JPEG Privacy and Security

JPEG Workshop on Media Blockchain

16 October 2018

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JPEG Privacy and Security Timeline

- Workshops
  - Brussels (October 2015)
  - La Jolla (February 2016)
  - Chengdu (October 2016)
- Use cases and requirements
- Call for proposals issued March 2017
- Proposals received in October 2017
- Initiated Part 4 of JPEG Systems: ”Privacy, Security and IPR features”
- Currently finalizing CD
- https://jpeg.org/jpegsystems/privacy_security.html

JPEG Privacy and Security - Features

- Protection features:
  1. Solutions to support **protection tools** to **protect parts of any type of JPEG images** and/or associated metadata independently, while ensuring **backward and forward compatibility** with JPEG coding technologies.
  2. Solutions to support handling of **hierarchical levels of access** and multiple protection levels for metadata and image protection.
  3. Solutions to support **file carving** systems.

JPEG Privacy and Security - Features

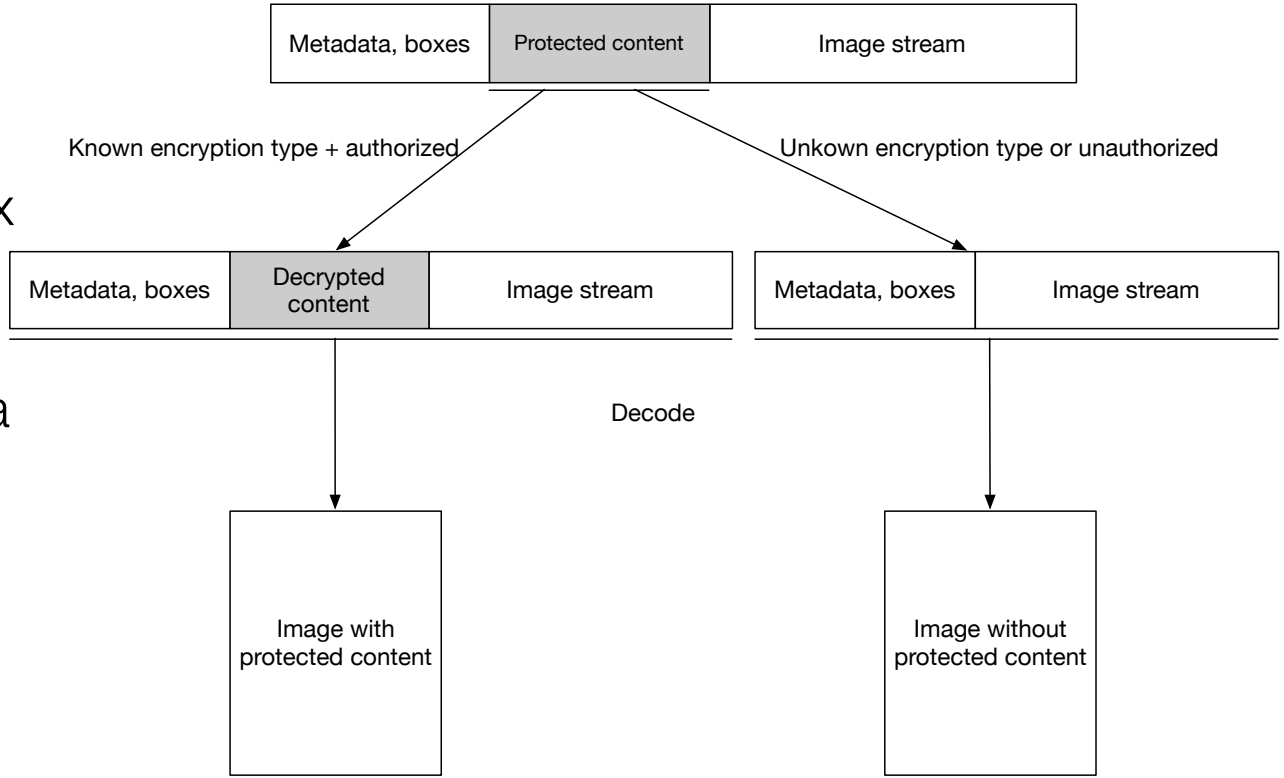
- Authenticity features:
  1. Solutions to support **integrity checking** of image data and/or embedded metadata.
  2. Solutions to support **avoiding stripping off metadata**, especially IPR information.
  3. Solutions to support **versioning** and/or **tracking changes** of an image and/or associated metadata and solutions to support embedding **provenance information**.
  4. Solutions to support embedding of trackable information to allow **identification and assessment of the master image** and identify derived or modified images from the master image.

