
Efficient watermark embedding for web images

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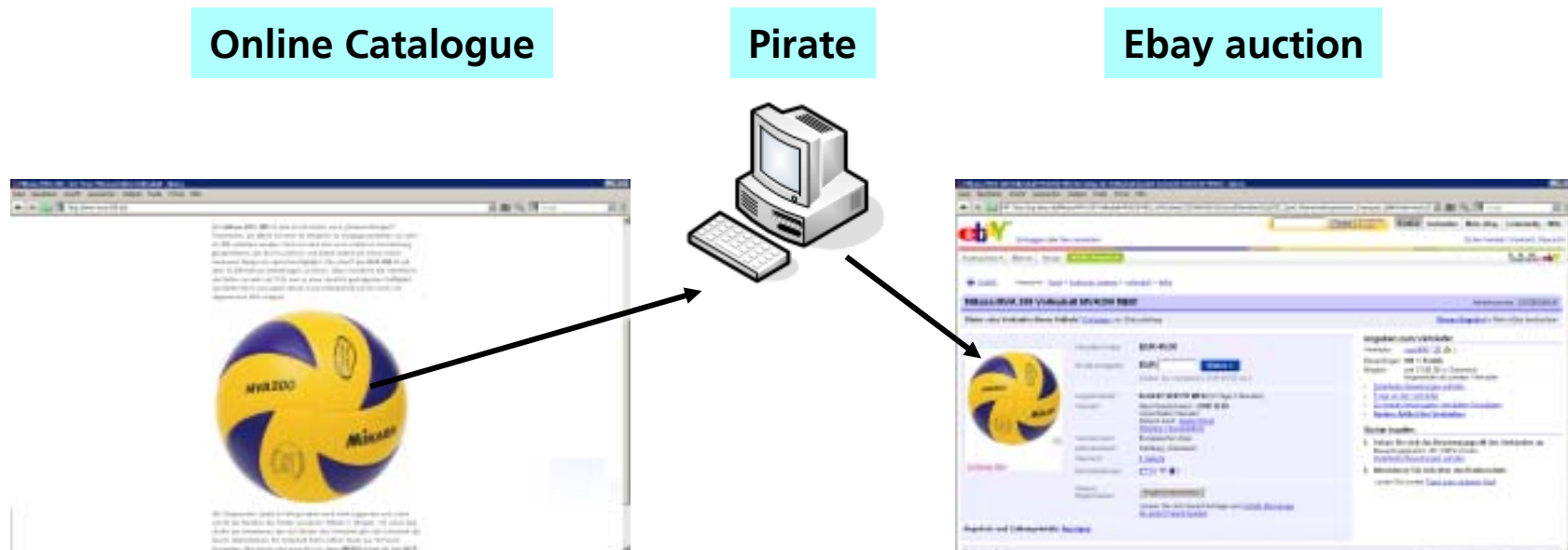
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Outline

- ❑ Motivation
- ❑ Concept
- ❑ Implementation
- ❑ Test
- ❑ Consequences
- ❑ Summary

Motivation

- ❑ Digitale Images are often copied
 - Often without considering copyright
 - Sometimes for illegal purposes

