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Review

Buyer seller watermarking protocols issues and challenges – A survey

Abid Khan [a], Farhana Jabeen [a,*], Farah Naz [a], Sabah Suhail [a], Mansoor Ahmed [a], Sarfraz Nawaz [b]

[a] COMSATS Institute of Science and Technology Islamabad, Pakistan
[b] Computer Laboratory, University of Cambridge, Cambridge, United Kingdom

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ABSTRACT

Advancements in computing and networking technologies have opened gateways for the content owners to produce and distribute their digital contents (e.g., audio/video/images) in a convenient and affordable manner. Despite all the advantages promised by the advancement in digital technology and widespread use of Internet, piracy of content is still big concern. Digital content can be easily copied without any quality loss. Content creators and owners are concerned about the consequences of illegal copying and distribution on a massive scale like loss of capital. As digital data can be duplicated and edited with great ease, this has led to Digital Rights Management (DRM) systems that can address the issues related to privacy and security of the digital contents. Digital watermarking is a promising technology employed by various DRM systems to achieve rights management. Buyer-Seller Watermarking (BSW) protocol integrates encryption, with digital watermarking and other techniques to ensure rights protection & security for seller as well as the buyer of the digital content. BSW protocols support copyright protection, piracy tracing, and privacy protection. Various approaches have been proposed for BSW protocols. In this context, the main contributions of this paper to the literature on BSW protocols are threefold: (i) it identifies the challenges in designing a BSW protocol; (ii) provides the taxonomy of existing approaches; and (iii) describes the strengths and weaknesses of the presented approaches by comparison and some open issues are highlighted.

Contents

[*] Corresponding author.
E-mail addresses: abidkhan@comsats.edu.pk (A. Khan), farhanakhan@comsats.edu.pk (F. Jabeen), sabahsuhail@comsats.edu.pk (S. Suhail), mansoorahmad@comsats.edu.pk (M. Ahmed), sarfraz.nawaz@cl.cam.ac.uk (S. Nawaz).

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1. Introduction

Over the last two decades the pace of technological changes in digital and high-speed communication technologies opened up new ways for the distribution of digital contents (audio/video/images). Internet computing is the basis of all large-scale distributed paradigms. The continuous development of Internet and the construction of new peer-to-peer (P2P), Grid, and Cloud (Furht and Escalante, 2010) computing infrastructures are improving the opportunities for e-businesses. These technologies allow people to buy and sell digital content from each other with great ease. There is an increase in the number of consumers shopping online.

A significant portion of peer-to-peer (P2P) file sharing, however, is without permission of the copyright owner and thus illegal. According to the recent survey by Chiang et. al. in 2007 (Chiang and Assane, 2002), on investigating US college students' file sharing and music consumption behavior, 83% of the students revealed that cost is a major factor in influencing their file sharing behavior. While about half of the students (i.e., 53%) indicated that time is a major factor. Advancement in digital and communication technologies, while of great potential, have caused piracy (the illegal sharing of digital media) to become a much more serious concern. A major challenge for digital media distribution is the possibility of unlimited consecutive copying without the consent of content owner, which threatens intellectual property rights. Apart from the technical difficulties, cultural issues play a vital role in creating hurdles to discourage digital piracy. Cultural differences influence not only the social behaviors but also how we view social behavior. The most important cultural difference is the difference between individualism and collectivism (Triandis, 1994). According to Donalson, Asian people have a collectivistic culture; their ethical norms put emphasis on the fact that individuals should share with society what they created (Husted, 2000). Asians consider copyright as a western concept, which is created "to preserve a monopoly over the distribution and production of knowledge and knowledge-based products" (Swinyard et al., 1990). According to figures from the music trade body International Federation of the Phonographic Industry (IFPI), global recorded music sales went down 15.4% in 2008 (Adegoke, 2009). Moreover, IFPI estimated from the studies in sixteen countries over the period of four years, that the number of illegally shared files was over 40 billion (Kennedy, 2009) in 2008. Moreover, in France about 13.7 million films were distributed on P2P networks in May 2008, compared to 12.2 million cinema tickets sold. In addition, about 1.6 billion songs were downloaded illegally in Spain in 2008, compared to two million legal downloads (Kennedy, 2009). Recently efforts have been made nationally and internationally to bring copyright laws up- to-date and to criminalize the avoidance of Digital Rights Management (DRM) (W. I. P. Organization, 2014). According to the recent survey (Karaganis, 2013) on practices regarding copying and downloading, and public sentiments regarding punishment in the United States (US) and Germany, nearly half of the population (45% of US citizens and 46% of German citizens) are actively involved in piracy. The percentage increases significantly (i.e., 70%) among the young generation of 18–19 years old. 59% of Germans support penalties, while 52% of US citizens back punishments for file sharers. In US, 37% of younger demographic support penalties, while 56% of Germans support penalties. Majority (i.e., about 75%) of the younger demographics support the practice of sharing with friends as reasonable. In US support for penalties is lower (i.e., 53% oppose penalties) among the younger demographics as compared to German young generation (56% support the penalties). In both countries majority support that penalty should be limited to warnings and fines.

As digital data can be duplicated and edited with great ease, this has led to DRM systems (Jonker and Mauw, 2004; Taban et al., 2006). A DRM system has to provide sufficient support for protecting the activities including content protection and rights management of purchasing, consuming, editing, storing, and distributing digital content. Existing DRM systems incorporate many different mechanisms, such as encryption, watermarking, and digital fingerprinting, to address the privacy and security issues related to the digital content.

Cryptography is a digital content protection technique against piracy (Liu and Li, 2004), which encrypts the digital content to protect the content from the attackers. Cryptography addresses network security issues by ensuring confidentiality, authenticity and integrity (e.g., authenticity is ensured with public key cryptography; integrity with digital signatures and hashing; and confidentiality with secret key cryptography) of digital content transmitted through a shared medium (Kessler, 2016). However,