JPEG Privacy and Security - Aim & Approach

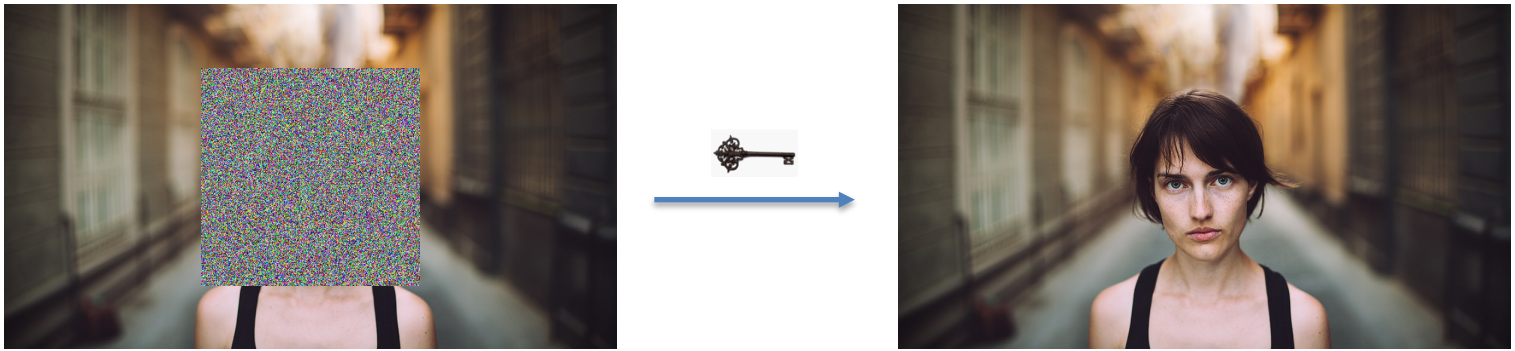
- Definition of tools to **support** protection and authenticity workflows in a **standardized way**
- Focus on **signaling syntax**
- Adoption of **existing technologies** for encryption etc.
- **Box based** approach
- Boxes wrapped in 1 or more APP11 marker segments to support JPEG-1 **backwards compatibility**
- Focus on definition of **generic boxes**
- Combined with **metadata definitions** with possibility to **reference boxes**

Protection

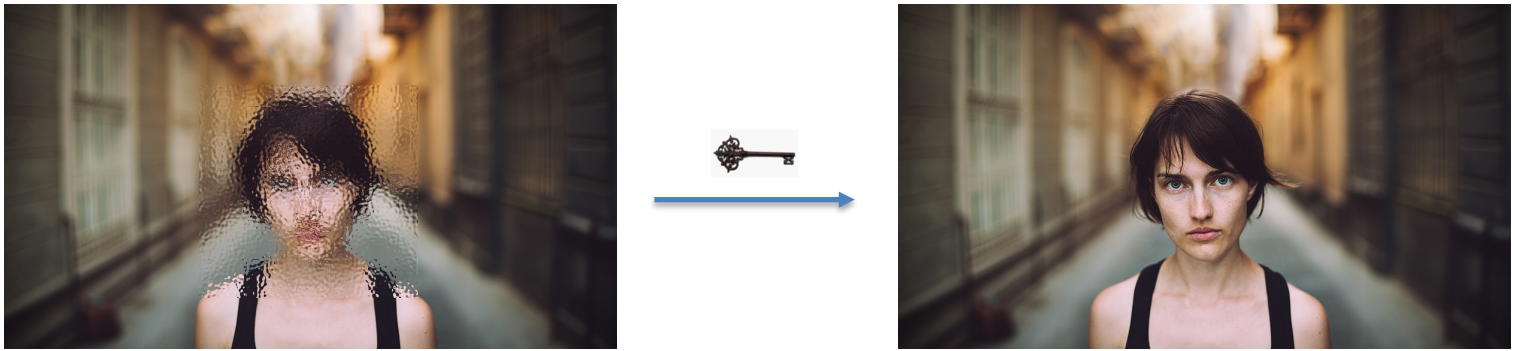
- **Protection box** wraps another encrypted box
- Since boxes are wrapped in APP11 marker segments data is split in chunks of 64kB which helps to support **file carving**



