The Multimedia Blockchain: A Distributed and Tamper-Proof Media Transaction Framework

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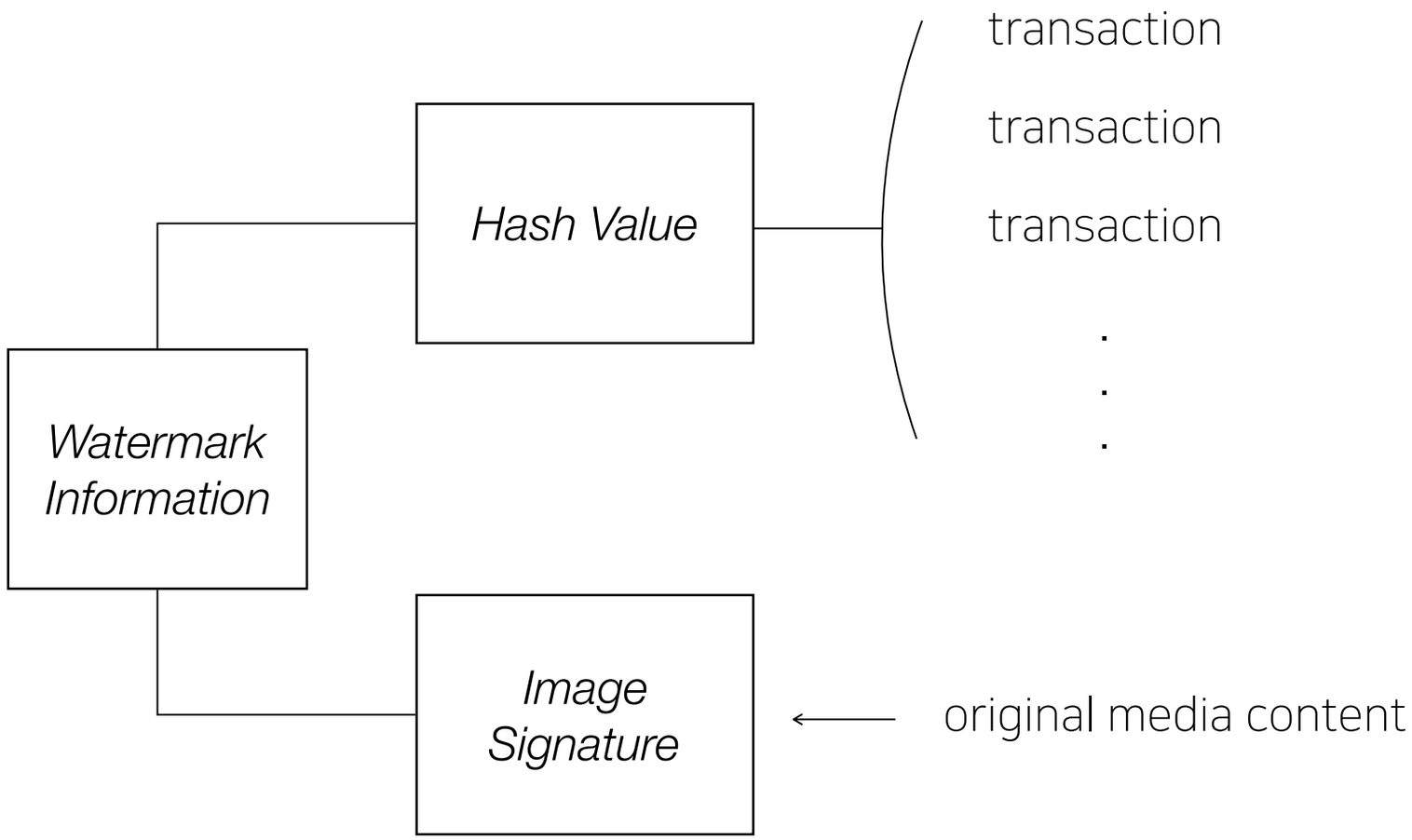
Introduction

- Media distribution also referred as **content delivery** is a form of digital distribution of multimedia contents which include audio, image and video.
- Online delivery medium.
- However, no one focuses on the **security and integrity of delivered content.**
- Secure watermarking (content protection), but..

