



Measuring a year of child pornography trafficking by U.S. computers on a peer-to-peer network[☆]



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ABSTRACT

We used data gathered via investigative “RoundUp” software to measure a year of online child pornography (CP) trafficking activity by U.S. computers on the Gnutella peer-to-peer network. The data include millions of observations of Internet Protocol addresses sharing known CP files, identified as such in previous law enforcement investigations. We found that 244,920 U.S. computers shared 120,418 unique known CP files on Gnutella during the study year. More than 80% of these computers shared fewer than 10 such files during the study year or shared files for fewer than 10 days. However, less than 1% of computers ($n=915$) made high annual contributions to the number of known CP files available on the network (100 or more files). If law enforcement arrested the operators of these high-contribution computers and took their files offline, the number of distinct known CP files available in the P2P network could be reduced by as much as 30%. Our findings indicate widespread low level CP trafficking by U.S. computers in one peer-to-peer network, while a small percentage of computers made high contributions to the problem. However, our measures were not comprehensive and should be considered lower bounds estimates. Nonetheless, our findings show that data can be systematically gathered and analyzed to develop an empirical grasp of the scope and characteristics of CP trafficking on peer-to-peer networks. Such measurements can be used to combat the problem. Further, investigative software tools can be used strategically to help law enforcement prioritize investigations.

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Introduction

Online child pornography (CP) trafficking has become a serious crime problem in the United States and worldwide, fostered by the development of online and digital technologies (Beech, Elliott, Birgden, & Findlater, 2008; Jenkins, 2001; Wolak, Finkelhor, & Mitchell, 2011; Wortley & Smallbone, 2012). We use the term *trafficking* because it denotes an illegal trade, which accurately describes the online trade in child pornography. Photographs and videos that contain child pornography are contraband because they show actual children being sexually abused and exploited (Wolak, Finkelhor, & Mitchell, 2005a). The crimes that constitute online CP trafficking (i.e., using the Internet to distribute or acquire CP) are unusual because they are a form of child sexual exploitation that involves no direct interaction with a victim. However, CP trafficking is not a victimless crime; the children and adolescents pictured in the images are victims of exploitation and often abuse by the

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producers of the images (Wolak, Finkelhor, & Mitchell, 2005b; Wolak, Finkelhor, Mitchell, & Jones, 2011). In addition, victims who realize their images are trafficked online may suffer from knowing their images are viewed for sexual purposes (Bazon, 2013; Svedin & Back, 1996; Weiler, Haardt-Becker, & Schulte, 2010).

In this paper, we describe our progress, joint with law enforcement, in investigating and measuring online CP trafficking in peer-to-peer (P2P) file sharing networks. P2P networks are said to be major online locations of the illegal trade in CP (Koontz, 2005; U.S. Department of Justice, 2010). Increasing proportions of U.S. arrests for CP possession and distribution involve offenders who used P2P networks to acquire CP, from 4% of all such arrests in 2000 to 61% in 2009 (Wolak, Finkelhor, & Mitchell, 2012). Although any online venue that can be used to transmit or post photographs or videos can be used to distribute or acquire CP, P2P networks make especially large contributions to the problem because of their worldwide range, public nature, and the easy access they provide to child pornography (Latapy, Magnien, & Fournier, 2013; Steel, 2009).

Research on the extent to which CP trafficking occurs on P2P networks is limited, however, and systematic measurements of the size of the problem, which could help law enforcement and policy makers understand its scope and characteristics, are scarce. There has been some research about the amount of CP trafficking in P2P networks, but most studies have been narrow in scale. For example, several researchers have documented the presence of CP on P2P networks (Hughes, Walkerdine, Coulson, & Gibson, 2006; Latapy et al., 2013; Prichard, Watters, & Spiranovic, 2011) or analyzed searches by P2P users to determine the percentage that appear to be requests for CP (Rutgaizer, Shavitt, Vertman, & Zilberman, 2012; Steel, 2009).

In contrast, our work paints a broader and more detailed picture by characterizing online activities by computers trafficking in CP on a P2P network over a year's time. Two previous papers published for the computer science field described worldwide patterns of CP trafficking on the Gnutella and eMule P2P networks (Hurley et al., 2013; Liberatore, Levine, & Shields, 2010). The present study is aimed at informing researchers, practitioners, law enforcement, and policy makers in the child maltreatment field about how CP trafficking in P2P networks can be measured and how such measurement can lead to strategic responses to combat and possibly even reduce the amount of CP available online. We measure CP trafficking activity by U.S. computers located on one P2P network, Gnutella, and provide perspective about how U.S. activity contributes to CP trafficking worldwide.

P2P File Sharing Networks

P2P file sharing networks are vast global systems used by millions of people to acquire, for free, popular music, current television shows, movies, electronic books, and other digital material from network users who are willing to share items in their possession. Media attention has focused on unauthorized sharing of copyrighted music and video files, but pornography is also widely available. This includes both legal images featuring adults and child pornography.

In general, individuals become P2P users by downloading software that connects them to the computers of other users in a network (e.g., Gnutella, BitTorrent, Ares). These other users could be located anywhere in the world. The software allows users to log onto the P2P network and issue requests for and download files from other network users, called *peers*. Users create shared folders that are accessible to others in the network and use these folders to receive downloaded files and also to share files they possess. Procedures vary somewhat among networks, but in most, users search for electronic files by using keywords, which are broadcast to the network of participating peers. Certain keywords are specifically associated with CP, but network users do not have to know these to obtain CP. Users can locate and acquire files by employing search terms that, for example, describe sex acts and children's ages, which are often contained in CP file titles and tags (Steel, 2009).

When a search finds a relevant file, the network generates an automated response that identifies the network location of the computer with the file and information about the file (e.g., size, name). If the user requests to download the file, the file is transferred. Searches may locate duplicates of requested files in shared folders from multiple computers, and downloads can be made simultaneously from such multiple sources. When this happens, each source contributes a portion of the file, in which case the file can be downloaded more quickly.

There are several reasons P2P networks may be particularly attractive to CP traffickers. First, CP on P2P networks is free and publically accessible. Any person with access to the Internet can connect to a P2P network, and any P2P user who wants to obtain CP can do so. Second, P2P networks do not make use of servers, thus, users can transmit illegal material without oversight from electronic service providers. Third, P2P networks may be more anonymous than other means used to acquire or distribute CP online, most of which require more direct contact with others. For instance, to transmit CP via email or text message, senders must direct communications to specific addresses. To access CP on websites, image boards, social networking, and similar sites, persons generally must know the CP distributor, join an online group, or find and pay for access to an illegal website, which may require credit card or other information to allow for payment. In contrast, CP traffickers who use P2P networks do not have to risk personal contact with other individuals or reveal their identities. To acquire CP, they simply search for material and download what they find into a shared folder. To distribute CP, they simply upload files into a shared folder, which allows others to find the material when they search for it. Given that P2P networks have millions of users and CP can be acquired and distributed as easily as other content, CP traffickers who consider the risk of being singled out and pursued by law enforcement may feel it is quite low.

This easy access to child pornography on P2P networks may create distinct harms. Network users who are curious about CP can easily satisfy their curiosity, and finding it so easily may make viewing CP seem normal and acceptable (Quayle & Taylor, 2002). Individuals who might not have become CP traffickers may do so after encountering the material in P2P networks. Easy access to CP in P2P networks also may foster the proliferation of CP. Every time a CP file is downloaded, a

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