

## Chapter XIII

# Digital Watermarking and Its Impact on Intellectual Property Limitation for the Digital Age

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### Abstract

*Digital media like audio, video, images, and other multimedia documents can be protected against copyright infringements with invisible, integrated patterns. Such methods are based on steganography and digital watermarking techniques. Most watermarks are inserted as a plain-bit or adjusted digital signal using a key-based embedding algorithm. The embedded information is hidden (in low-value bits or least significant bits of picture pixels, frequency, or other value domains) and linked inseparably with the source data structure. For the optimal watermarking application a trade-off between competing criteria like robustness, nonperceptibility, nondetectability, and security has to be made. Most watermarking algorithms are not resistant against all attacks—even friendly attacks like file and data modifications can destroy the watermark very easily. This chapter gives an overview about the basic ideas of watermarking, applications for e-business, problems, and limitations.*

## **Commercial Relevance of Protection Systems for Digital Media Types**

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The digital representation of multimedia documents has become very popular in the last decade. This is particularly due to the economical integration of technologies developed in the context of the Internet and the capabilities of efficient transmission, storage, and almost loss-free copying of digital media. Computer games, software, video, audio, and other digital products represent economically significant and expanding markets. E-commerce giants like Amazon or eBay demonstrate the significance of the Internet for advanced business activities and making profits. Besides the increasing popularity and acceptance of Internet distribution channels like online shops, auctions, streaming video and audio stores will promote the Internet to become the most relevant invention ever. Since more people using broadband access methods like DSL, satellite, and T1 the demand for various streaming media products has increased. Streaming media services are set up by most broadband Internet providers. Internet giants like Yahoo, Apple, and Microsoft are enabling the digital distribution of entertainment products like audio and video, steadily establishing new Internet services, and offering DVD-video for one to five euros. Apple has been successfully selling audio tracks via the Internet since 2003, and other companies will soon follow with similar business models. But, as audio, video, and any other digital media can easily be copied and redistributed over networks; a lot of business models (mentioned previously) and devices like DVD recorders were detained on purpose (Cox, Miller, & Bloom, 2002). Particularly, the music and entertainment industry struggles against the illegal distribution over networks, especially peer-to-peer, in recent years. The International Intellectual Property Alliance (IIPA) has estimated the annual world wide trade loss in its country reports due copyright piracy was up to \$15.8 billion in 2005, \$15.1 billion in 2004 (IIPA, 2006), \$13.2 billion in 2003 (IIPA, 2005), and \$10.2 billion in 2002 (IIPA, 2004). In 2003 the IIPA estimates the total losses due to piracy between \$20-22 billion not counting losses due to Internet piracy (IIPA, 2003). As the copyright industry generates the highest foreign sales for the U.S. economy, the annual loss in 2002 can be estimated up to 15% worldwide by \$88 billion in foreign sales (Siwek, 2002).

However, digital media can be straightforwardly copied and illegally redistributed over various channels. Risk and capital loss will prevent further activities and investments until a juristic and technical protection mechanisms are available. These concerns are supported by the facts that digital mass recording devices like MD, CD, MP3 recorder, digital photo devices, and camcorders have impressively entered the market (Anderson & Petitcolas, 1999; Cox, Miller, & Bloom, 2000; Hanjalic, Langelaar, Van Roosmalen, Biemond, & Langendijk, 2000; Hartung & Kutter, 1999; Mintzer, Braudaway, & Yeung, 1997; Petitcolas, Anderson, & Kuhn, 1999; Swanson, Kobayashi, & Tewfik, 1998; Wu & Liu, 2003). The importance and the

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