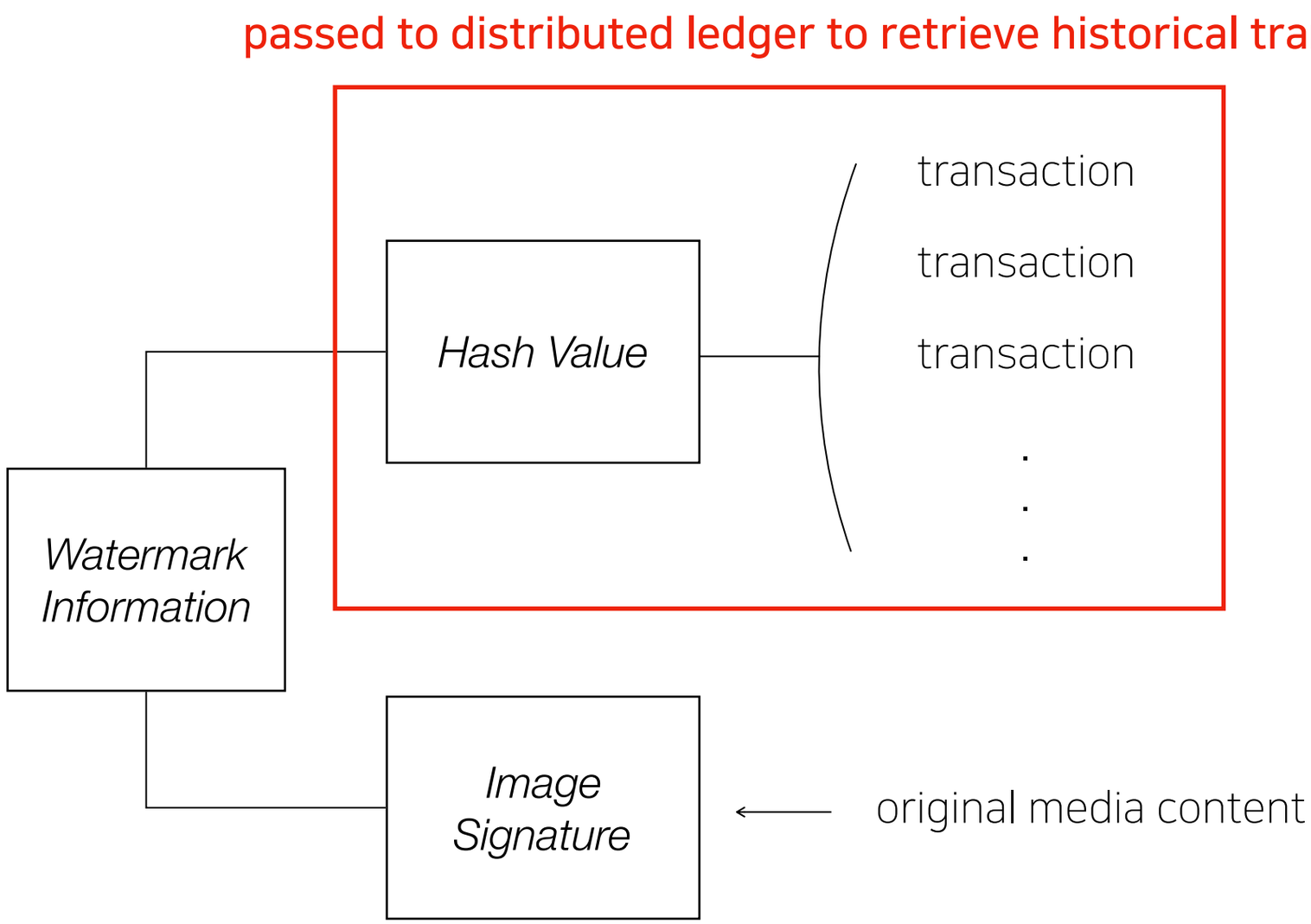
In this paper..

- **Blockchain** is promising technology that has the potential to introduce transparency.
- Current multimedia distribution **doesn't preserve self-retrievable information of transaction trails or content modification histories.**
- Digital copies of valuable artworks for various purpose
- **Tampered original media** with to fabricate false propaganda over social media
- A novel watermarking based Multimedia Blockchain framework

