Private Information in Public Data

A Forensic Analysis of Unaffected User Image Metadata Provided by Online Platforms

IARIA INTERNET 2026

Felix Fischer, Elisabeth Ziesch, Dirk Labudde

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University of Applied Sciences

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Motivation

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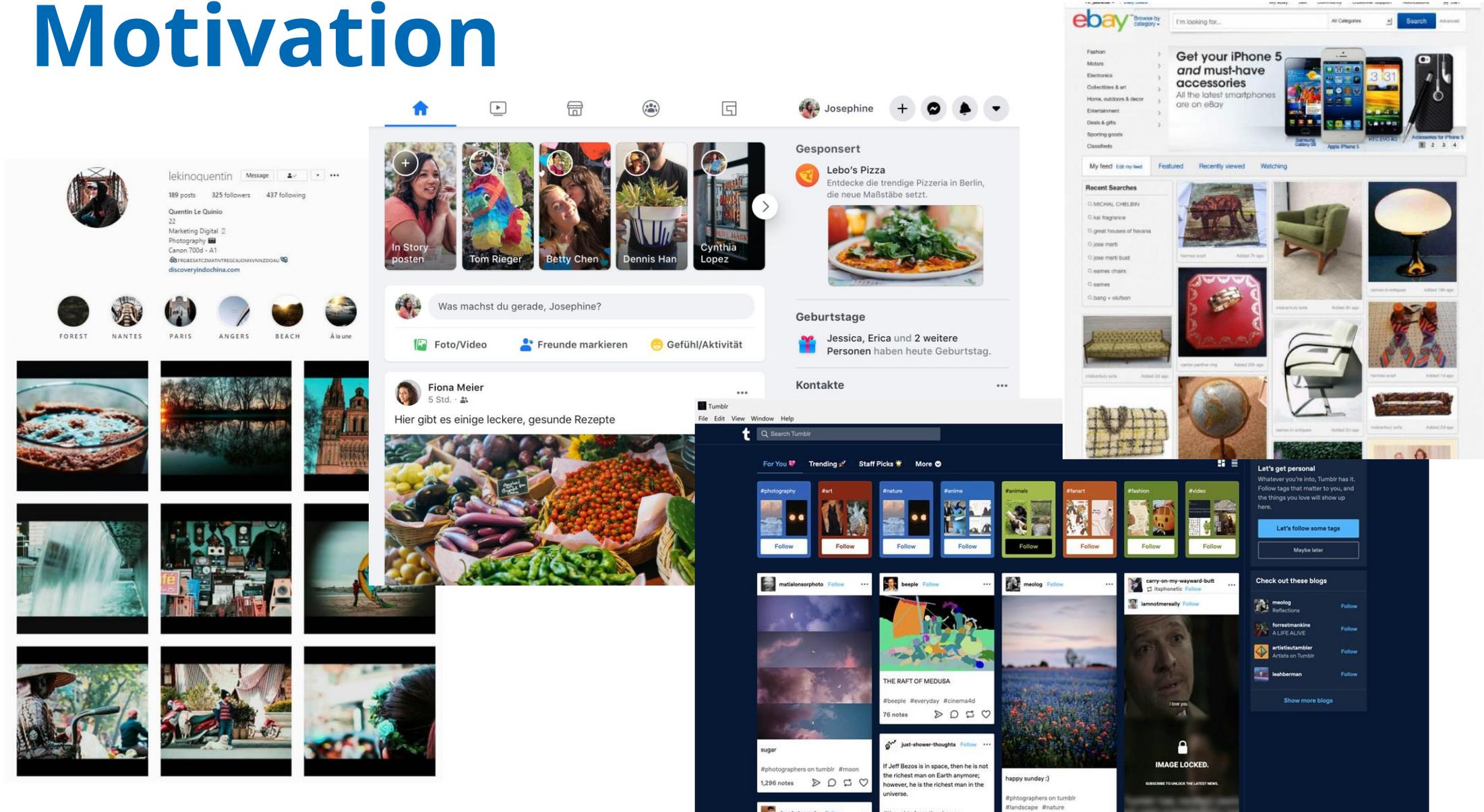
Motivation

