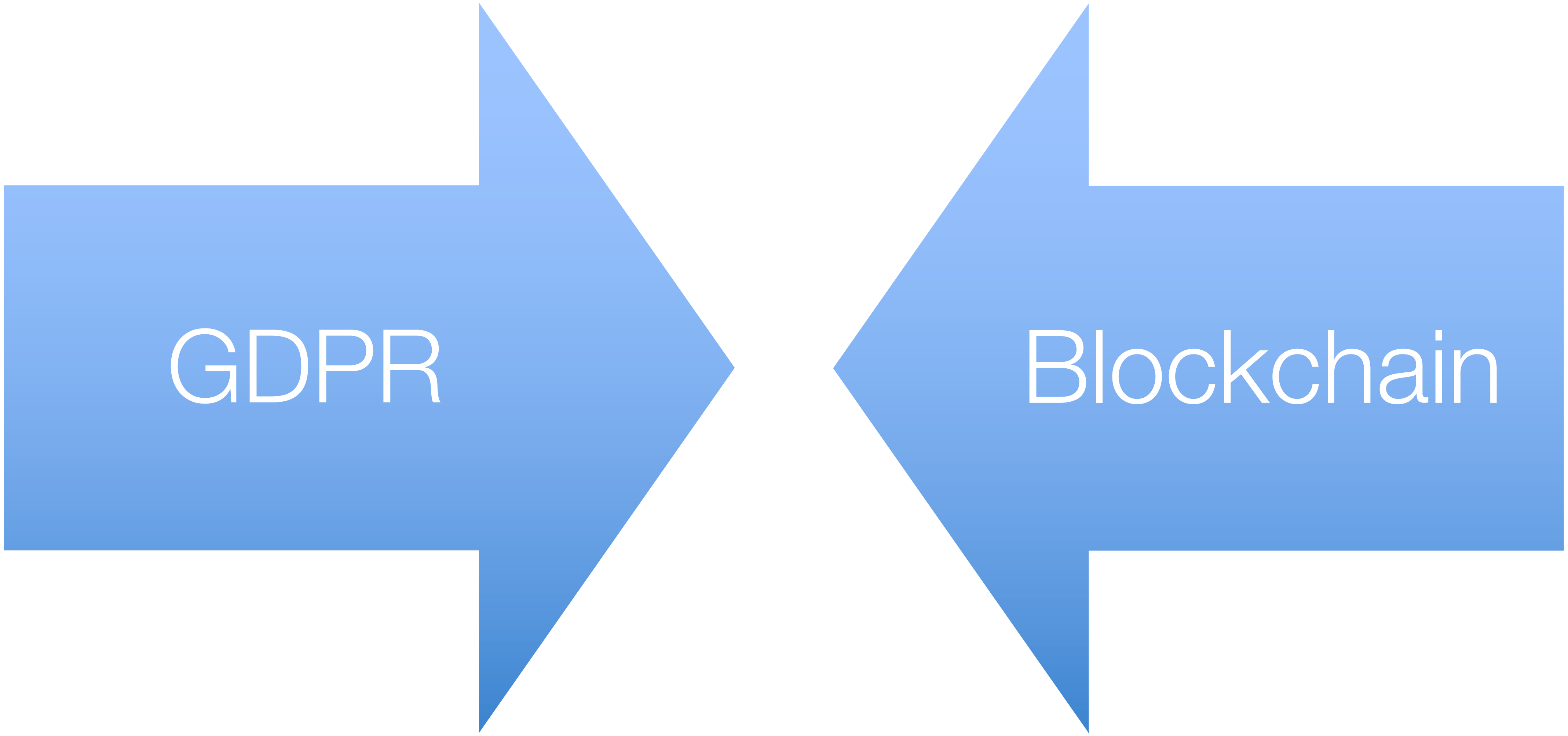
Blockchain and GDPR

Blockchain Hands On, March 5th 2019, Fusion, Geneva
Jörn Erbguth, Dipl.-Inf., Dipl.-Jur.
Consultant Legal Tech, Blockchain, Smart Contracts and Data Protection
PhD candidate, University of Geneva

