia-Pacific	**Combined**
BitTorrent	33.0	100.1	52.4	185.63	31.8	96.4	50.5	178.7
Video streaming	28.8	48.2	19.7	96.70	28.6	48.0	19.6	96.3
Direct download cyberlockers	22.2	75.6	63.8	161.46	20.4	69.5	58.7	148.6
eDonkey	0.3	5.5	2.5	8.24	0.3	5.5	2.5	8.3
Ares	7.8	15.7	0.7	24.24	7.8	15.7	0.7	24.3
Usenet	0.9	3.0	0.5	4.38	0.9	3.0	0.5	4.4
Total	**92.9**	**248.1**	**139.6**	**480.7**	**89.8**	**238.2**	**132.5**	**460.6**
Unduplicated users *	**66.0**	**176.2**	**99.1**	**341.2**	**63.7**	**169.1**	**94.1**	**327.0**

Numbers may not add up due to rounding.
* Unduplicated unique visitors / users of: bittorrent portals; eDonkey clients; Ares clients; Usenet clients; video streaming link sites; and direct download cyberlockers.

Across the three major regions (North America, Europe, and Asia-Pacific), **327.0m unique and unduplicated internet users were found to access infringing content in January 2013**. Europe provided 51.7% (169.1m) of those users; Asia-Pacific provided 28.8% (94.1m); and North America provided 19.5% (63.7m).

[47] Regional figures are calculated by examining the regional breakdown of users for each site within each ecosystem for January 2013 according to comScore data.

8.2 Infringing bandwidth use

The second aim of this report was to repeat and enhance upon the ground-breaking research published by Envisional in 2011 into the amount of infringing bandwidth used by different infringement methods. This earlier report estimated that in 2010, 23.8% of worldwide bandwidth and 17.5% of bandwidth in North America was used for infringing purposes. As noted earlier in this report, data limitations meant that it was not possible to repeat the exact calculations that led to the production of a single figure for worldwide infringing consumption of bandwidth.

For this updated research, data was obtained from two main sources: Sandvine provided analysis of specific types of bandwidth consumption within three regions of the world (North America, Europe, and Asia-Pacific) and data was also drawn from Cisco on the overall growth in bandwidth use both worldwide and in different regions of the world.

The Cisco data demonstrated the extent to which the absolute amounts of bandwidth consumed increased between 2010 and 2012 and the extent to which bandwidth consumption increased per individual internet user. Overall bandwidth consumption roughly doubled in this period in all regions of the world as Table 8.2.1 shows. Cisco recorded worldwide consumption of bandwidth growing by 109.0% between 2010 and 2012. In North America, overall bandwidth consumption grew by 105.0%; in Europe, 109.6%; and in Asia-Pacific, 111.2%. These are substantial increases over a relatively short period of time but the velocity of increase shows little sign of slowing. Cisco believes internet traffic will triple between 2012 and 2016, for instance. Bandwidth consumption also grew per individual internet user between 2010 and 2012.

Table 8.2.1 calculates the estimated bandwidth consumption both on an absolute and per internet user basis in these three regions in 2010 and 2012, using data from Cisco on bandwidth use and from the ITU on the internet user population in the different regions.

Table 8.2.1: Bandwidth consumption, 2010-2012 (Cisco / ITU)

	2010			2012			Change 2010-2012	
	Monthly regional bandwidth consumption (petabytes)	Internet users (millions)	Monthly consumption per user (GB)	Monthly regional bandwidth consumption (petabytes)	Internet users (millions)	Monthly consumption per user (GB)	Overall	Per user
Worldwide	20,181.6	1,966.00	10.3	42,188.9	2,497.00	19.5	**+109.0%**	**+ 90.1%**
North America	6,987.2	267.65	26.1	14,320.5	273.67	54.9	**+105.0%**	**+ 110.2%**
Europe	5,484.2	476.21	11.5	11,496.5	518.51	23.2	**+109.6%**	**+ 101.9%**
Asia-Pacific	6,782.1	932.39	7.3	14,322.8	1,076.68	13.9	**+111.2%**	**+ 91.8%**

As noted, bandwidth consumption data from Sandvine was used to outline overall bandwidth use in three regions of the world during 2012. Previous sections of this report calculated the level of infringing bandwidth use in each region for each infringement ecosystem. Table 8.2.2 below shows two sets of data. The left-hand side shows the change in the absolute levels of infringing bandwidth consumption for each category as well

as on a per user basis. The right-hand side shows the total amount of infringing bandwidth use in each of the three regions. This ranges from 11.35% in North America to 34.96% in Asia-Pacific.