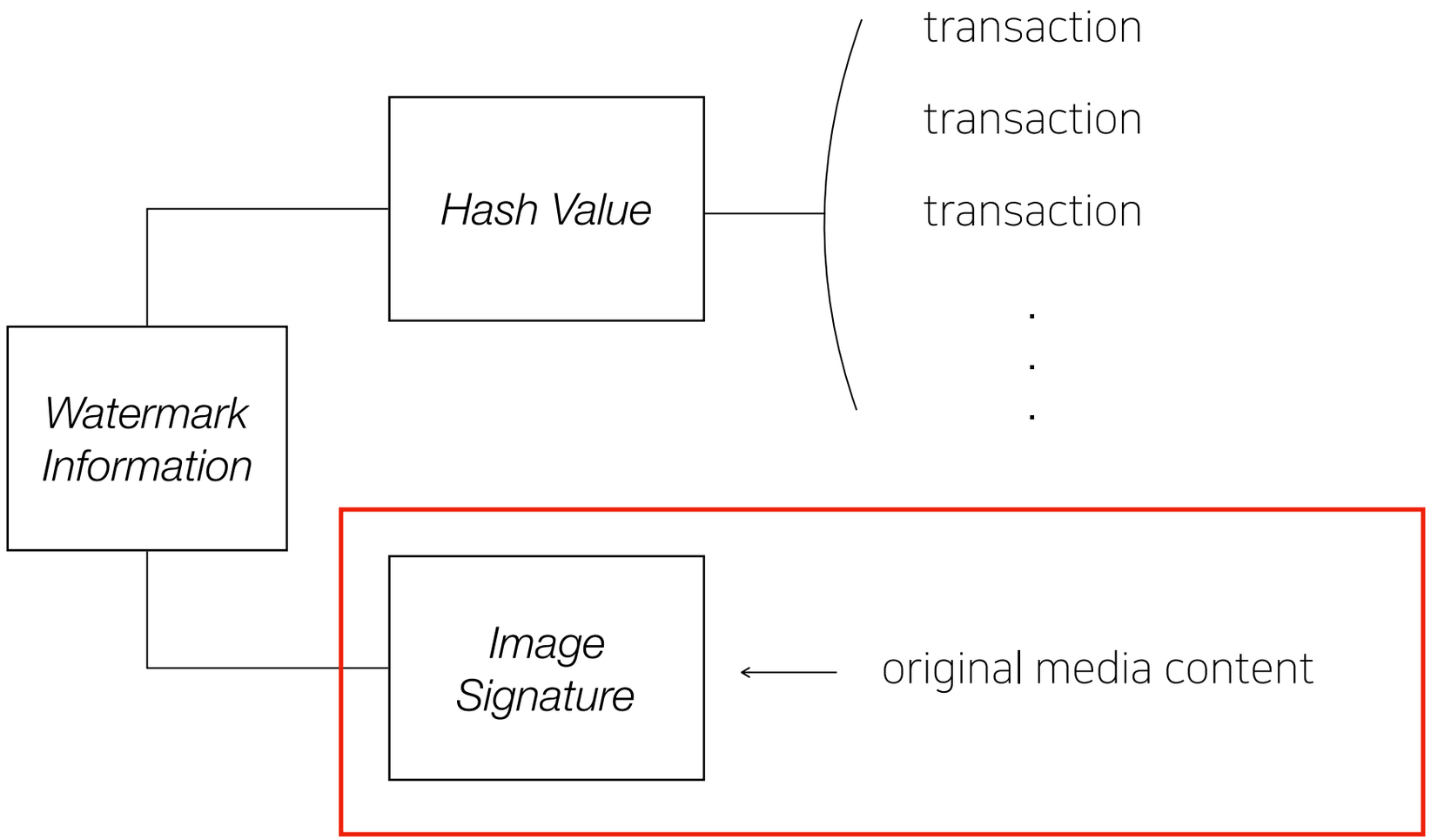
Watermark Information



Watermark Information



Watermark Information

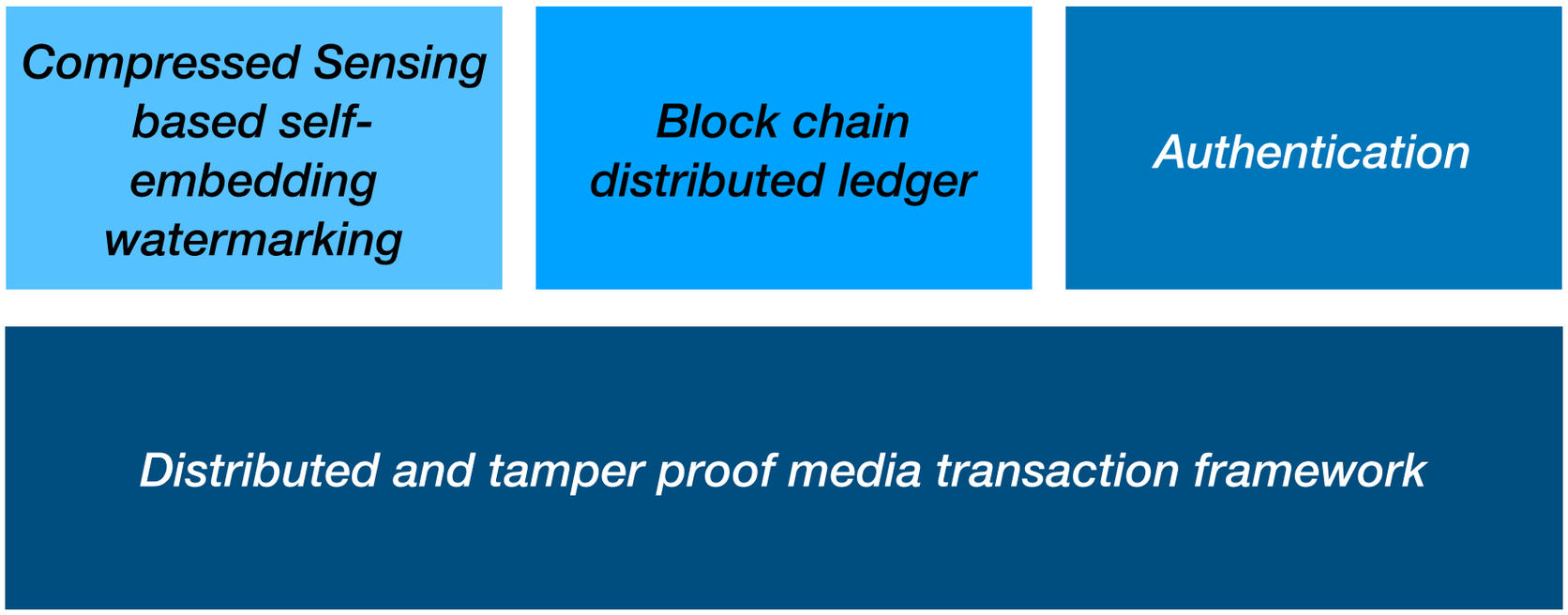


used to reconstruct the edited / tampered regions ***(compressive sensing algorithm)***