joern@erbguth.ch +41 787256027

GDPR vs. Blockchain


GDPR

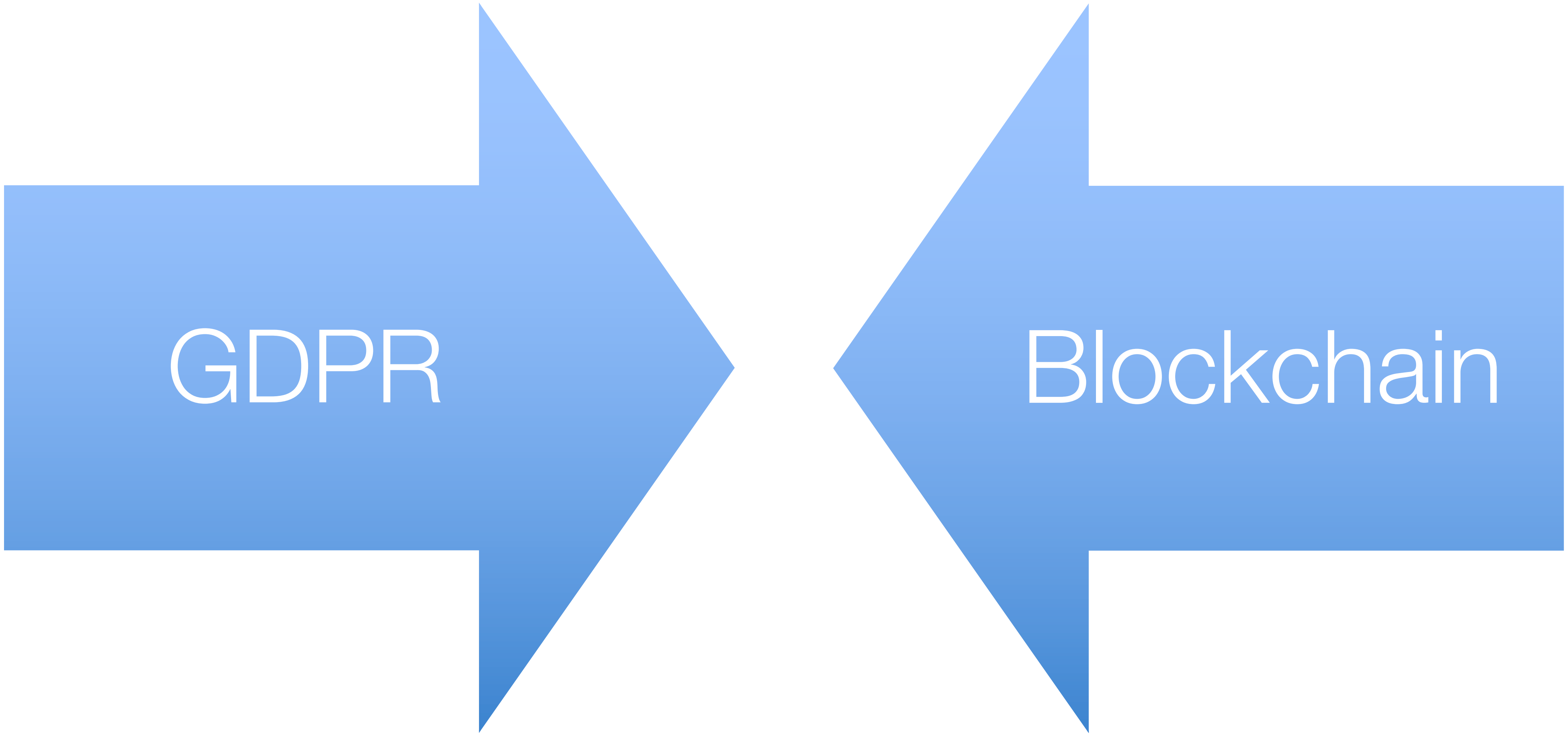
Blockchain

Right to …

Art. 16: rectification
Art. 17: erasure
Art. 18: restriction of processing

immutable
public

GDPR vs. Blockchain



GDPR

Blockchain

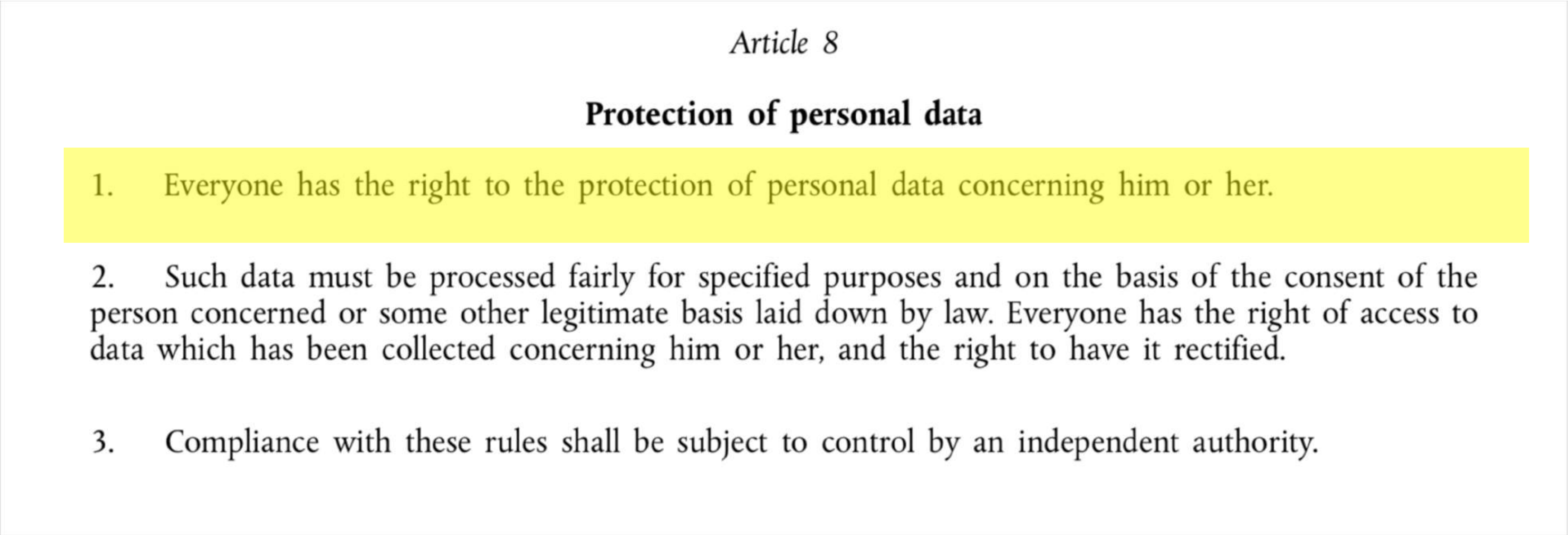
Clear responsibilities
controller
processor

distributed responsibility
anonymous participation

Agenda

- GDPR
- How to evaluate GDPR compliance
- How to use hashing correctly
- Public and permissioned blockchains
- 5 ways for blockchain applications to cope with GDPR