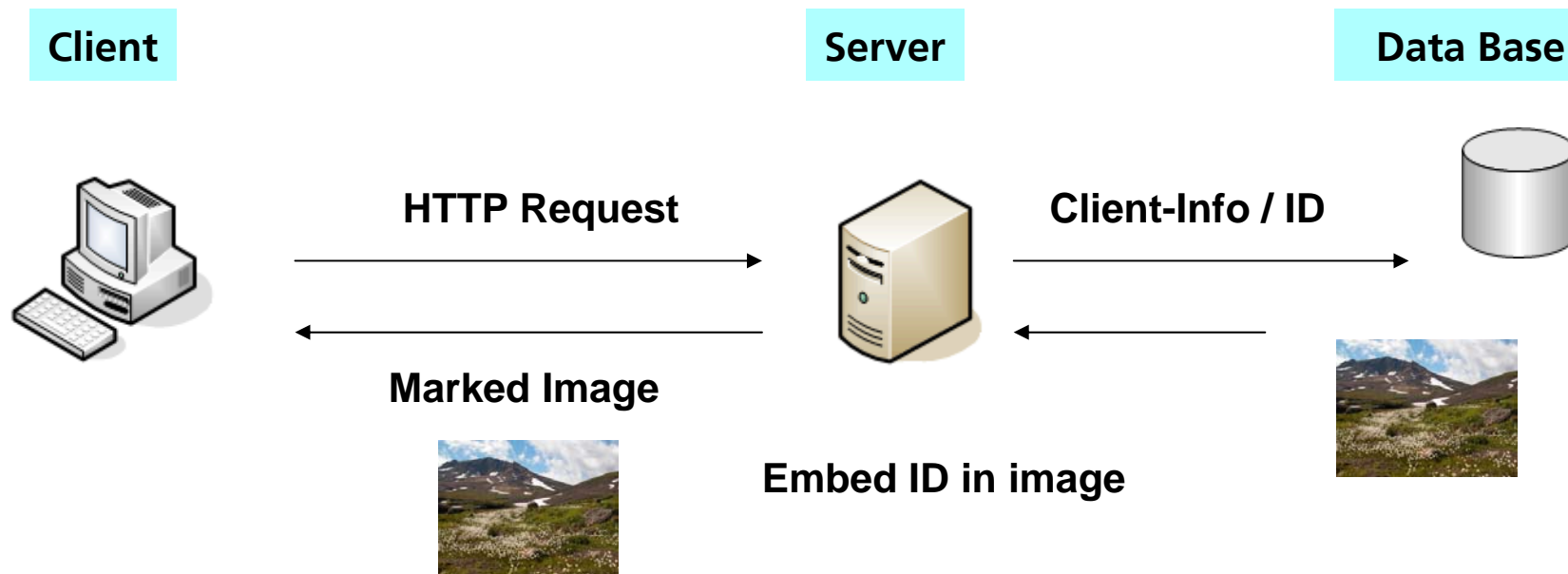


Motivation

- ❑ Digitale watermarking can help to identify copyright violations
 - By embedding a coypright info
 - By embedding an individual access ID
- ❑ Challenges:
 - Watermarking can be time-consuming
 - Integrating individual watermarking into systems can be complex