For North America, the figures shown for the change in infringing bandwidth use Sandvine data for bandwidth for the North American region in both 2010 and 2012. However, it was not possible to collect data from Sandvine for bandwidth use explicitly for Europe and Asia-Pacific in 2010, though it was available for 2012. As such, the figures for the change in bandwidth use between these dates for the Europe and Asia-Pacific regions use worldwide bandwidth figures for 2010 but dedicated figures for each region alone in 2012. As such, the results for bandwidth *change* for Europe and Asia-Pacific are not as reliable as those for North America. This factor does not affect at all the right-hand side of the table which shows total infringing bandwidth use in each region for 2012.

Table 8.2.2: Infringing bandwidth use summary (NetNames / Cisco / Sandvine)

	Change in infringing bandwidth use, 2010-2012						**Infringing bandwidth percent, 2012 (Sandvine)**		
	North America		**Europe**		**Asia-Pacific**				
Category	Absolute	Per user	Absolute	Per user	Absolute	Per user	**North America**	**Europe**	**Asia-Pacific**
BitTorrent	105.1%	100.6%	191.3%	167.6%	403.4%	335.9%	8.70%	15.10%	25.90%
Video streaming	154.2%	148.5%	345.8%	309.4%	925.0%	787.6%	1.80%	2.87%	6.55%
Cyberlockers	-74.5%	-75.1%	-45.5%	-49.9%	-53.3%	-59.6%	0.26%	1.27%	1.08%
eDonkey	-58.9%	-59.5%	767.8%	697.0%	-57.3%	-63.0%	0.28%	7.17%	0.35%
Gnutella	-97.6%	-97.6%	-99.0%	-99.1%	-81.9%	-99.1%	0.01%	0.01%	0.01%
Usenet	-31.0%	-32.5%	-12.9%	-20.0%	-81.9%	-84.4%	0.30%	0.34%	0.07%
Total	**48.2%**	**44.9%**	**165.4%**	**143.7%**	**239.3%**	**193.8%**	**11.35%**	**26.76%**	**34.96%**

The table clearly shows **significant overall increase in the consumption of infringing bandwidth between 2010 and 2012 in all three regions**.

- In North America, the **absolute amount of content consumed via infringement increased by 48.2% overall and by 44.9% per user**. Despite the overall percentage of infringing bandwidth falling from 17.5% in 2010 to 11.35% in the two-year period, **the amount of infringement in North America has risen**.
- In Europe, the amount of infringing bandwidth increased by 165.4% overall and by 143.7% per user. **More than one-quarter of all bandwidth in Europe is consumed by infringing content**.
- In Asia-Pacific, the bandwidth consumed by infringement tripled overall and increased by 239.3%. It also increased by 193.8% per user. **More than one-third of all bandwidth in Asia-Pacific is taken up by the distribution of infringing content.**

BitTorrent and video streaming are the main drivers of increased levels of infringement, with the amount of bandwidth that is consumed by infringing use of bittorrent more than doubling in all three regions of the world between 2010 and 2012, both in absolute terms and per user. This increase is particularly high in Asia-Pacific.

The contribution of video streaming to infringing bandwidth consumption has also increased – by more than a factor of four in Europe and by more than ten times in absolute terms in Asia-Pacific.

The consumption of infringing bandwidth by direct download cyberlockers has dropped across all three regions, likely affected by the closure of the MegaUpload direct download cyberlocker in January 2012 and the consequent disruption to the direct download cyberlocker ecosystem. Gnutella use has fallen to almost nothing while Usenet consumption has also decreased slightly in North America and Europe and significantly in Asia-Pacific.