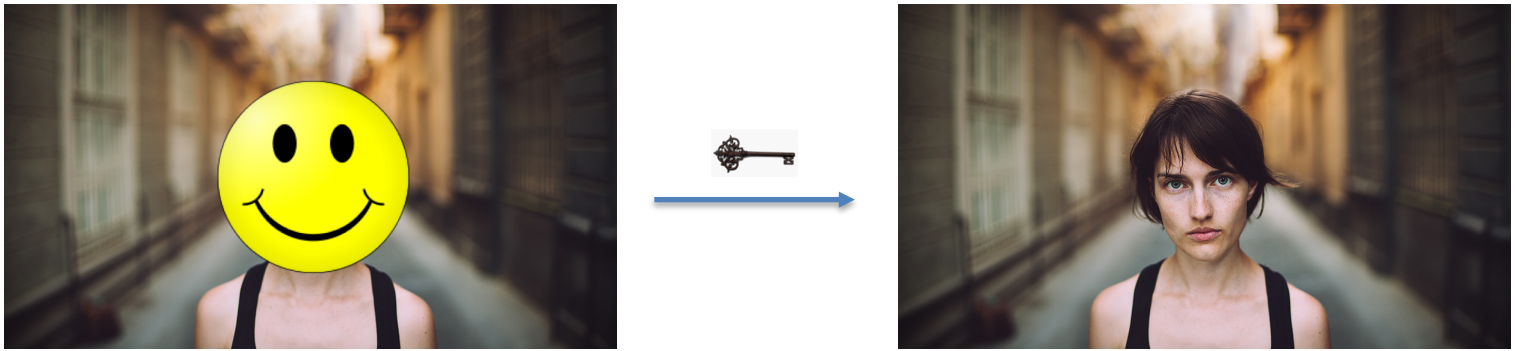
Partial protection support



Partial protection support

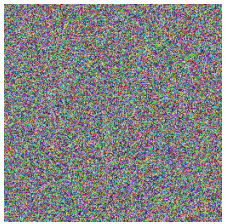


Partial protection support



Partial protection

Header, metadata	Encrypted data (Original content)	Image stream (Protected image)