Concept

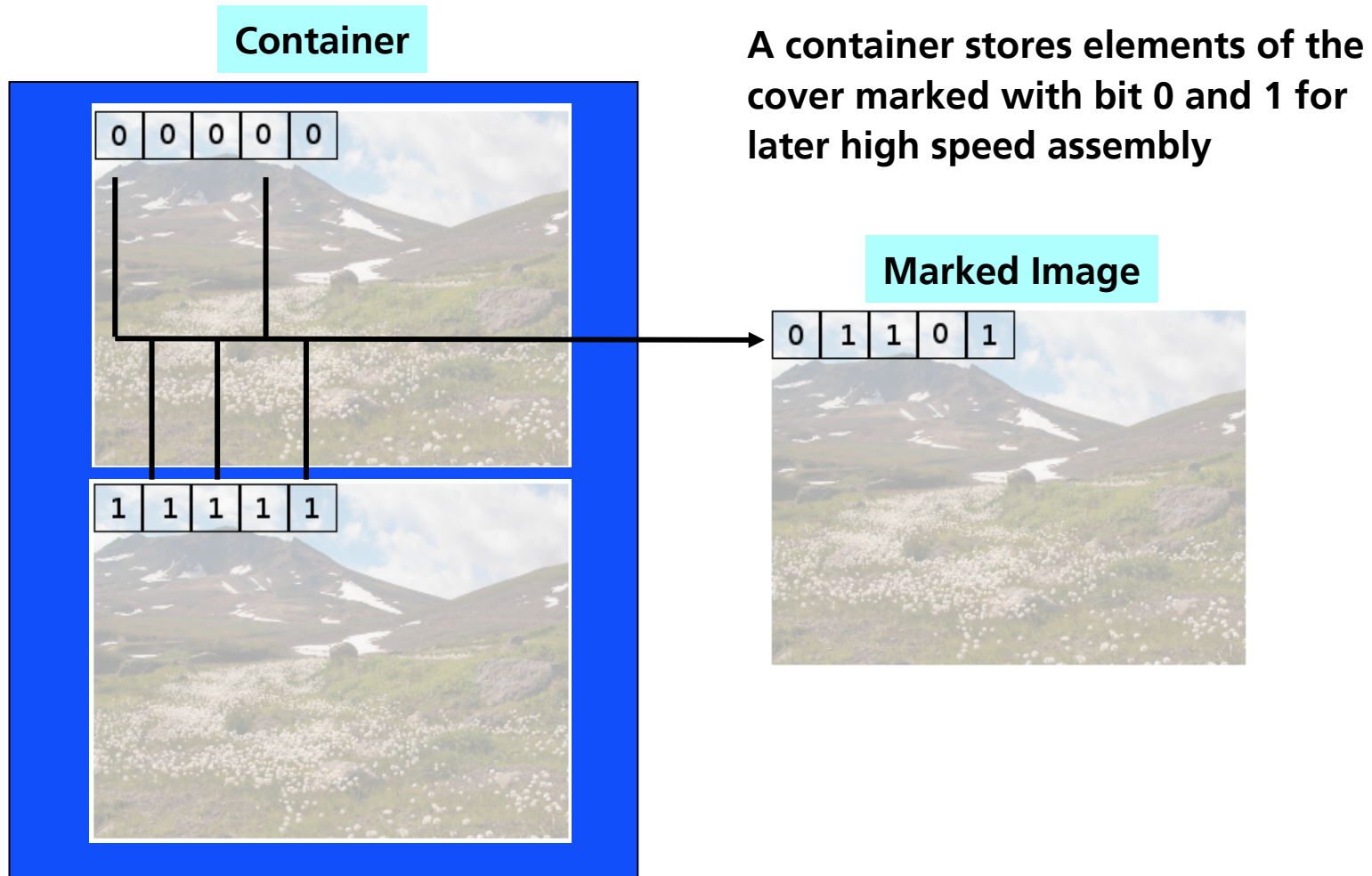
- ❑ Watermarking needs to become an embedded task transparent for end users
- ❑ This would dramatically reduce the barriers for watermarking-based content protection



Concept

- ❑ Typical watermarking algorithm (non-LSB)
 - Embedding time per image: ~1 second
 - Requires transformations, visual model, permutation,...
- ❑ Too slow for transactional embedding on web servers