The eDonkey file sharing network shows a decrease in bandwidth use in North America and Asia-Pacific but a substantial increase in Europe. This large change in eDonkey use in the region does not reflect other data shown in Section 4 which suggests declining popularity of the network worldwide. However, the result may be at least partly explained as an artefact from the previously mentioned use of worldwide data as a base for the comparison of bandwidth for Europe for 2010. Europe is known to be the region in which the heaviest use of eDonkey is conducted and comparing the relatively high use of eDonkey in that region alone for 2012 with overall bandwidth consumption from eDonkey worldwide two years before might obfuscate the true (lower) rate of change.

The decline in the use of the file sharing network Gnutella occurred after legal action against the owners of the LimeWire client was eventually successful in closing the company in 2010. The virtual disappearance of Gnutella as a significant consumer of internet bandwidth during the two year monitoring period demonstrates how abruptly user behaviour can change on the internet.

8.3 Conclusion

This piece of research had two major goals. First, to attempt to accurately size the overall piracy universe online: how many internet users regularly obtain infringing content using the different ecosystems available to them? Second, to repeat and extend previous analysis performed on the bandwidth consumption of infringing content: how much internet bandwidth is consumed by the distribution of infringing material and did that amount increase in the two years since the previous study on this subject?

There are two key conclusions:

- **The piracy universe comprises hundreds of millions of unique internet users**. **Three hundred and twenty seven million unique internet users worldwide** regularly turn to piracy ecosystems to obtain infringing content. Piracy is rampant across the internet, with free copies of films, television episodes, games, music, software, and books consumed through a variety of technical means.
- Second, **levels of infringement are increasing**. Analysis of bandwidth consumption using data from Sandvine and Cisco demonstrates that not only has the overall amount of bandwidth consumed by popular piracy ecosystems such as bittorrent and video streaming increased in the last two years, **but the amount of infringing content consumed by each internet user has risen substantially**.

The practise of infringement is tenacious and persistent. Even in the North American market, where legitimate distribution services such as Netflix and Pandora are in their most mature state, infringement has grown substantially since 2010 in both absolute and per user terms.

There have been some successful attempts to limit infringement. The legal action against the operators of LimeWire, for instance, effectively put an end to the use of Gnutella for widespread infringement, and the multi-national law enforcement operation against MegaUpload and MegaVideo caused significant amounts of disruption within the direct download cyberlocker ecosystem. Yet despite these discrete instances of success, and despite the wide availability in some regions of methods to consume material legitimately, the piracy universe not only persists in attracting more users but hungrily consumes increasing amounts of bandwidth.

9 Appendix A: Selected sites

The sites featured in the following lists are those used to calculate the charts for web site popularity in Sections 3, 5, and 6. Each site featured at least once in the calculation of the aggregate or unduplicated visitor figure for site visitors for comScore data between July 2009 and January 2013. Those sites which featured at least once in the monthly top twenty list used for the long-term comScore analysis are coloured in **red**.

9.1 BitTorrent portals

1337x.org
9bt.org
ahashare.com
arenabg.com
baixakifilmetorrent.com.br
baixarfilmestorrentgratis.net
baixartorrent.net
banglatorrents.com
bestxl.com
bigtorrent.org
bigtorrento.ru
bigtorrents.org
bitfish8.com
bitnova.info
bitreactor.to
bitsnoop.com
bitsoup.org
bittorrent.am
bittrend.com
bitturk.net
bitvn.org
bt-chat.com
btchina.net
btloft.com
btmee.com
btmon.com
btwuji.com
coda.fm
contorrent.com
cpasbien.com
cztorrent.net
d-addicts.com
demonoid.com (also .me)
desibbrg.com
desitorrents.com
divxtotal.com
dmhy.org
dvdtorrent.ru
ebookshare.net
elitetorrent.net
etorrent.ru
exdesi.com
extratorrent.com
eztv.it
fapis.com
fast-torrent.org
fast-torrent.ru
fenopy.eu (also .se, .com)
file.lu
file.sh
films-torrent.ru
firebit.org
free-torrents.org
fulldls.com
gamestorrents.com
goldenshara.com
gougou.com
h33t.com
hdbird.com
hdvnbits.org
iklangratiz.com
ilcorsaronero.info
indytorrents.org
iptorrents.com
isohunt.com
kat.ph (also kickasstorrents.com)
katushka.net
kinokopilka.tv
kinozal.tv
ktxp.com
lasttorrents.org
lien-torrent.com
limetorrents.com
linkomanija.net
lokotorrents.com
malaysiabay.org
maroctorrent.net
mastitorrents.com
megadown.eu
megashara.com
megatorrents.org
mejortorrent.com
mininova.org
mixtapetorrent.com