Charter of Fundamental Rights of the European Union



Article 8

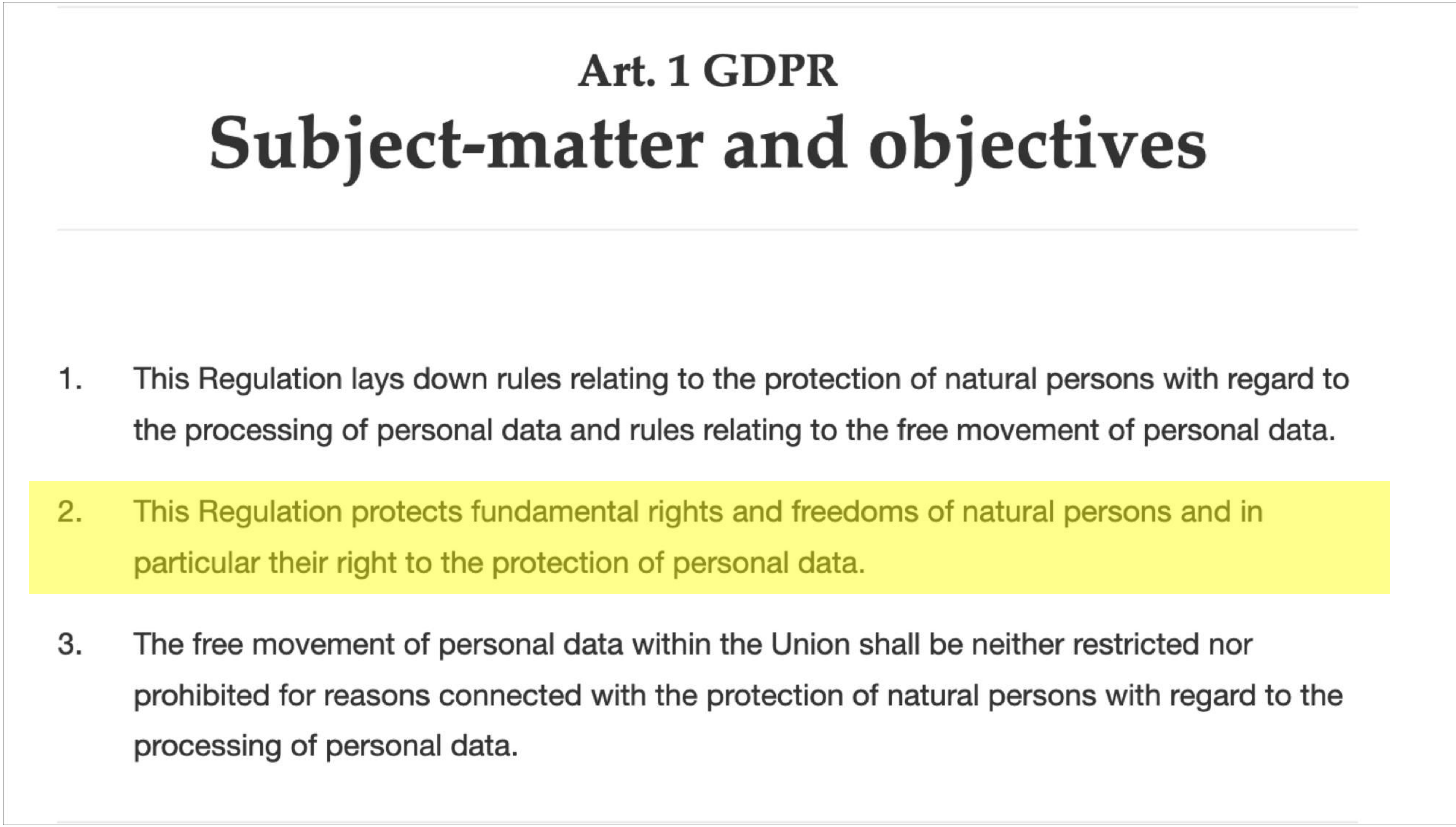
Protection of personal data

1. Everyone has the right to the protection of personal data concerning him or her.

2. Such data must be processed fairly for specified purposes and on the basis of the consent of the person concerned or some other legitimate basis laid down by law. Everyone has the right of access to data which has been collected concerning him or her, and the right to have it rectified.

3. Compliance with these rules shall be subject to control by an independent authority.

What does the GDPR protect?



Art. 1 GDPR

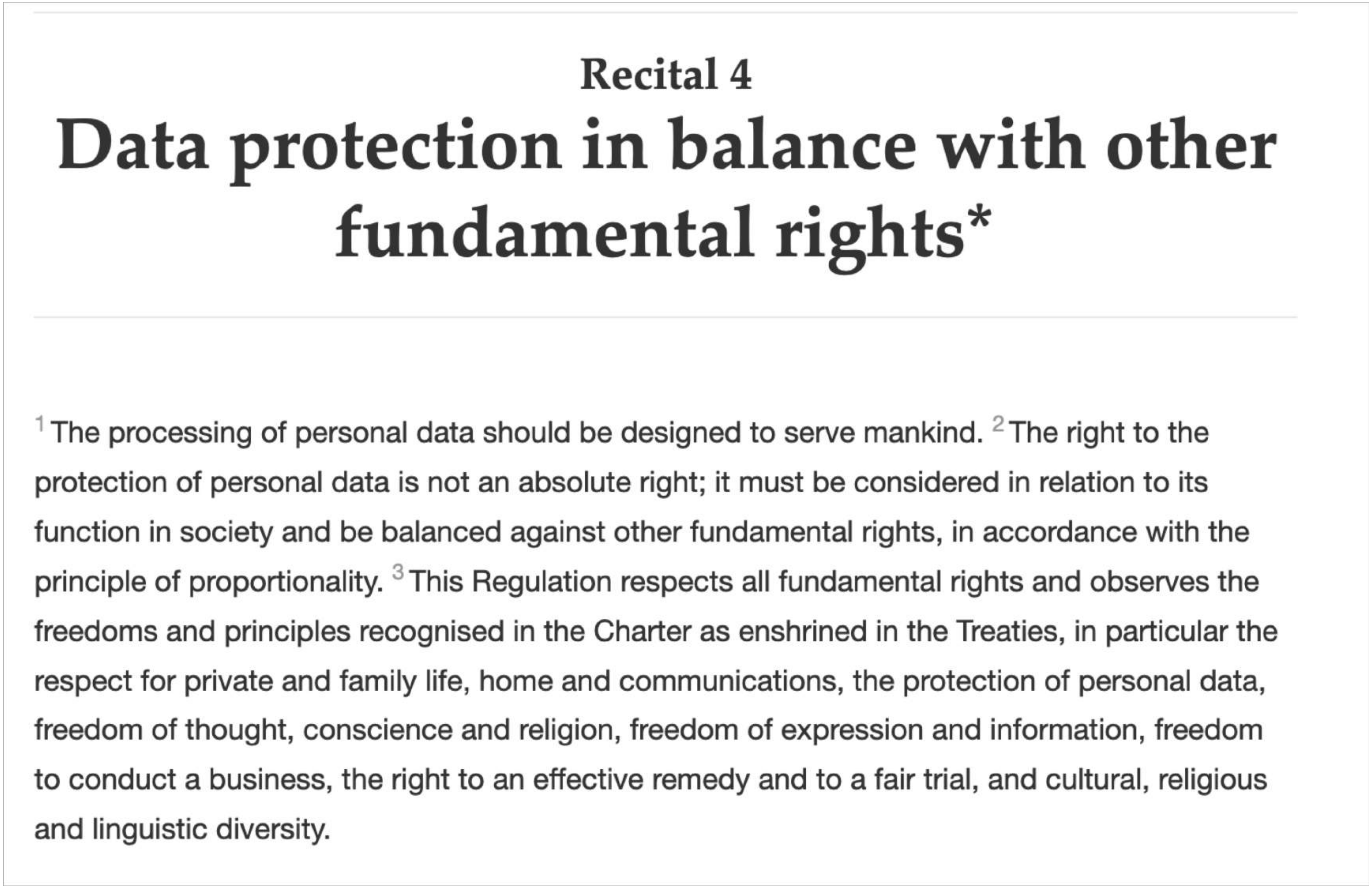
Subject-matter and objectives

1. This Regulation lays down rules relating to the protection of natural persons with regard to the processing of personal data and rules relating to the free movement of personal data.

2. This Regulation protects fundamental rights and freedoms of natural persons and in particular their right to the protection of personal data.

3. The free movement of personal data within the Union shall be neither restricted nor prohibited for reasons connected with the protection of natural persons with regard to the processing of personal data.

GDPR in Relation to Other Fundamental Rights



Recital 4

Data protection in balance with other fundamental rights*

[1] The processing of personal data should be designed to serve mankind. [2] The right to the protection of personal data is not an absolute right; it must be considered in relation to its function in society and be balanced against other fundamental rights, in accordance with the principle of proportionality. [3] This Regulation respects all fundamental rights and observes the freedoms and principles recognised in the Charter as enshrined in the Treaties, in particular the respect for private and family life, home and communications, the protection of personal data, freedom of thought, conscience and religion, freedom of expression and information, freedom to conduct a business, the right to an effective remedy and to a fair trial, and cultural, religious and linguistic diversity.

General Data Protection Regulation (GDPR)

- Processing of personal data is forbidden
- Unless there is proper justification
- Obligations for controllers and processors
- Rights for data subjects
- Includes obligation to information security
- Fines up to 20 mill. € or 4% of worldwide annual turnover

How to evaluate GDPR compliance

- Does GDPR apply?
- Is there processing of personal data?
- Is there a justification for this data processing?
- Do I comply with the obligations of GDPR?