Concept

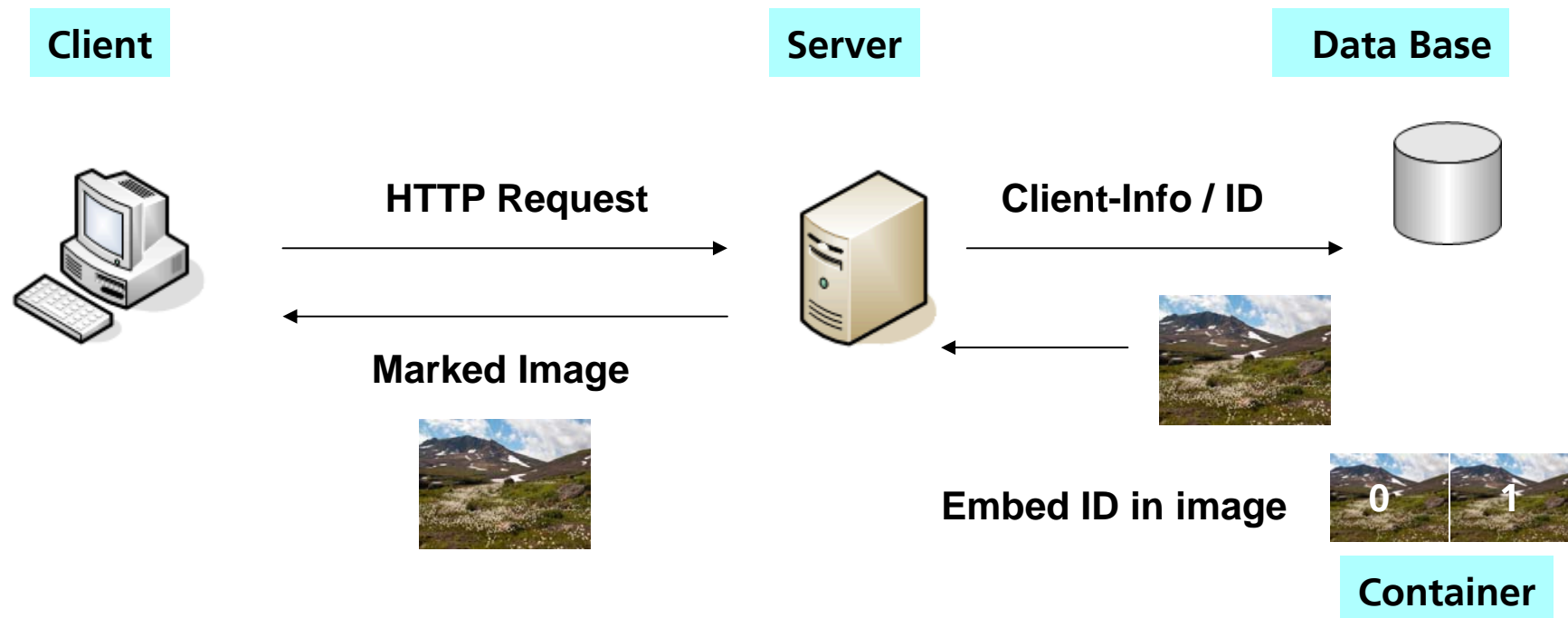


Concept

- ❑ Not each watermarking algorithm is suited for container watermarking
 - Required: Potential segmentation in independent binary blocks
 - Therefore correlation to complex noise patterns fails
 - Alternative: Pre-calculate each potential message
 - Explosion of container size
- ❑ Watermarking algorithm: Segmark
 - Noise pattern matching in frequency domain
 - Direct embedding in JPEG images
 - One Bit per 32x32 pixel block

Concept

- ❑ Container speeds up environment



Implementation/ Challenges

Marked Image



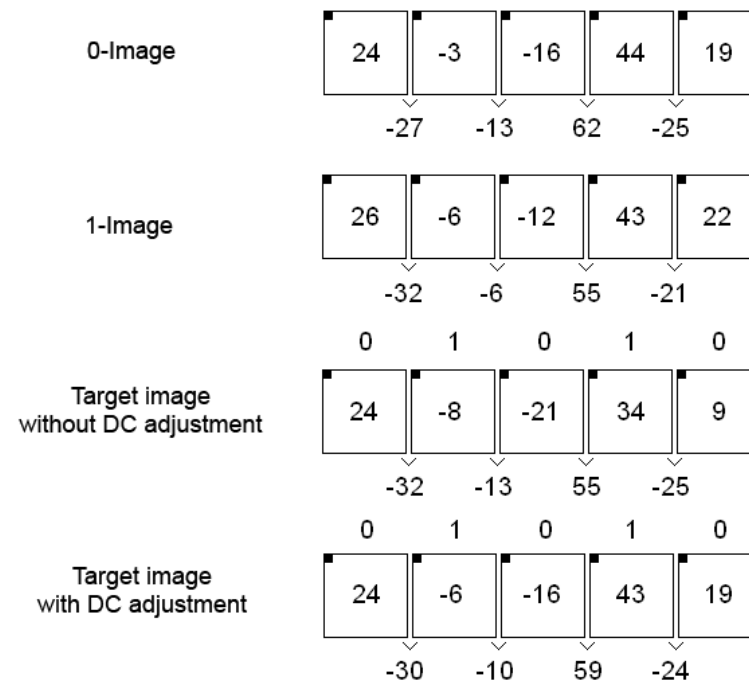
Marked Image from container



- ❑ Watermarking container depends on cover format
 - Example: JPEG blocks are not independent
 - This causes container artifacts