mnova.eu
monova.org
moviesdvdr.com
my-hit.ru
newtorrents.info
nnm-club.ru
nowtorrents.com
nyaa.eu
nyaatorrents.org
omgtorrent.com
onebigtorrent.org
onlytorrents.com
opentorrent.ru
p2pbg.com
picktorrent.com
piratbit.net
piratebayuk.co.uk
pirateproxy.net
piratereverse.info
pirateshit.com
pornal.biz
psychocydd.co.uk
qkshare.com
queentorrent.com
rarbg.com
rus-torrents.ru
rutor.org
rutracker.org
scrapetorrent.com
seedoff.net
seedpeer.me
seventorrents.com
smartorrent.com
subtorrents.com
sumotorrent.com
t411.me (also torrent411.com)
take.fm
tamilcreation.com
tamiltorrents.net
tfile.me
thepiratebay.se (also .org)
theunblockedbay.info
tnttorrent.info
todotorrents.com
top-torrent.ws
torcache.net
torentilo.com
torlock.com
torrent.cd
torrent.to
torrentalot.com
torrentbit.net
torrentbox.com
torrentbutler.eu
torrentcrazy.com
torrentdeluxe.com
torrentdownloads.be
torrentdownloads.me (also .net)
torrent-files.org
torrent-finder.info
torrentfrancais.com
torrent-francais.com
torrent-free.ru
torrentfunk.com
torrenthound.com
torrentino.com
torrentino.ru
torrentino.tv
torrentleech.org
torrentman.com
torrento.net
torrent-oyun.com
torrentpond.com
torrentportal.com
torrentproject.com
torrentr.eu
torrentreactor.net
torrentresource.com
torrentrg.com
torrentroom.com
torrents.net
torrents.net.ua
torrents.ru
torrent-shara.net
torrentsland.com
torrentsmd.com
torrentspy.com
torrentszona.com
torrentz.eu (also .com)
torrentzap.com
torrtilla.ru
tvtorrents.com
unblockedpiratebay.com
vertor.com
viettorrent.vn
wahas.com
x-torrents.org
yify-torrents.com
yourbittorrent.com
yyets.net
zamunda.net
zoozle.net