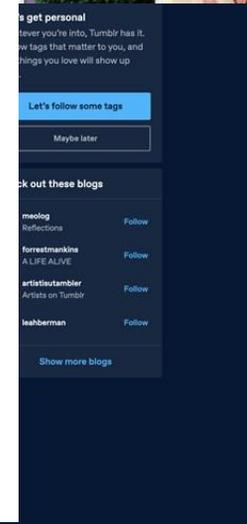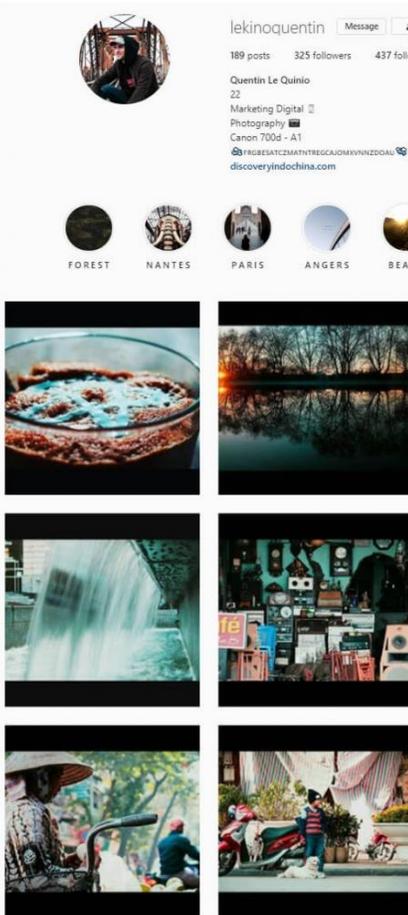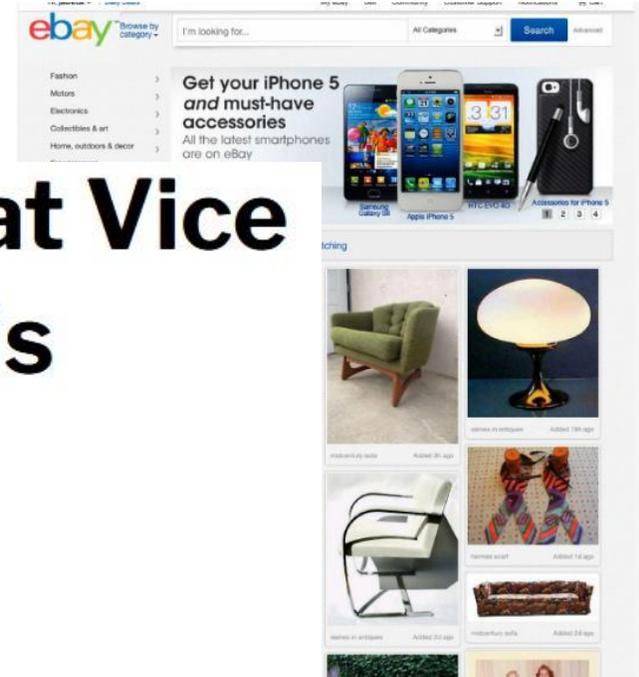John McAfee Admits That Vice Accidentally Revealed His Location in Guatemala

Rookie move, suckers.

By Jessica Roy · 12/04/12 10:09am

The photo in question. (Photo: Vice)

Antivirus software king John Mcafee finally admitted this morning that an "unseasoned technician at *Vice* headquarters" royally screwed him yesterday by accidentally revealing his top secret location to the entire Internet. Whoops!

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What is Metadata?

- Information about other data

- Adding context

- Facilitate search and management of data

- For Images: EXIF, XMP, IPTC

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EXIF - Exchangeable Image File Format

- Created by Japan Electronic and Information Technology Industries Associatio

- Creation timestamps

- Camera settings

- Goals:
  - Precise search
  - Precise retrieval
  - Precise viewing of images

Image Width	1080
Image Height	1920
Make	Canon
Camera Model Name	Canon EOS 350D DIGITAL
Orientation	Horizontal (normal)
Software	Canon fp Ver.4.00.0.V88
Modify Date	17.04.2023, 18:12:50
Artist	Elisabeth Ziesch
Copyright	Elisabeth Ziesch
Exposure Time	1/45
F Number	72645
Exposure Program	Manual
ISO	100
Shutter Speed Value	1/2000
Aperture Value	4
Metering Mode	Spot
Flash	No Flash
Focal Length	98.9 mm
Color Space	sRGB