Does the GDPR apply? (Art. 2, 3)

- Some entity that is considered a controller or a processor is in the EU
- Offering goods or services to data subjects in the EU
- Monitoring behavior of data subjects in the EU
- Not if only for personal use or household activity

Personal data (Art. 4.1)?

Any information relating to an identified or identifiable natural person

- Pseudonymous data is personal data
- Anonymous data is **not** personal data

Recital 26: To determine whether a natural person is identifiable, account should be taken of **all the means reasonably likely to be used** ... either by the controller or by another person to identify the natural person directly or indirectly.

Examples of personal data

✓ IP addresses

✓ Bitcoin addresses

✓ “anonymized” movement profile

✓ “anonymized” browsing history

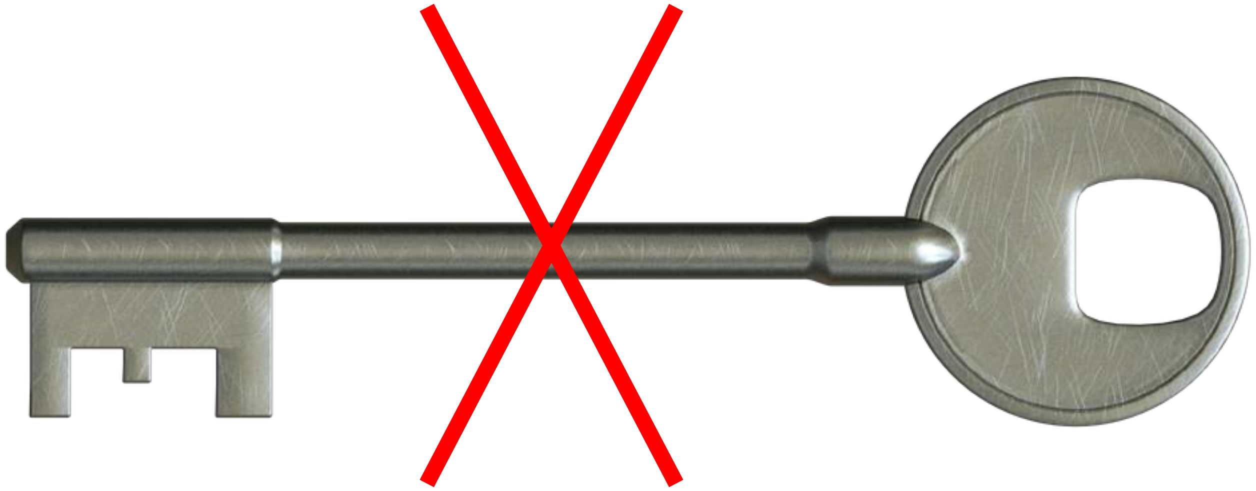
✗ aggregated movement profiles

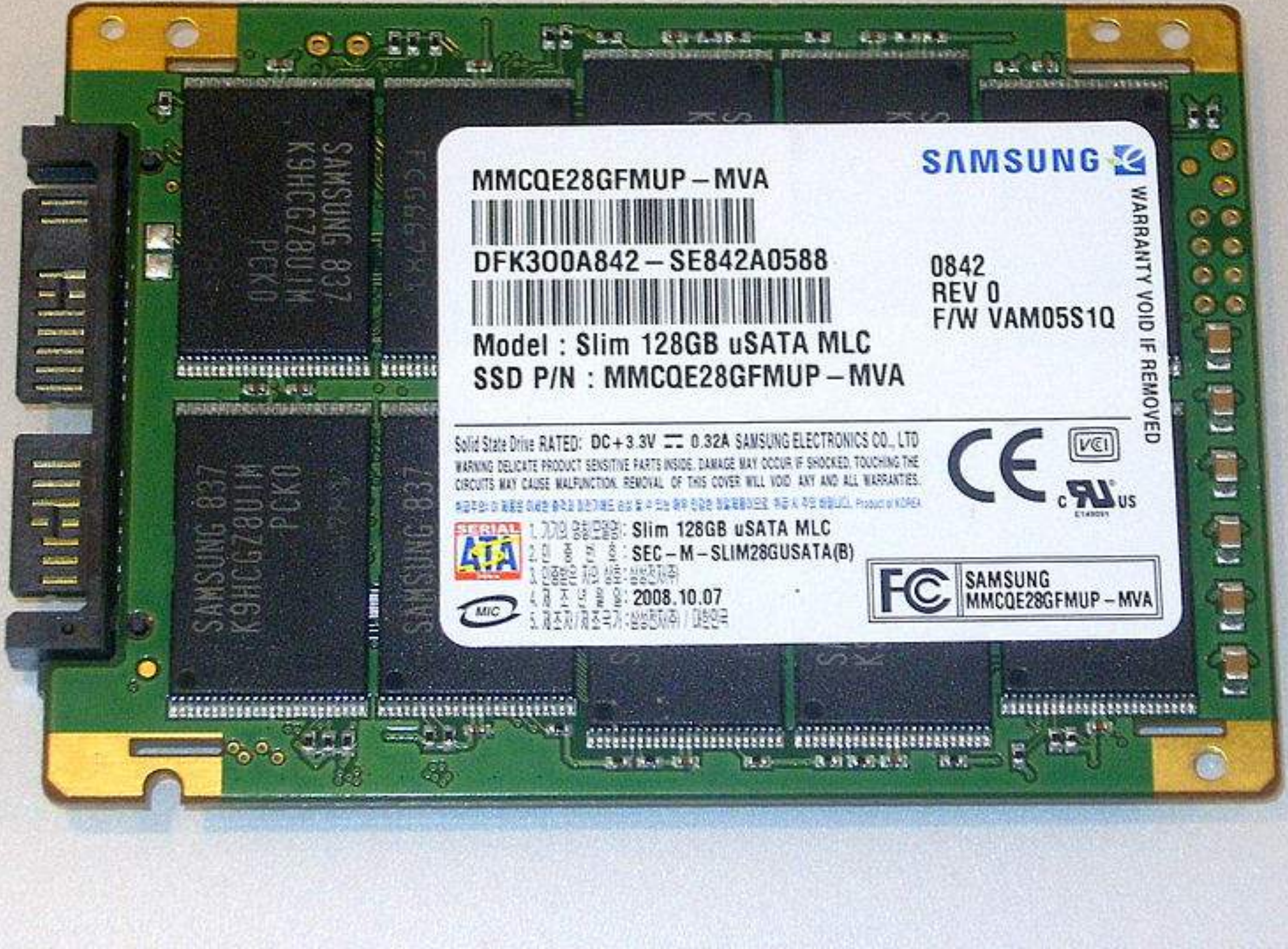
✗ aggregated browsing history

Attention: Look at the individual case – do not generalize

Encryption

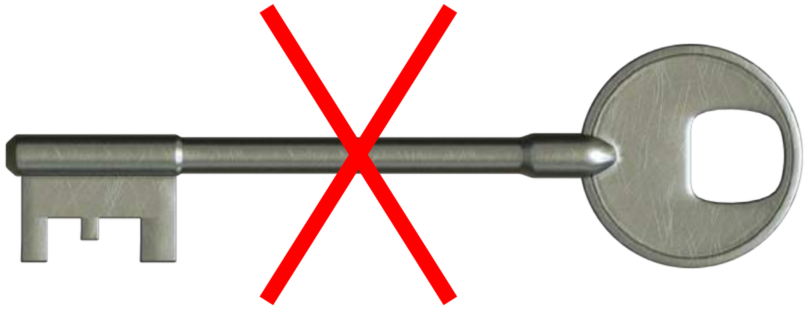
Deletion of the encryption key = deletion of the content?