9.2 Video streaming link sites

0movies.com
123tamiltv.com
1channel.ch (also .com)
1kino.com
24kadra.com
alluc.org
awz.ru
bestkino.su
bharathcinemas.info
bharatmovies.com
blinkx.com
cine24.tv
cinebasti.com
cinemaxx.ru
cinetube.es
cinetux.org
cinevedika.net
cucirca.com
cuevana.tv
cuevana2.tv
delishows.com
desifun.co.uk
desirulez.net
desitvforum.net
djluv.in
dpstream.net
duoi.net
fastepisodes.net
fastpasstv.ms (also .com)
film4ik.ru
filmin.ru
filmlinks4u.net
film-online.su
free-tv-video-online.me
graboid.com
hindilinks4u.net
iitv.info
imovies4you.com
iwannawatch.ch (also .net)
joox.net
ketnooi.com
kinobomba.net
kinolimon.ru
kino-live.org
kinomaniak.tv
kinomatrix.com
kinox.to
letmewatchthis.com
linecinema.org
maniavid.com
moovyshoovy.com
movie25.com
movie2k.to
movieberry.com
moviesberg.net
moviesdatacenter.com
movie-stream.to
my-source.ru
new-kino.net
ninjavideo.net
oko-kino.ru
onlinemoviesfreee.com
onlinesfilms.com
onlinewatchmovies.net
peekvid.com
peepat.com
peliculasyonkis.com
phim1.biz
phim16.com
phim3s.net
phim4g.com
phim85.com
phimkfc.com
phimnhanh.net
playtube.pl
quicksilverscreen.ch (also .com)
rajtamil.com
rajubutt.com
series.ly
seriesdanko.com
serieslisting.com
seriespepito.com
seriesyonkis.com
sidereel.com
smotri-online.info
solarmovie.so (also .eu)
surfthechannel.com
taiphimonline.com
tamiltwist.com
teleplus.ru
telly-tv.com
thiruttuvcd.com
totalmovie.com
tubeplus.me
tv-links.co.uk
tv-links.eu
tvduck.com
tvmuze.com
tvshack.net (also .bz)
tvshow7.eu
video247.tv
videobull.com
videomasti.net
viooz.eu
vuaphim.net
watch-free-movie-online.net
watchfreemovies.ch
watch-freeseries.mu
watch-hindi-movies.com
watch-movies.net
watchseries.li (also .eu)

watchseries-online.eu
watchseriesus.com
watchtvfree.co
watchtvshow.info
xemphimon.com
xemphimso.com
xemphimtot.com
yaske.net
zerx.ru
zmovie.co
zmovie.tv

9.3 Video streaming hosts

allmyvideos.net
clicktoview.org
daclips.in
divxstage.eu
duckload.com
faststream.in
filebox.com
filego.org
flashstream.in
flashx.tv
gorillavid.in
loombo.com
megavideo.com
miloyski.com
moevideos.net
movpod.in
movreel.com
movshare.net
nosvideo.com
novamov.com
nowvideo.eu
played.to
potlocker.net
primeshare.tv
putlocker.com
senseless.tv
sharerepo.com
sixshare.com
sockshare.com
stream2k.eu
streamcloud.eu
tomwans.com
uploadc.com
veehd.com
veervid.com
veevr.com
vidbull.com
vidbux.com
videobb.com
videopremium.net
videoslasher.com
videoweed.es (also .com)
videozed.net
videozer.com
vidstream.in
vidxden.com
vreer.com
vureel.com
watchfreeinhd.com
xtshare.com
xvidstage.com
zalaa.com
zooupload.com
zshare.ma (also .net)

9.4 Direct download cyberlocker link sites

123tamilforum.com
300mblinks.com
acheidownload.biz
amaderforum.com
anicole.net
anime-sharing.com
apne.tv
arabseed.com
argentinawarez.com
baguskurniawan.com
baixae.com
baixarfilmescompletos.com
baixedetudobr.com
baixemuito.com
baixeturbo.org
ba-k.com
bartzmovie.com
blog-peliculas.com
boerse.bz
bollyrulez.net
bollyzone.ch

