4. Digital Rights Management
Digital Rights Management revisit

- DRM and film: DVD CSS
- DRM and music
  - audio CD: from Sony BMG
  - internet music: iTunes store
- E-books: Adobe Acrobat and MS Reader
Protecting Digital Intellectual Property

- Preventing Copying With Encryption
  - 加密
- Preventing Copying With Watermarking
  - 水印
Encryption

- RSA
- DES
- MD5
Stenography
Stenography
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1. removing all but the last 2 bits of each color component
2. $\times \ 85$
Stenography

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2. $\times 85$
Digital Watermark

- Invisible ink on multimedia data
  - image
  - video
  - music
  - graphics
Digital Watermark

- Image
Image watermarking

$W(x,y) : $ Pseudorandom Pattern \{-1, 0, 1\}

$I \cdot w(x,y) = I(x,y) + k \cdot W(x,y)$
Image watermarking

\[ \mathcal{W}(x,y) \]

\[ I'(x,y) \]

\[ R(\text{correlation}) = E[I'(x,y)\mathcal{W}(x,y)] \]

Yes

\[ I'(x,y) = \mathcal{I}(x,y) \]

\[ R > \text{Threshold} \]

No

\[ I'(x,y) \neq \mathcal{I}(x,y) \]

detecting
DCT based algorithm

Original Image → DCT → + → IDCT → Watermarked Image

Pseudorandom Noise (Watermark) → absolute → k → X

Watermarked Image → IDCT → - → 1/k

Original Image → IDCT

Extracted Watermark

Correlate

Decision
Digital Watermark

- Music: mp3stego

  http://www.petitcolas.net/fabien/steganography/mp3stego/index.html

  a simple demo
Digital Watermark

• Graphics:

Alice

Bob
Metadata for DRM

- MPEG-21: REL
- A Digital Item
  - is a structured digital object with a standard representation, identification and metadata
- User
  - is any entity that interacts in the MPEG-21 environment or makes use of Digital Items
## DRM technologies and associated devices

<table>
<thead>
<tr>
<th>Name</th>
<th>Used in</th>
<th>Date to use</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fairplay</td>
<td>iPod and iTunes</td>
<td>2003+</td>
<td>The purchased music files are encoded as AAC, then encrypted with an additional format that renders the file exclusively compatible with iTunes and the iPod.</td>
</tr>
<tr>
<td>3-play</td>
<td>Microsoft Zune</td>
<td>2006+</td>
<td>Music files that are received wirelessly from other Zune devices can be played only a maximum of three times on the device.</td>
</tr>
<tr>
<td>Janus WMA</td>
<td>All PlaysForSure Devices</td>
<td>2004+</td>
<td>Janus is the codename for portable version of Windows Media DRM for portable devices.</td>
</tr>
<tr>
<td>OMA DRM</td>
<td>Implemented in over 550 phone models.</td>
<td>2004+</td>
<td>A DRM system invented by the Open Mobile Alliance to control copying of cell phone ring tones.</td>
</tr>
</tbody>
</table>
DRM opposition
DRM opposition

digital rights management
= digital restrictions management?
DRM opposition

digital rights management = digital restrictions management?
Apple began selling "DRM-Free" music through their iTunes store in April of 2007.

The DRM-Free iTunes files were still embedded with each user's account information.