SAMSUNG
MMCQE28GFMUP – MVA
DFK3O0A842 – SE842A0588
0842
REV 0
F/W VAM05S1Q
Model : Slim 128GB uSATA MLC
SSD P/N : MMCQE28GFMUP – MVA
WARRANTY VOID IF REMOVED
Solid State Drive RATED: DC + 3.3V ⎓ 0.32A SAMSUNG ELECTRONICS CO., LTD
WARNING DELICATE PRODUCT SENSITIVE PARTS INSIDE. DAMAGE MAY OCCUR IF SHOCKED, TOUCHING THE CIRCUITS MAY CAUSE MALFUNCTION. REMOVAL OF THIS COVER WILL VOID ANY AND ALL WARRANTIES.
Product of KOREA
CE
VCI
c UL us
SERIAL ATA
MIC
1. 기기의 명칭(모델명): Slim 128GB uSATA MLC
2. 인 증 번 호: SEC – M – SLIM28GUSATA(B)
3. 인증받은 자의 상호: 삼성전자(주)
4. 제 조 년 월 일: 2008.10.07
5. 제조자/제조국가: 삼성전자(주) / 대한민국
FC
SAMSUNG
MMCQE28GFMUP – MVA
SAMSUNG 837
K9HCG78U1M
PCK0

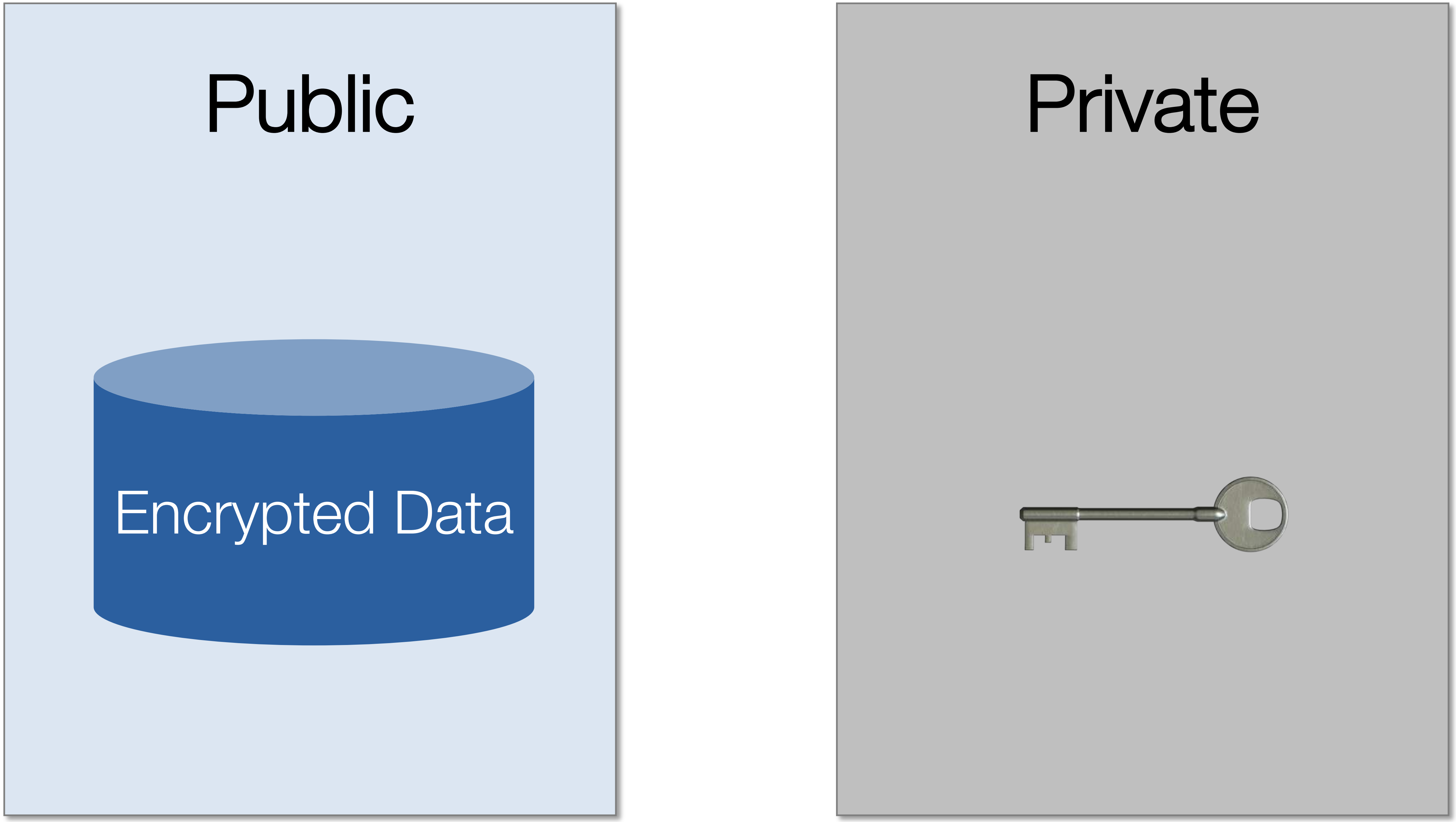
GDPR-compliant deletion?

- Deletion of the encryption key = deletion of the content?



- Is there a remaining copy of the key?
- Will the encryption method become insecure in the future?