bppaste.com
brasildowns.com.br
butorrent.com
cinebasti.com
cinetux.org
darkwarez.pl
ddlspot.com
derinport.in
descargarfull.com
descargarpelicula2.com
divxm.com
dl4all.com
dl4v.com
downeu.net
downparadise.ws
downtwarez.com
dpelicula.net
dreamkino.net
egydown.com
esoft.ws
estamosrodando.com
estrenosonline.org
exvagos.com
filecrop.com
filesabc.com
fileshut.com
filesonicsearch.com
filespart.com
filestube.com
filetram.com
filmmediafire.com
flmsdown.net
forodirecto.com
forumw.org
forumwizard.net
freshwap.me (also .com)
fulldescargasdvd.com
fullpelis.com
ganool.com
general-files.com
getmediafire.net
golden-ddl.com
gratismusica.org
gratispeliculas.org
hackstore.net
hindiserials.tv
hitkino.org
hnmovies.com
hotfilesearch.com
icefilms.info
iload.to
irfree.com
israbox.com
jpddl.com
kangwahyu.com
katz.cd
kino.to
kinokubik.com
kino-reliz.com
kzshare.com
lacuevana.org
leecher.to
leecher.to
libertyland.tv
lospirateros.net
mamega.com
marvincity.com.ar
megadownload.net
megarapid.net
megasearchupload.com
monsterdivx.com
moova.ru
movie-blog.org
moviedetector.com
moviespack.com
moviespeliculas.net
moviz.net
multfilmchik.ru
musicasparabaixar.org
mygully.com
nazuka.net
omelhordatelona.biz
ourrelease.org
oxe7.com
peb.pl
peliculas4.com
peliculas-latino.net
pobieramy24.pl
pordescargadirecta.com
raidrush.ws
rapidlibrary.com
redlist-ultimate.be
rlsbb.com
rlslog.net
rpds-download.net
samouchka.net
sempregratis.org
serienjunkies.org
sharepirate.com
skidrowcrack.com
sos117.com
taringa.net
tehparadox.com
telechargementz.org
telecharger-tout.com
terabit.biz
tinydl.com
tinymoviez.com
tipete.com
torrentspain.com
trackvideo.ru
uyirvani.com
vagos.es
verpeliculasonlines.com
warez-bb.org
waz-warez.org
yesfilmes.org

zasca.com

zonadictoz.org

zone-telechargement.com

9.5 Direct download cyberlockers

180upload.com

1fichier.com

1st-files.com

2shared.com

4shared.com

albafile.com

amonshare.com

asfile.com

badongo.com

bayfiles.com

billionuploads.com

bitshare.com

cramit.in

crocko.com

cyberlocker.ch

czshare.com

datafilehost.com

dataport.cz

dbank.com

depositfiles.com

edisk.cz

egofiles.com

exoshare.com

extabit.com

fastshare.cz

fastshare.org

faststream.in

filebase.to

filebox.com

filedownloads.org

filedropper.com

filefactory.com

fileflyer.com

filegag.com

filejungle.com

filemates.com

filenuke.com

filepost.com

filerio.in

filesend.net

filesmelt.com

filesmonster.com

filesonic.com

filesserve.com

filestock.ru

filestore.to

fileswap.com

file-upload.net

freakshare.net

fshare.vn

gigasize.com

hellshare.com

hipfile.com

hitfile.net

hostuje.net

hotfile.com

hulkshare.com

ifile.it

jandown.com

jheberg.net

jumbofiles.com

leteckaposta.cz

letitbit.net

limelinx.com

load.to

lumfile.com

mediafire.com

megashares.com

megaupload.com

mlfat4arab.com

muchshare.net

multishare.cz

myupload.dk

netload.in

openfile.ru

oron.com

partage-facile.com

project-free-upload.com

putshare.com

queenshare.com

quickshare.cz

rapidgator.net

rapidshare.com

rapidshare.de

rarefile.net

rghost.net

rusfolder.com

ryushare.com

secureupload.eu

sendspace.pl

sharecash.org

shareflare.net

share-online.biz

shareplace.com

speedshare.org

tinyupload.com

turbobit.net

ufox.com

uloz.to

ultramegabit.com

ultrashare.net

unextfiles.com

upgrand.com

upload.com.ua

uploadc.com

uploadcore.com
uploaded.net
uploadhero.co
uploadhero.com
uploading.com
uploadstation.com
upnito.sk
uptobox.com
usaupload.net
venusfile.com
verzend.be
vidpe.com
vip-file.com
wrzuc.to
wupload.co.uk
wupload.com
wyslijto.pl
x7.to
ziddu.com
zippyshare.com