Implementation/ Challenges

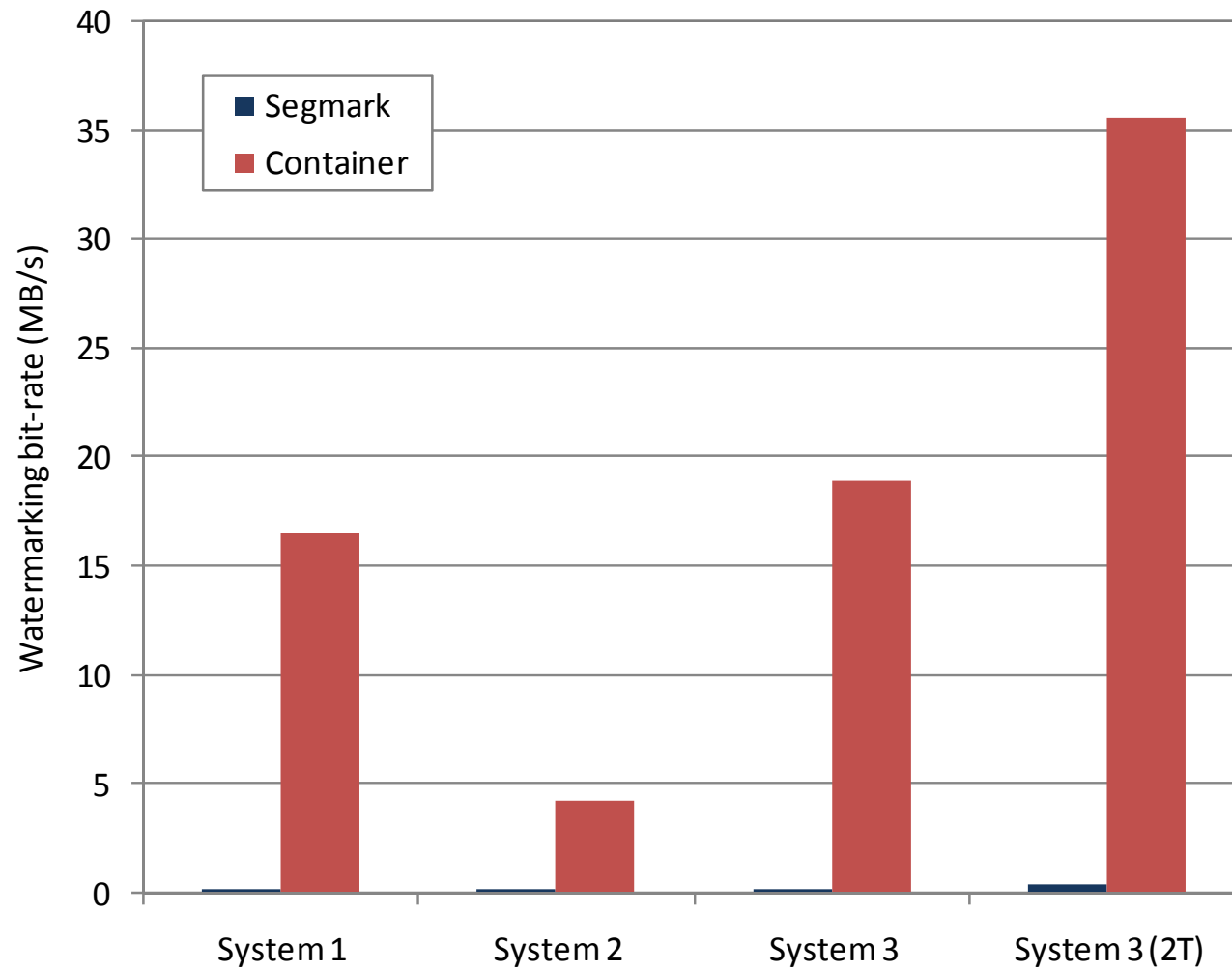
- ❑ Reason: DC in JPEG is stored as delta value from block to block
- ❑ Switching from „0“ to „1“ blocks may de-synchronize this delta value
- ❑ Absolute DC values are stored within container
- ❑ Delta values are corrected „on the fly“