Multimedia Security

- A **self-embedding watermarking scheme** embeds the host image information as watermark within image itself.
- Such scheme allow **tamper detection** and **recovery of the original image.**
- **A frequency domain wavelet based self-embedding watermarking algorithm** ensures **content integrity** by detecting and recovering any tampering / editing attempt on the host media.

Media transaction framework



Self-embedding watermarking

- It uses a **pseudo-random projection** of the original image as the watermark and embeds it robustly within the host **using a wavelet based technique.**
- Once extracted the host image is recovered using a compressive sensing base image **reconstruction algorithm.**

Watermarking Process

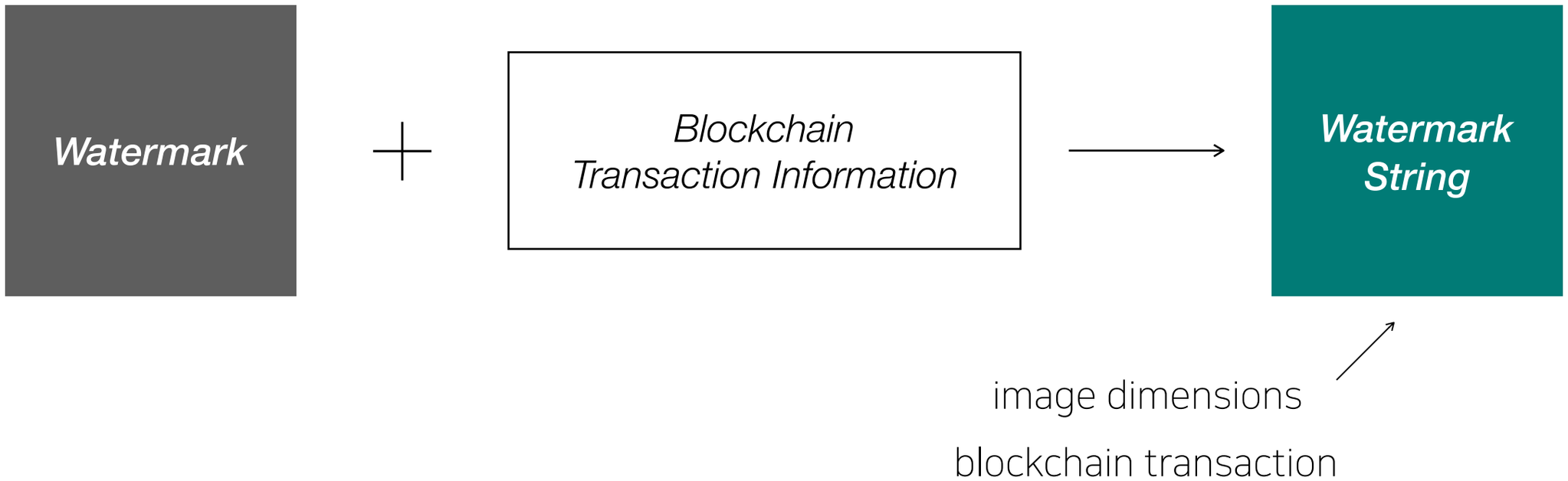
Original Image

Down-sampled Original Image

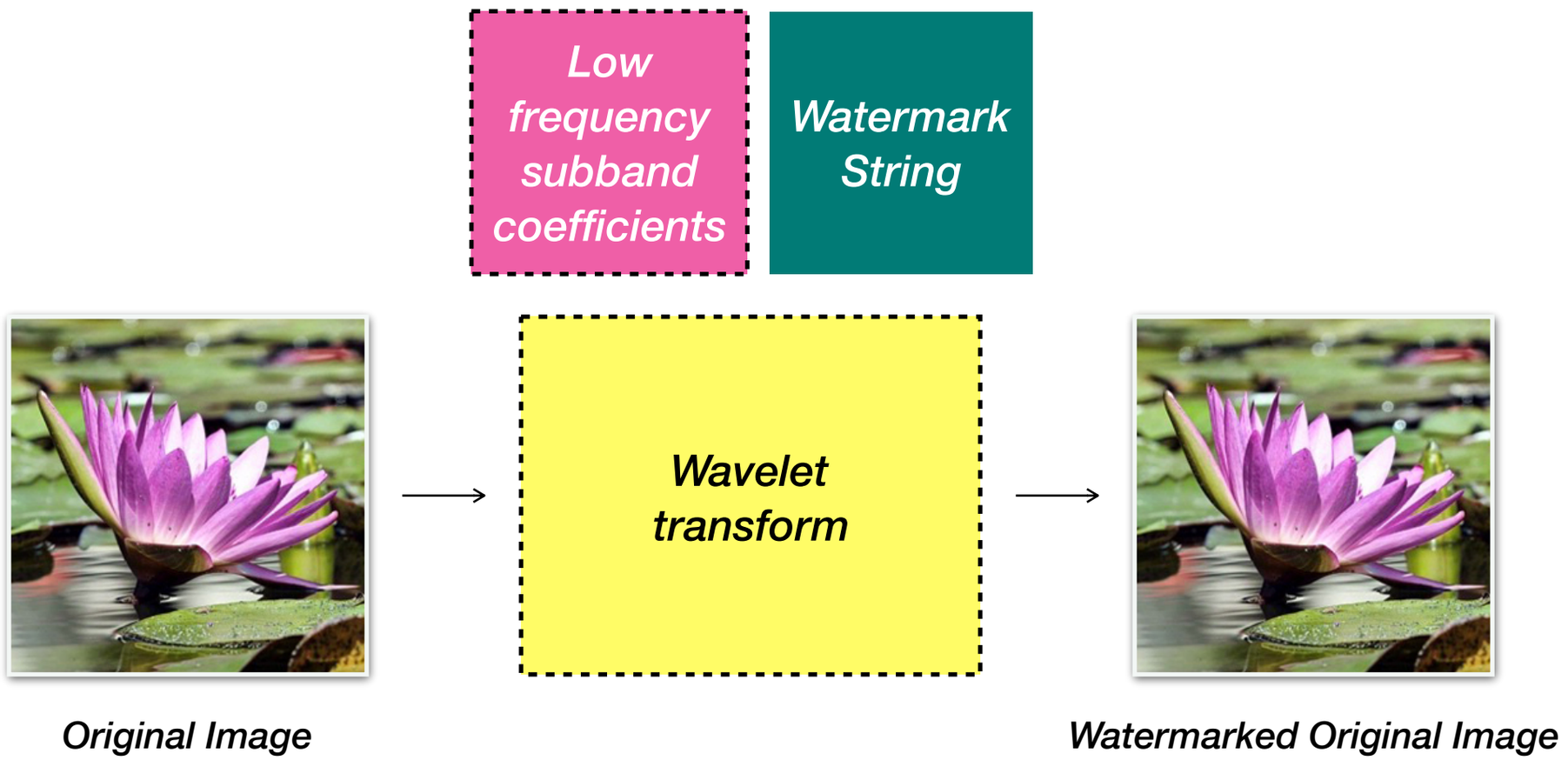
CS-based pseudo random projection

Watermark

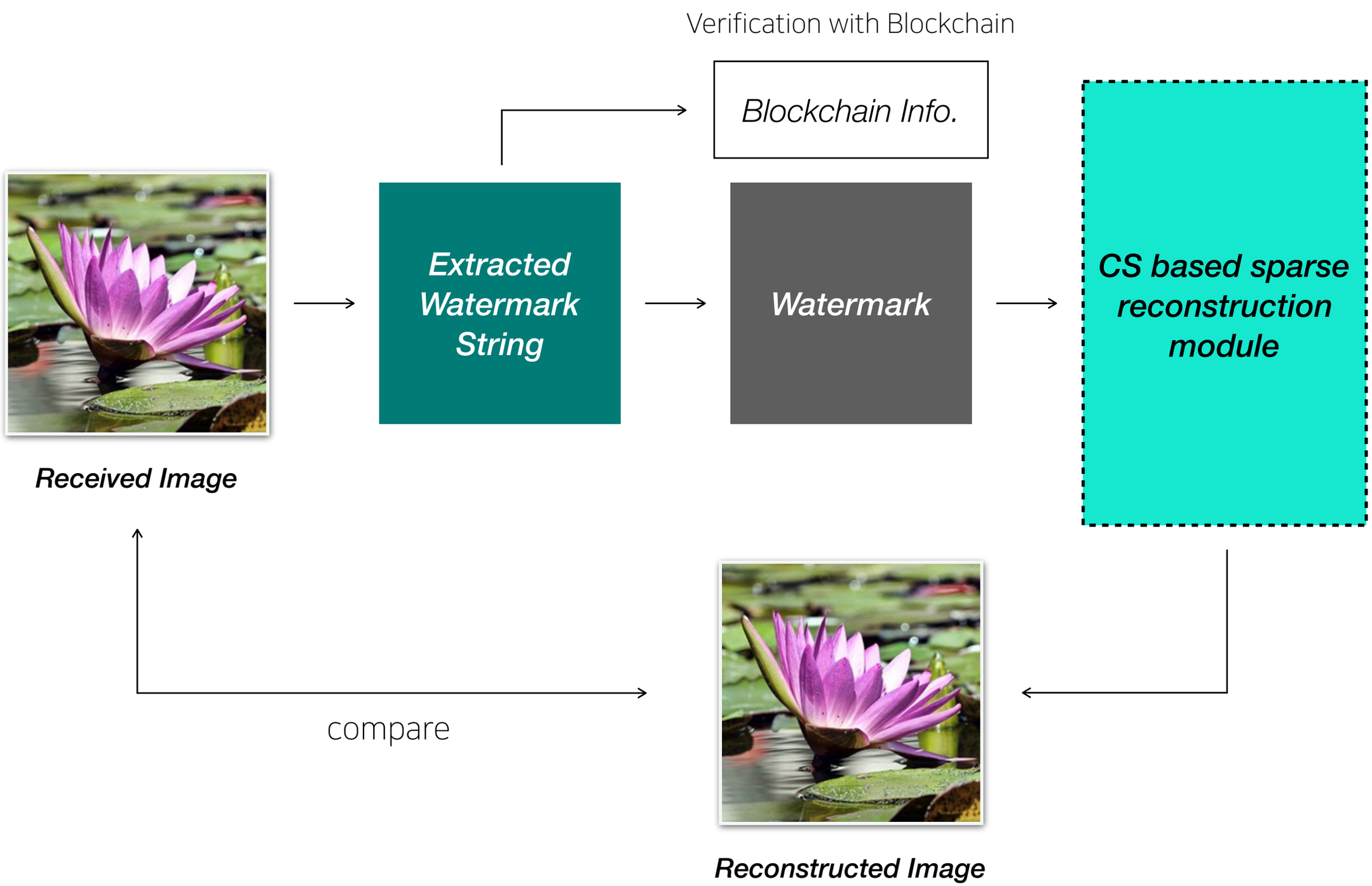
Watermarking Process