XMP - Extensible Metadata Platform

- Created by Adobe

- Uses XML

- Goals:
  - Image processing
  - Copyright information
  - Geographic tagging
  - Creation dates

Sprache	de
Titel	*_image
Autor(en)	Elisabeth Ziesch
Verwendungsrechte	668554
Stichwörter/Betreff	Baum, Blueten, Haus
Aufnahmedatum	17.04.2023
Dateiformat	image/jpg
Erstellungs-Datum	17.04.2023, 18:12:50
Letzte Änderung	17.04.2023, 18:12:50
Letzte Änderung der Metadaten	17.04.2023, 18:12:50
Ort	Mittweida
Land/Hoheitsgebiet	Deutschland
Erstellungs-Datum	17.04.2023

IPTC - International Press Telecommunications Council

- Replaced mostly by XMP

- Target groups:
  - Journalism
  - Museums

- Goals:
  - Keeping cultural heritage
  - Author
  - Content description

CountryCode	DE
CreatorCity	Mittweida
CreatorCountry	Deutschland
CreatorAddress	Technikumplatz
CreatorPostalCode	09648
CreatorRegion	Sachsen
CreatorWorkEmail	e*******@email.com
CreatorWorkTelephone	0***********9
CreatorWorkURL	www.*********.de

Image Formats

- JPEG - Joint Photographic Experts Group
  - Loss-based compression
- PNG - Portable Network Graphics
  - Lossless compression
- TIFF – Tagged Image File Format
  - High quality without information loss
  - Similar to RAW
- WebP
  - Very flexible, better compression as JPEG

135 Selected Platforms

Messenger
Element, Signal, ICQ, Skype, HalloApp, WeChat, Line, Discord, Viber, WhatsApp, Webex by Cisco, Telegram, Zoom, Google Chat, Fluffy Chat, Messenger (Google), VK, Messenger (Meta)

Dating
Match, EliteSingles, Badoo, Bumble, LOVOO, BlackPlanet, MeetMe, Tagged, Zoosk, OkCupid, Canoodle

Community
Shutterfly, Quora, AboutMe, Minds, CaringBridge, Academia, Brainly, GoodReads, Care2, Snapfish, Crockets, RallyPoint, NextDoor, Opportunity, Polywork, Quanswer, Medium, Evernote, 23snaps, Influenster, girls ask guys, Elpha, Travellerspoint, Patient Like Me, ResearchGate, DailyStrength, Diaspora, Wattpad, Yelp, Slack, LiveJournal, Stack Overflow

Cloud-Storage
Microsoft OneDrive, Dropbox, Google Photos, Amazon Photos, Google Drive

Foto-Sharing
500xp, VSCO, TinyPic, Behance, DeviantArt, PicsArt, Foto-Community, Unsplash, Pixaby, PostImage, ArtStation, ImageShack, SmugMug, YouPic, Reverly, Pexels, Dribble, EyeEm, Houzz, Imgur, GuruShots, Crevado

Cooking
Chefkoch, Tastemade, Cookpad, Yummly

Marketplaces
Vinted, Shpock, eBay, Facebook Marketplace, Craigslist, Kleinanzeigen, Etsy