Use of Hash Values

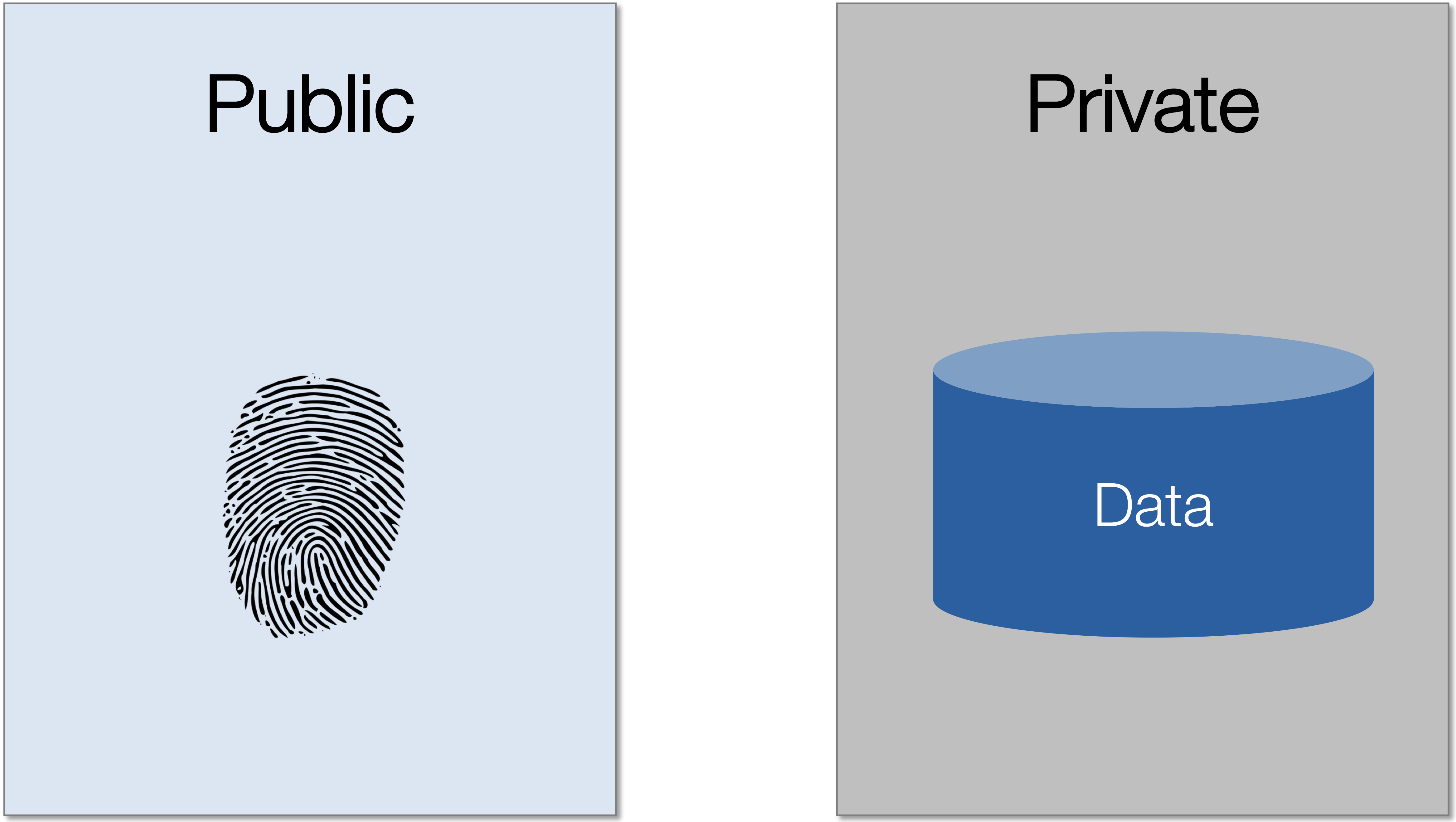


Public

Encrypted Data

Private

Use of Hash Values



Public

Private

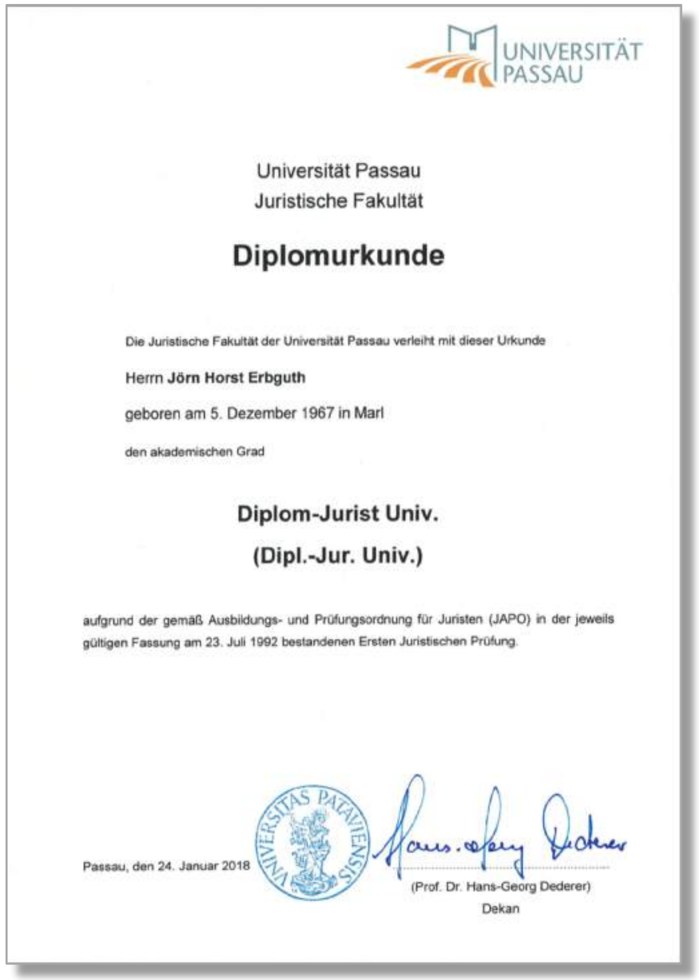
Data

Cryptographic hash functions

- Serve as digital fingerprints
- Virtually unique
- Fixed length (e.g. 32 bytes)
- For digital objects of any size
- One-way function

Demo 2

Kryptografische Hashwerte, datenschutzkonform



UNIVERSITÄT PASSAU

Universität Passau
Juristische Fakultät

Diplomurkunde

Die Juristische Fakultät der Universität Passau verleiht mit dieser Urkunde

Herrn **Jörn Horst Erbguth**

geboren am 5. Dezember 1967 in Marl

den akademischen Grad

Diplom-Jurist Univ.