Watermarking Process

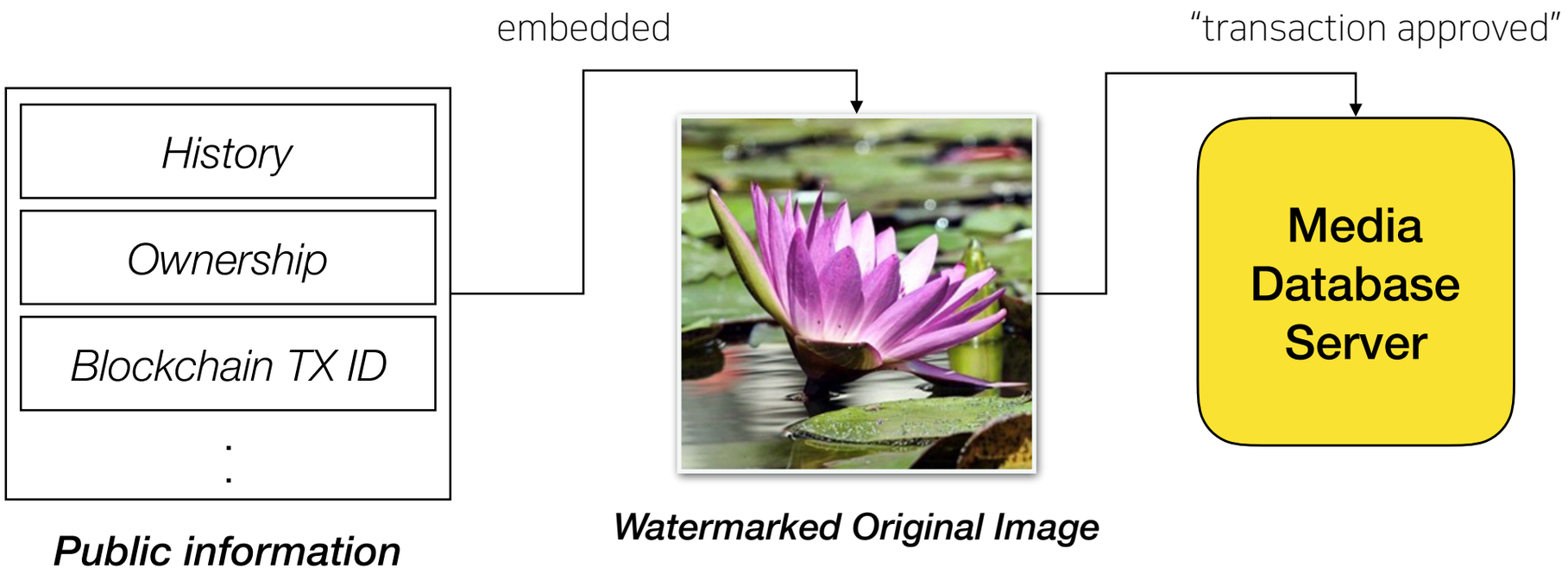


Authentication Process



The Multimedia Blockchain

- The transaction can be embedded with smart contracts and the public information.
- This public information is useful to record the transaction information of image/media such as, **transaction** and **modification history**, **ownership**, **blockchain transaction ID**, etc and the **information of CS samples** which can be used to reconstruct the original image/media.