10 Appendix B: Detailed data

A: Infringing unique visitors: comparison between November 2011 and January 2013

Unique Visitors (millions)	Worldwide		Combined North America, Europe, and Asia-Pacific		North America		Europe		Asia Pacific	
	2013	2011	2013	2011	2013	2011	2013	2011	2013	2011
Total infringing unique visitors	432.00	417.80	326.98	297.63	63.75	45.37	169.14	158.92	94.09	93.34
% Change	3.40%		9.86%		40.49%		6.43%		0.80%	
Total internet audience	1,530.90	1,438.88	1,264.04	1,183.50	215.69	210.48	409.31	378.47	639.04	594.54
% Change	6.40%		6.81%		2.47%		8.15%		7.48%	
Infringing visitors as percent of total internet audience	28.22%	29.04%	25.87%	25.15%	29.56%	21.56%	41.32%	41.99%	14.72%	15.70%
% Change	-2.82%		2.86%		37.10%		-1.59%		-6.22%	
BitTorrent infringing unique visitors	204.88	161.76	178.73	144.58	31.81	22.96	96.42	71.78	50.49	49.84
% Change	26.66%		23.61%		38.54%		34.33%		1.31%	
Video streaming infringing unique visitors	112.00	91.65	96.29	75.40	28.65	18.94	48.03	43.82	19.61	12.64
% Change	22.21%		27.69%		51.28%		9.60%		55.07%	
Direct download cyberlocker infringing unique visitors	210.61	229.62	148.62	160.99	20.39	19.94	69.55	78.20	58.69	62.85
% Change	-8.28%		-7.68%		2.27%		-11.07%		-6.62%	

B: Infringing page views: comparison between November 2011 and January 2013

Page views (billions)	Worldwide		Combined North America, Europe, and Asia-Pacific		North America		Europe		Asia Pacific	
	2013	2011	2013	2011	2013	2011	2013	2011	2013	2011
Total infringing page views	16.64	15.66	13.91	12.67	2.89	2.17	7.17	6.51	3.85	3.98
% Change	6.25%		9.84%		33.25%		10.07%		-3.27%	
Total infringing page views - bittorrent	8.47	6.33	7.39	5.66	1.32	0.90	3.99	2.81	2.09	1.95
% Change	33.82%		30.60%		46.36%		41.92%		7.03%	
Total infringing page views – video streaming	4.93	3.83	4.23	3.15	1.26	0.79	2.11	1.83	0.86	0.53
% Change	28.56%		34.34%		59.16%		15.31%		63.14%	
Total infringing page views – direct download cyberlockers	3.24	5.50	2.29	3.86	0.31	0.48	1.07	1.87	0.90	1.51
% Change	-41.03%		-40.64%		-34.31%		-42.82%		-39.95%	

C: Infringing bandwidth: comparison between 2011 and 2013

Note: regional bandwidth data was only available for North America, Europe, and Asia-Pacific and hence worldwide data could not be produced for many data points.

Bandwidth (petabytes)	Worldwide		Combined North America, Europe, and Asia-Pacific		North America		Europe		Asia Pacific	
	2013	2011	2013	2011	2013	2011	2013	2011	2013	2011
Total Infringing Bandwidth			9,566.7	3,689.6	1626	1,097.1	3,075.8	1,158.7	4,863.6	1,433.2
% Change			159.29%		48.21%		165.45%		239.35%	
Total Internet Bandwidth	42,189	20,181	40,139.8	19,253.5	14,320.5	6,987.2	11,496.5	5,484.2	14,322.8	6782.1
% Change	109.05%		108.48%		104.95%		109.63%		111.19%	
% Infringing of Total Bandwidth		23.70%	23.83%	19.16%	11.35%	15.70%	26.75%	21.13%	33.96%	21.13%
% Change			24.37%		-27.69%		26.63%		60.69%	
BitTorrent Infringing Bandwidth			6,691.5	1,940.2	1,245.9	607.4	1,735.9	595.9	3,709.6	736.9
% Change			244.89%		105.12%		191.31%		403.41%	
Video Streaming Infringing Bandwidth			1,526.9	267	257.8	101.4	329.9	74	938.1	91.5
% Change			471.87%		154.24%		345.81%		925.25%	
Direct Download Cyberlocker Infringing Bandwidth			337.9	745.2	37.2	146.2	146	267.8	154.7	331.1
% Change			-54.66%		-74.56%		-45.48%		-53.28%	
Other (eDonkey, Gnutella, Usenet)			1,010.4	737.2	85.1	242.1	864	221	61.2	273.7
% Growth			37.06%		-64.85%		290.95%		-77.64%	