Sozial Media
GORF, Vero, Pinterest, Flickr, Snapchat, Whisper, hi5, YouTube, Wer kennt wen, Plurk, Facebook, Tumblr, Mixi, Mastodon, FC2, Yareny, MeWe, Spinchat, X (Twitter), Xing, Yooco, Amino, Galleria, TikTok, Befilo, Twitch, Taringa, Gab, LinkedIn, Basistar, Reddit, Demoxia, Facebook Lite, ASKfm, Instagram, CloutHub
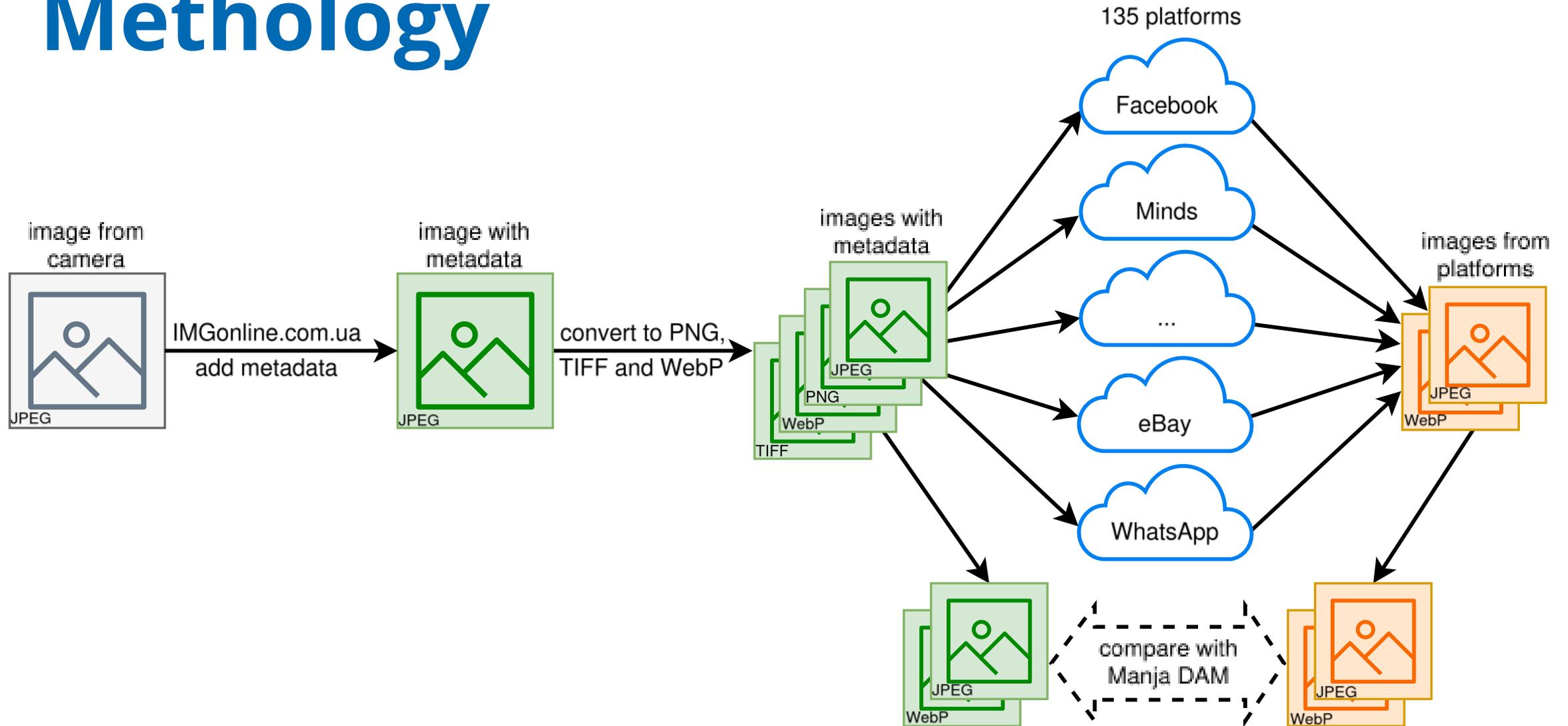
Methology

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Inserting Metadata

- **IMGonline.com.ua**

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Comparison of Metadaten

- **Manja Digital Asset Management**

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Complete removal of Metadata

Messenger
Signal
Line
HalloApp
WhatsApp
Telegram
Messenger (Google)
VK

Dating
Match
EliteSingles
Badoo
Bumble
LOVOO
BlackPlanet
MeetMe
Tagged
Zoosk
OkCupid
Canoodle

Community
Quora
AboutMe
Minds
Care2
Crockets
RallyPoint
Quanswer
NextDoor
Opportunity
Polywork
23snaps
Influenster
Travellerspoint
DailyStrength
Diaspora
Wattpad
Yelp
Stack Overflow

Cloud-Storage

Foto-Sharing
Foto-Community
Unsplash
Pixaby
ArtStation
YouPic
Pexels
Houzz
Imgur
GuruShots
Crevado

Sozial Media
GORF
Vero
Snapchat
Whisper
Plurk
hi5
YouTube
Yareny
Mixi
Mastodon
Spinchat
Xing
X (Twitter)
TikTok
Befilo
Twitch
Gab
LinkedIn
Basistar
Reddit
Demoxia
Facebook Lite
ASKfm
Instagram
CloutHub