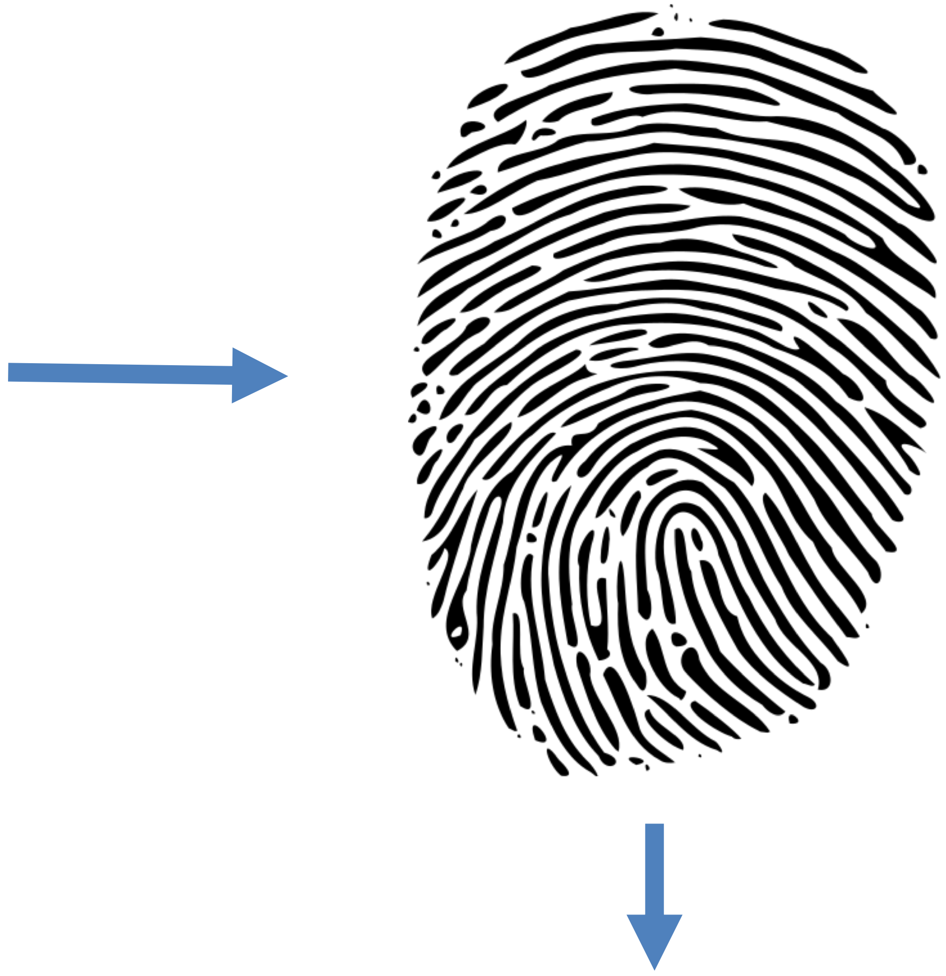
(Dipl.-Jur. Univ.)

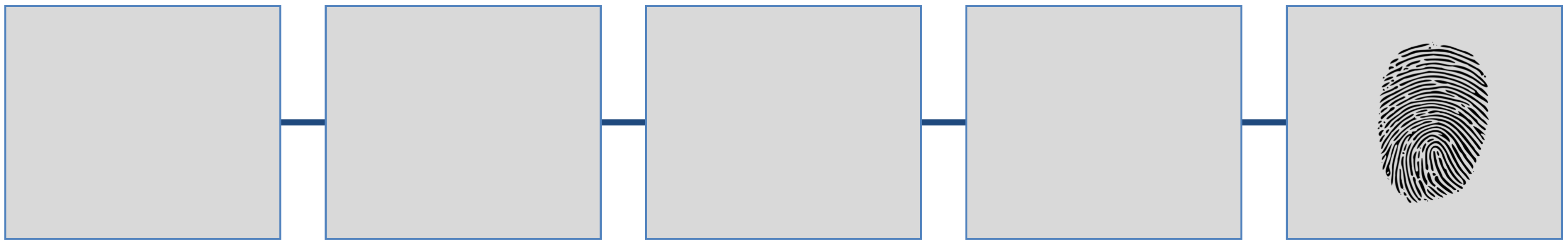
aufgrund der gemäß Ausbildungs- und Prüfungsordnung für Juristen (JAPO) in der jeweils gültigen Fassung am 23. Juli 1992 bestandenen Ersten Juristischen Prüfung.