The Transaction History

Transaction

0x8d065ce43846c3bca286c28c5d5228d754a9622426928bc691f7c10bc039d6a0

Thursday, March 9, 2017 2:01 AM
(a month ago, **108** Confirmations)

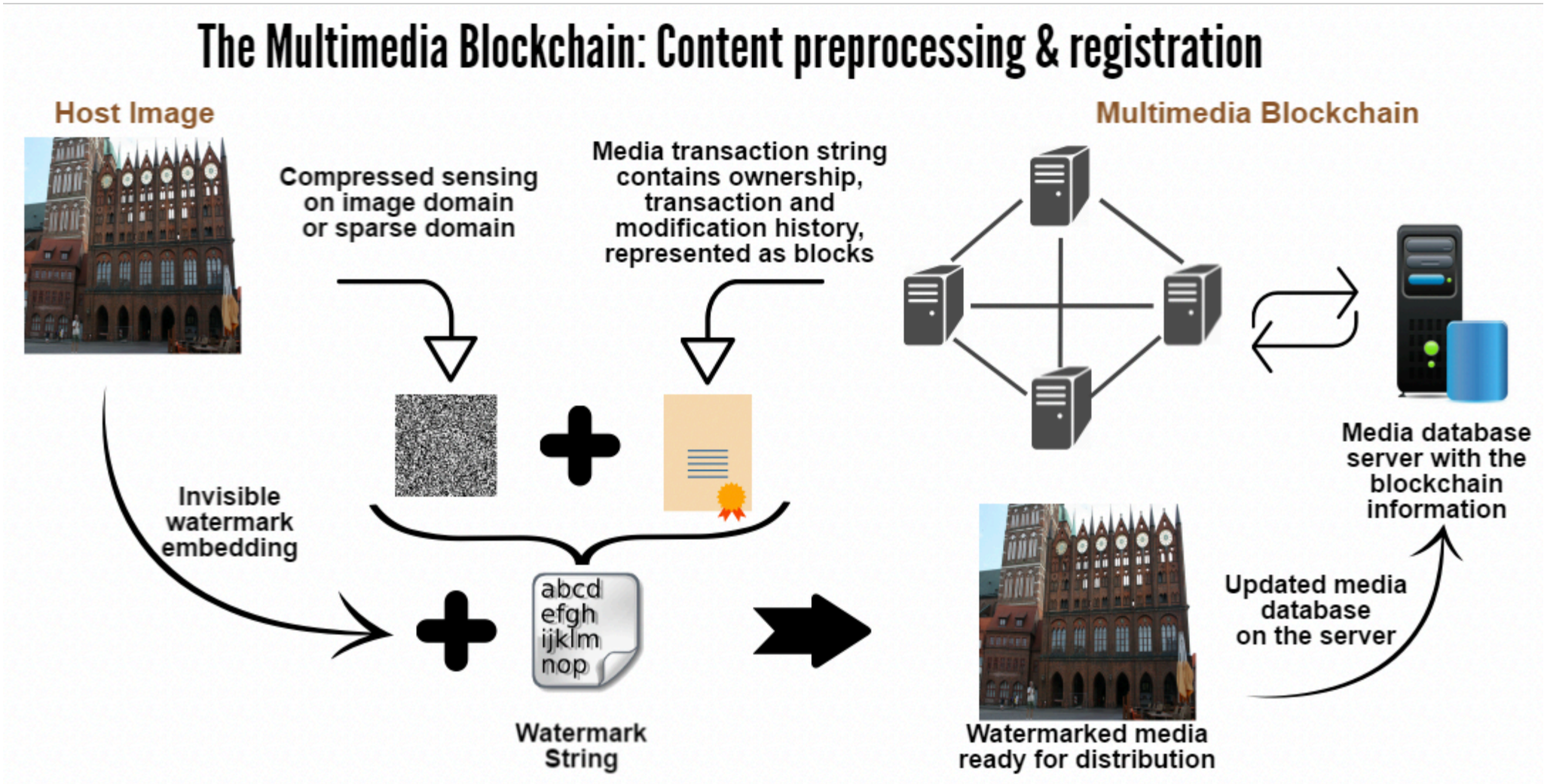
Amount	50.00 ETHER
From	0x511f4DF03B2F6CE6855fc3374f0fAf76cf6dFD3c
To	0x375ac88fF21515885EFA1E05C756ec0b5cC0D59f
Fee paid	0.00042 ETHER
Gas used	21,000
Gas price	0.02 ETHER PER MILLION GAS
Block	181 0xe8b2180abc7bc0f839c9337bde807f91b208a4...