Cooking
Chefkoch
Tastemade
Cookpad
Yummly

Marketplaces
Vinted
Shpock
eBay
Craigslist
Kleinanzeigen
Etsy

Complete retention of Metadata

Dating

Community
Academia
Snapfish
Quanswer
Evernote

Messenger
Element
Webex by Cisco
Zoom   Google Chat   Fluffy Chat
Messenger (Meta)

Foto-Sharing
DeviantArt   TinyPic
SmugMug

Sozial Media
Flickr
FC2

Cloud-Storage
Microsoft OneDrive   Dropbox
Google Photos   Amazon Photos
Google Drive

Cooking

Marketplaces

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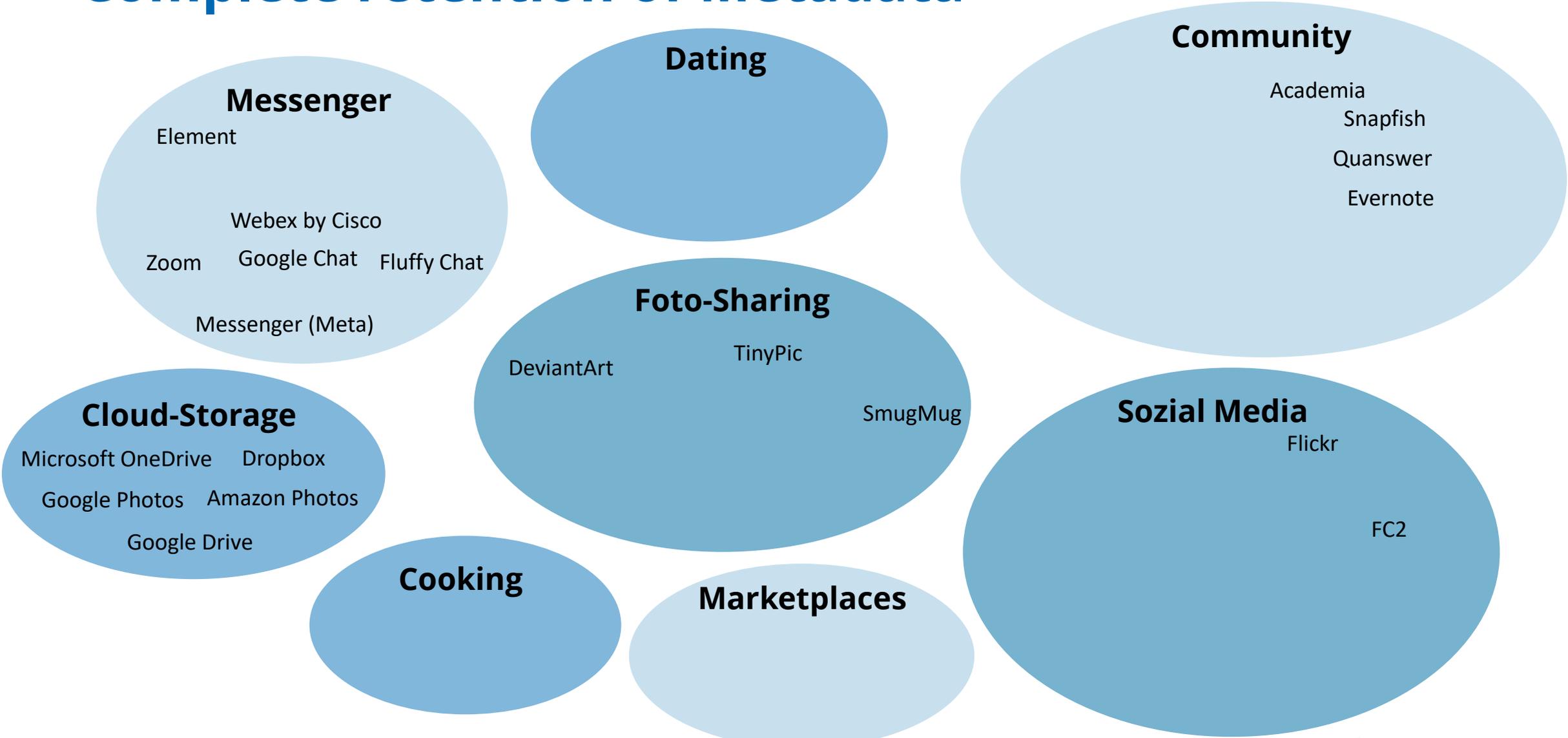
Partial preservation of metadata