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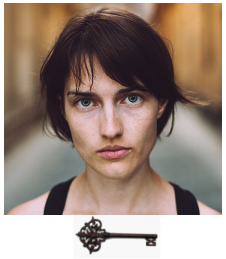
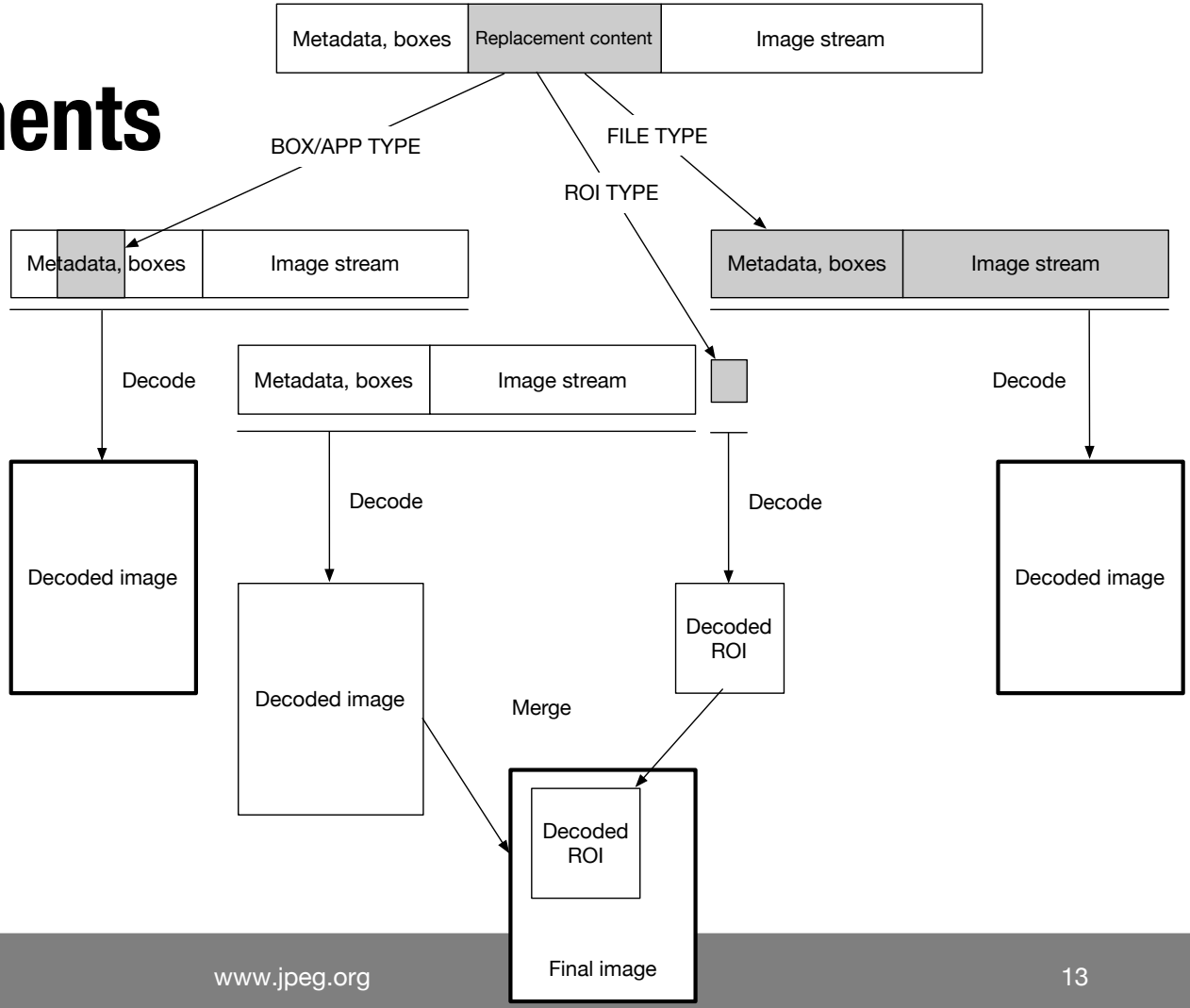


Partial protection

Header, metadata	Image stream (Original image)