The Image Database

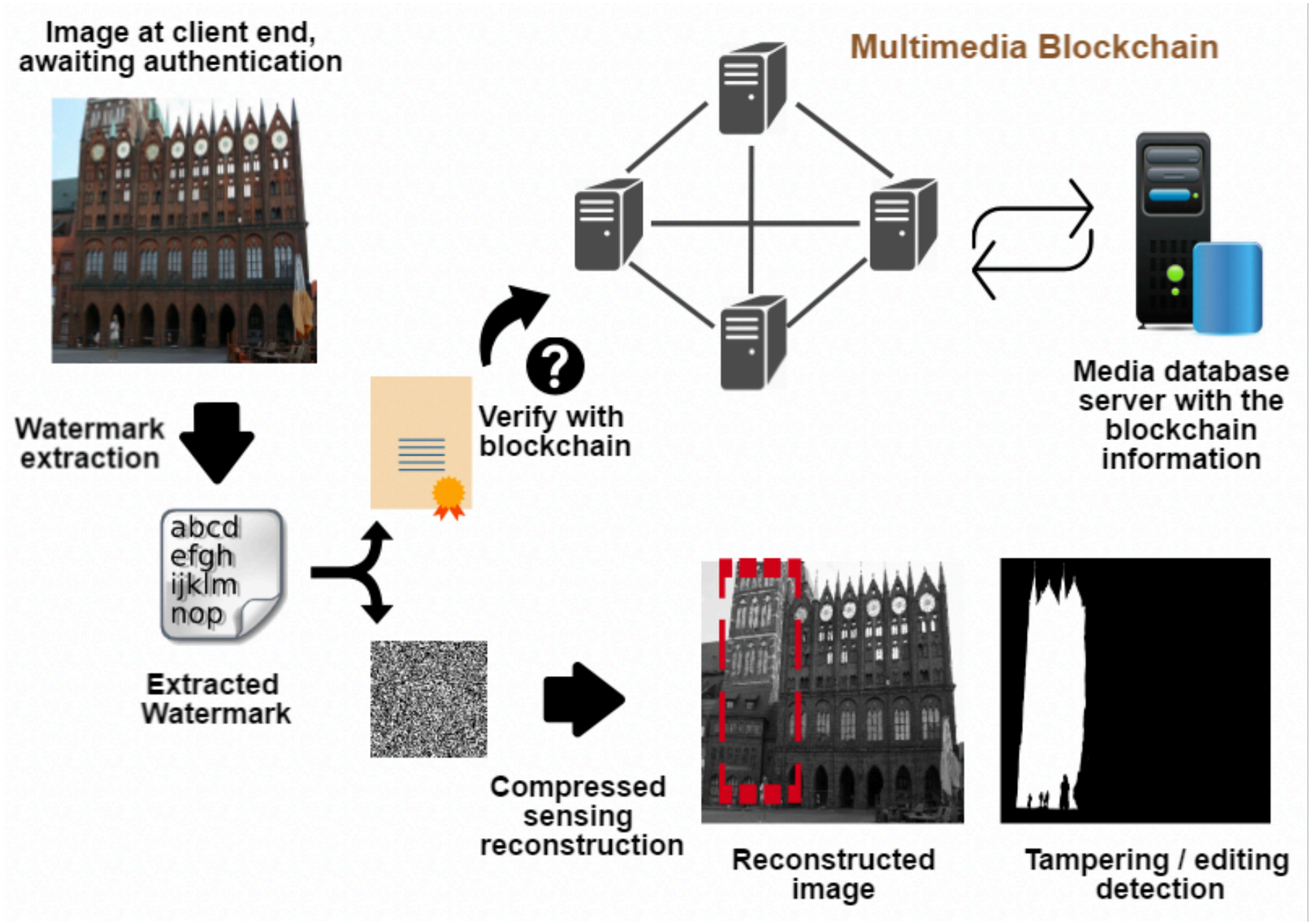
Info	DSP2017
Owner	0x375ac88fF21515885EFA1E05C756ec0b5cC0D59f
Previous Owner	0x511f4DF03B2F6CE6855fc3374f0fAf76cf6dFD3c
Tranaction ID	0xe1dd1c8f72ac924c1ca6761a3e1a40dde21a5d3b077ab57c
Price	1
Image	

Info	DSP2017
Owner	0x375ac88fF21515885EFA1E05C756ec0b5cC0D59f
Previous Owner	0x511f4DF03B2F6CE6855fc3374f0fAf76cf6dFD3c
Tranaction ID	0xe1dd1c8f72ac924c1ca6761a3e1a40dde21a5d3b077ab57c
Price	1
Image	

Content Processing and Transaction



Content Auth and Reconstruction



Results

- The blockchain network was build on the test-net of the Ethereum.
    1. Firstly they generate **transaction IDs** through the Ethereum testnet and **the sparse random sample from the host image.**
    2. These two are concatenated to a **watermarking string.**
    3. Once watermarked, **the image is tampered** with existing tampering mask.
    4. We **extract the watermark** from this tampered image and **reconstructed the original image** in order to detect editing / tempering.
    5. The extracted **transaction ID** was also retrieved to the corresponding transaction on Ethereum test-net **to authenticate the ownership and transaction history.**

Results Images

Original Image

Watermarked Image

Tampered Image

Reconstructed Image

Tampered Region Detection