Messenger
- Skype
- ICQ
- WeChat
- Discord
- Viber

Dating

Community
- Shutterfly
- CaringBridge
- GoodReads
- Brainly
- Medium
- girls ask guys
- Elpha
- Patient Like Me
- ResearchGate
- DailyStrength
- Slack
- LiveJournal

Foto-Sharing
- 500xp
- VSCO
- Behance
- PicsArt
- PostImage
- ImageShack
- EyeEm
- Reverly
- Dribble

Cloud-Storage

Sozial Media
- Pinterest
- Wer kennt wen
- Facebook
- Tumblr
- MeWe
- Yooco
- Amino
- Galleria
- Taringa

Cooking

Marketplaces
- Facebook Marketplace

Dates and times

Messenger
- Skype
- ICQ
- Discord
- Viber

Dating

Community
- Shutterfly
- CaringBridge
- GoodReads
- girls ask guys
- Elpha
- Patient Like Me
- ResearchGate
- LiveJournal

Foto-Sharing
- Behance
- PostImage
- ImageShack
- Reverly
- EyeEm

Cloud-Storage

Sozial Media
- Pinterest
- Wer kennt wen
- MeWe
- Yooco
- Galleria
- Taringa

Cooking

Marketplaces

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Copyright

Messenger
Skype
ICQ
Discord Viber

Dating

Community
Shutterfly
CaringBridge
GoodReads
Medium
girls ask guys Elpha
Patient Like Me ResearchGate
LiveJournal

Foto-Sharing
Behance
PostImage ImageShack
Reverly Dribble EyeEm

Cloud-Storage

Sozial Media
Pinterest
Wer kennt wen
Facebook
MeWe Tumblr
Yooco
Galleria Taringa

Cooking

Marketplaces
Facebook Marketplace

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Color space metadata

Messenger
- Skype
- ICQ
- Discord
- Viber

Dating

Community
- Shutterfly
- CaringBridge
- GoodReads
- girls ask guys
- Elpha
- Patient Like Me
- ResearchGate
- LiveJournal