Replacements



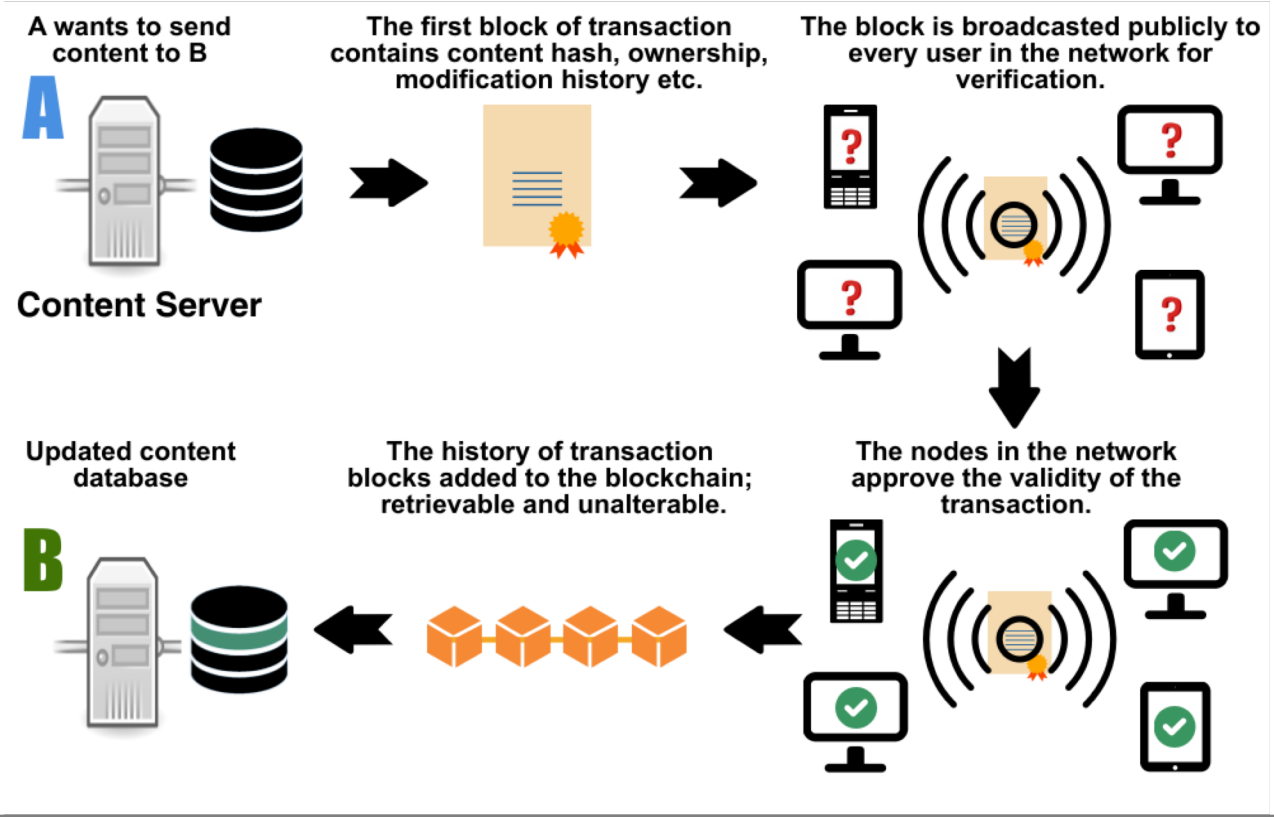
Metadata

- Metadata features
  - Access control
  - IPR
  - Provenance
- Adoption of **JPEG Universal Metadata Box Format** (JUMBF)
  - Wraps **metadata** and/or **associated content**
  - Mechanism for **referencing** boxes within metadata

Image integrity

- Support **embedding of signatures** of image content or metadata
- Allows to **identify** if **changes** were made in combination with:
  - Watermarking
  - Third party registration authority
  - Blockchain / distributed ledger
- New AhG on **Blockchain** initiated in January 2018

Blockchain technical overview



Blockchain benefits

- Blockchains provide a solution for a **distributed ledger** that is proven to be **immutable** and **community driven**
- Avoids need of trusted third parties
- **Adopted in many domains**, including cryptocurrencies, IP and creative work registration, registration of diamonds & artworks, contracts, multimedia, …
- Opportunity for new business models

Blockchain downsides

- Mining requires **huge amounts of computation power** (and energy)
  - Current estimate is 73TWh/year, almost equal to energy consumption of Austria (72TWh/year)[1]
- At this moment, **no proven alternative for proof of works** exists that do not rely on a third party
  - However, active research on this topic, e.g. “proof of stake”

[1] https://digiconomist.net/bitcoin-energy-consumption

Blockchain in a multimedia context

- Blockchains can be used to **register entire images or IPR information**
- Provides a **solution for authenticity use cases** without need for a third party register or watermarking
- Can provide a novel solution for **rewarding photographers**
- **Camera manufactures** could make a closed blockchain of all pictures taken with a particular camera

Challenges

- **Incentive** for mining?
- **Environmental impact** of computational power / energy needs
- **Alternatives** to proof of work?
- **Privacy concerns** and right to be forgotten

Standardization efforts

- ISO TC 307 Blockchain and distributed ledger technologies
- CEN-CENELEC Focus Group on blockchain and distributed ledger technologies
- ITU-T Focus Group on Application of Distributed Ledger Technology (FG DLT)

Standardization steps

Inform and engage

Collect additional use cases

Assess use cases

Define requirements

A decision on issuing a call for proposal