Implementation/ Framework

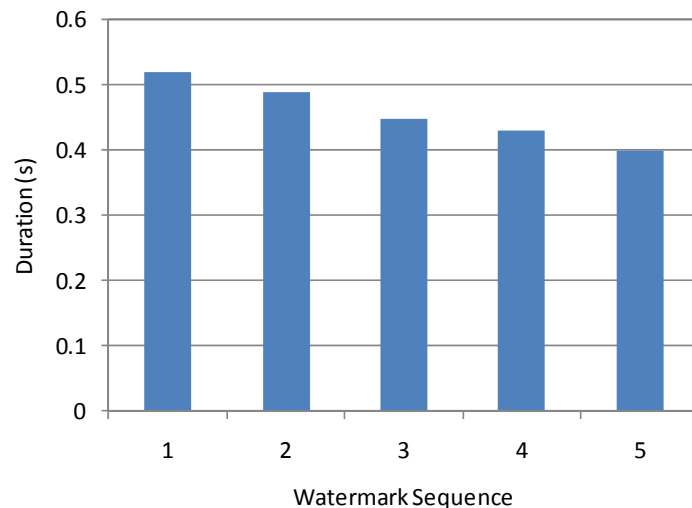
- ❑ Preparation
 - Webpage (text, images) is stored in CMS
 - Container files for images are created
- ❑ Usage
 - User accesses webpage „example.php“
 - Web Server fetches files from storage
 - PHP script creates image individualized html or pdf
 - ID and all available data stored in DB
 - Web Server provides document to user
- ❑ Only drawback
 - Caching must be deactivated

Test results



Test results

- ❑ Performance depends on embedded message
 - Better storage strategy will improve this
- ❑ Test set
 - 8 JPEG files
 - total size: 4 MB



| | Trial 1 | Trial 2 | Trial 3 | Average |
|---------------------|----------------|----------------|----------------|----------------|
| 1) 1010101010101010 | 0.56 s | 0.50 s | 0.49 s | 0.52 s |
| 2) 1100110011001100 | 0.47 s | 0.53 s | 0.48 s | 0.49 s |
| 3) 0000111100001111 | 0.52 s | 0.42 s | 0.41 s | 0.45 s |
| 4) 1111111100000000 | 0.39 s | 0.41 s | 0.47 s | 0.43 s |
| 5) 0000000000000000 | 0.39 s | 0.39 s | 0.43 s | 0.40 s |

Consequences

- ❑ Efficient watermarking of all content within web sites
- ❑ This allows tracking of content through its complete life cycle
 - Image on web site
 - Access by user X, IP address and date is stored, ID is embedded
 - From now on the IP address of X and the individual copy of the image are linked...
 - If X uses the image in own work
 - If X passes the image on
 - If X prints the image

Consequences

- ❑ Copyright protection may not be the end of the line...
 - Company CMS providing individual documents tracing information leakage
 - Printers printing digital copies in high speed individually without the need of the yellow dots
 - Crawlers following the usage of images via the Internet

Summary

- ❑ Image watermarking can help to enforce copyright and to prevent fraud
- ❑ It is necessary to make watermarking a transparent process
- ❑ This requires efficient watermarking
- ❑ Watermarking containers can help, but require additional processing steps compared to common watermarking
- ❑ Prototypic implementation of segmark container speeds up watermarking by factor 100
- ❑ This may lead to an Internet of individually marked copies...