Foto-Sharing
- 500xp
- VSCO
- Behance
- PicsArt
- PostImage
- ImageShack

Cloud-Storage

Cooking

Marketplaces

Sozial Media
- Wer kennt wen
- Tumblr
- MeWe
- Yooco
- Galleria
- Taringa

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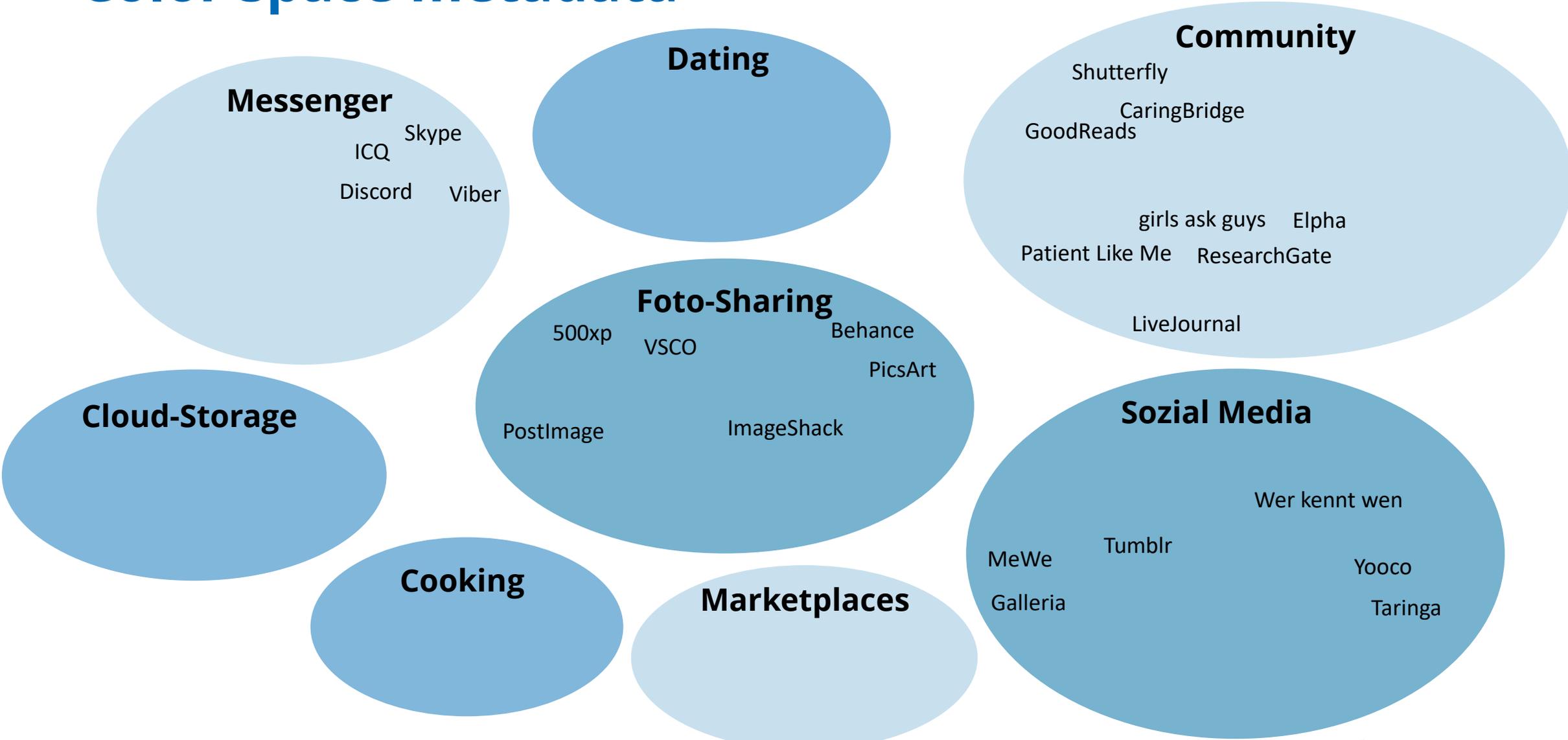
Localtion information

Messenger
Skype
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Discord

Dating

Community
girls ask guys   Elpha
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PostImage

Sozial Media
Wer kennt wen
MeWe   Yooco
Galleria   Taringa

Cooking

Marketplaces

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Camera model

Messenger
- Skype
- ICQ
- Discord
- Viber

Dating

Community
- Shutterfly
- CaringBridge
- GoodReads
- girls ask guys
- Elpha
- ResearchGate
- LiveJournal

Foto-Sharing
- PostImage
- ImageShack
- Reverly

Cloud-Storage

Sozial Media
- MeWe
- Galleria
- Yooco
- Taringa

Cooking

Marketplaces

No conversion of format

Messenger
Element
Skype
ICQ
Discord
Webex by Cisco
Zoom
Google Chat
Fluffy Chat

Dating
MeetMe

Community
Academia
Snapfish
Crockets
RallyPoint
Evernote
Elpha
Travellerspoint
Patient Like Me
Diaspora
Slack
LiveJournal
Stack Overflow

Foto-Sharing
500xp
VSCO
TinyPic
DeviantArt
Unsplash
Pixaby
SmugMug
Reverly

Cloud-Storage
Microsoft OneDrive
Dropbox
Google Photos
Amazon Photos
Google Drive

Cooking

Marketplaces

Sozial Media
Flickr
hi5
Mastodon
MeWe
Xing
Yooco
Basistar
ASKfm

Deduce the platform by fingerprint?

- Only for partial platforms (25%)

- Only if **all** metadata fields have been filled before upload

- Foundings can be used as negative mask.

  - „This image can not be downloaded from XYZ."

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Conclusion

- 60% remove metadata completly
- All platforms with sesitive data remove metadata (Dating)
- Cloud storage does not modify data
- No unified handling of image formats
- No modification of metadata
- TIFF is rarely accepted
- We provided an upper limit of expected forensic metadata.

Possible deviations

- Experient performed in germany (strict privacy laws)
- Browser Microsoft Edge
- Virtual Android for Apps
- Download minutes after Upload
  - Old images = different outcome?
- Just direct chats, no group chats

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Future Work

- More platforms and media formats

- Metadata in documents (PDF, …)

- Different app sections (group chats, stories, status)

- Is metadata still present on the server? (removed during download)

- Changes in image content (watermark, compression, …)

- App vs web application

- Smartphone vs computer

Gracias!

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