

# File-Sharing and the Darknet

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## INTRODUCTION

The public interest in free information exchange is considerable. Besides textual information, this includes multimedia content, data sets and software as well. Compared to text data, the latter require the transfer of huge data volumes, which cannot be handled via Email, forums or chats. In part, the Internet is also rooted in this interest. (Nelson et al., 1981) addressed the global exchange of research results as early as 1960 in the Xanadu project.

However, the free exchange of information can also be misused for illegal measures, including copyright violations, the distribution of child pornography, illegal propaganda or instructions for building explosives. The degree of stigmatization for these use cases varies largely. Large parts of the Internet community has always supported the uncontrolled distribution of copyrighted material. This has led to a constant battle between copyright holders and file sharing activists, with technological advances on both sides. The automated crawling of IP addresses by file sharing peers was answered by obfuscation measures, which can be seen as first approaches to privacy networks. Legal discussions about the impact of file sharing for copyrights were initiated as well (Wood, 2009).

These networks allowed distributing arbitrary file types, often arguing with privacy and the risk of censorship in more public file distribution networks and mentioning documents with political backgrounds as the typical data to be shared. However, they were also utilized for the file sharing of mp3s and movies. Child pornography is reported to be commonly shared via such protected networks as well.

Privacy networks and the file sharing in it are typical examples of a dual use, but this work will not be discussing the pros and cons. Every side will find arguments either for supporting or prohibiting this technology. In addition, the legal aspects of file sharing and copyright differ depending on the country. Our aim is to show which role file sharing and the growing need for privacy within it played in the development of privacy networks and how to achieve privacy in file sharing networks today.

## BACKGROUND

With increasing download speeds and the general growth of the Internet, sharing content over the Internet became more and more common. Even before the world wide web was introduced, mailing lists and FTP servers were used to access illegal copies of photos, documents or (with the rise of mp3) songs. The first file sharing methods were still centralized and depended on a server. Law enforcement or administrators could easily attack these servers. This led to the adoption of alternative infrastructures, the peer-to-peer networks. File sharing via peer-to-peer networks has been used for the exchange and distribution of copyrighted material since the advance of this technology.

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This section discusses the history of illegal content distributed via the Internet, commonly called 'warez', and first general approaches to distributed warez without being monitored and sued.

### **Bulletin Boards**

The concept of warez existed even before the Internet as we know it today. The book NO COPY reports from the origins of today's warez scene (Kroemer & Sen, 2006). In the 80's copyrighted contents were distributed in so-called Bulletin Board Systems (short: BBS). The dial-in into these forums was not as common as today and typically only technically interested people met there.

In these small communities, it was important that members actively supported the community before downloading, for example by uploading their own content or commercial software with removed copy protection. Commercial interests were almost not existent. At the end of the 1990s, the law enforcement took stronger action against this community.

This led to uncertainty among many participants, who now regarded the support of the scene as too great a personal risk. At the same time, the Internet, as we know it today, began to gain popularity. As a result, many warez from the BBS were uploaded and made accessible to everyone. These two factors were mainly responsible for the decline of the Bulletin Boards.

### **World Wide Web**

Various, mostly commercially motivated ways of obtaining illegal copies of media have developed to this day on the Internet. Sites like Kinox.to or Bs.to provide hyperlinks to movies and series freely. According to an estimate of the Alexa.com website, these two were the 36th and the 23rd most visited websites respectively (Alexa, 2016). The small communities of the 1980s and 1990s, which in their time had made only little access to copies possible, have now been replaced by websites with millions of clicks. Everyone with an Internet connection can access them, and banners and similar advertisements monetize this massive access. According to the Motion Picture Association of America (MPAA), today's warez scene is pyramid-like structured (MPAA, 2006). The so-called suppliers procure the material, for example by filming cinema performances, and sell these recordings to replicators and release groups. They multiply the material explosively and make it available to other people, the facilitators. They download the content from the servers of the release groups, which are also called top sites, and upload it to publicly accessible sites. Once this has been done, the masses can access many different offers to access the illegal material. In this way, a few sources supply the entire Internet with warez. A more detailed view on the warez scene can be found in the article by D'ecary-H'etu et al. (D'ecary-H'etu, Morselli, & Leman-Langlois, 2012).

### **Peer-to-Peer Networks**

A peer-to-peer (P2P) network describes a network architecture in which all network participants have equal rights. Unlike a client-server infrastructure in which clear roles are assigned, nodes in a P2P network can both provide and retrieve services. Most P2P networks use the infrastructure of the Internet as a basis and are organized centrally or decentrally depending on the implementation[25]. Since early P2P networks allowed a simple identification of peers, for example by their IP address or similar identifiers,

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