Passau, den 24. Januar 2018

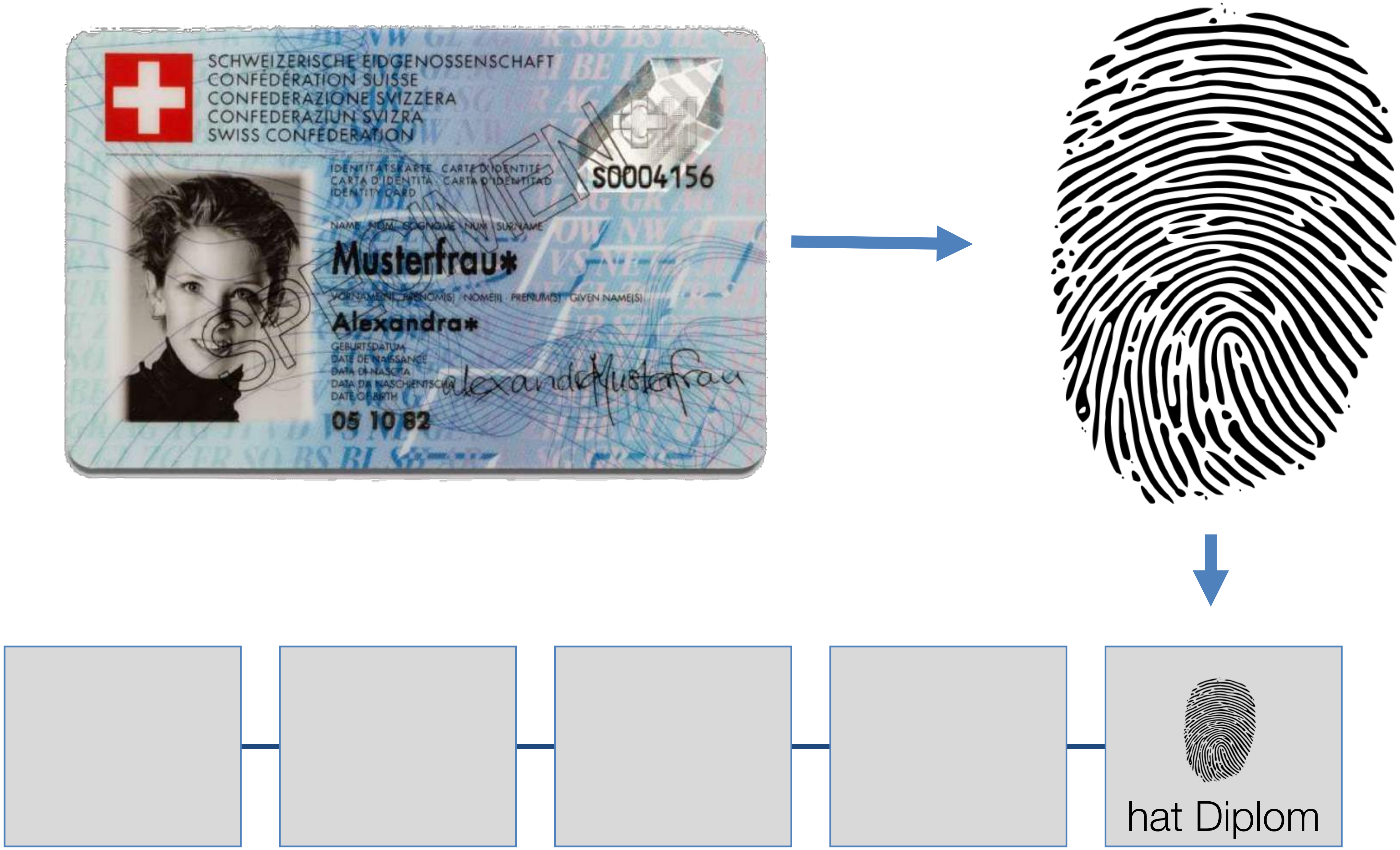
UNIVERSITAS PATAVIENSIS

(Prof. Dr. Hans-Georg Dederer)
Dekan





Kryptografische Hashwerte, nicht datenschutzkonform



SCHWEIZERISCHE EIDGENOSSENSCHAFT
CONFÉDÉRATION SUISSE
CONFEDERAZIONE SVIZZERA
CONFEDERAZIUN SVIZRA
SWISS CONFEDERATION

IDENTITÄTSKARTE CARTE D'IDENTITÉ
CARTA D'IDENTITÀ CARTA D'IDENTITAD
IDENTITY CARD

S0004156

SPECIMEN

NAME NOM COGNOME NUM SURNAME
Musterfrau*

VORNAME(N) PRÉNOM(S) NOME(I) PRENUM(S) GIVEN NAME(S)
Alexandra*

GEBURTSDATUM
DATE DE NAISSANCE
DATA DI NASCITA
DATA DA NASCHIENTSCHA
DATE OF BIRTH
05 10 82

alexandra Musterfrau

hat Diplom

Use Cases for Cryptographic Hash Functions

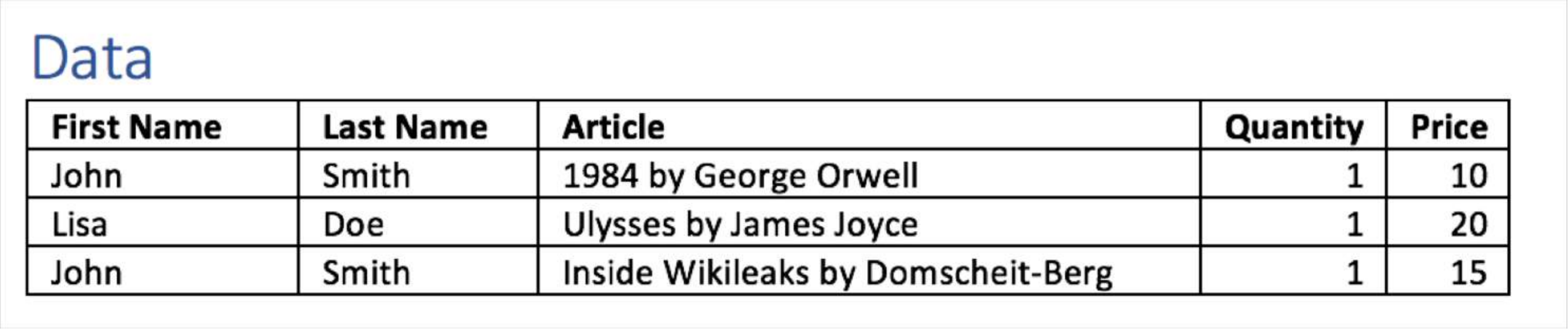
- Validate external documents
- Time-stamping
- Proof of Existence
- Basic functionality for cryptography and DLT

The wrong use of hash functions can lead to the identification of data subjects!

Adding Salt and Pepper to Hashes

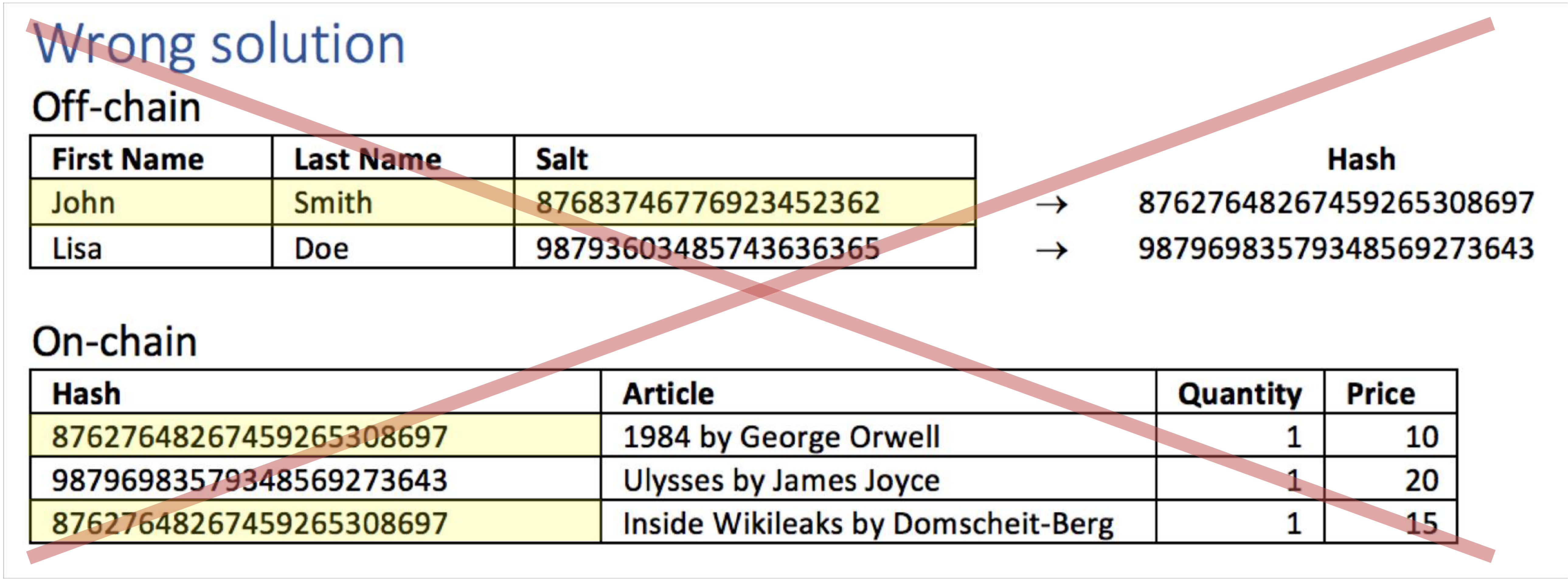
- Ensuring enough **entropy**
- Making guessing really hard
- Can prevent rainbow table attacks
- Can prevent parallel attacks

How to Hash Data



Data

First Name	Last Name	Article	Quantity	Price
John	Smith	1984 by George Orwell	1	10
Lisa	Doe	Ulysses by James Joyce	1	20
John	Smith	Inside Wikileaks by Domscheit-Berg	1	15



Wrong solution

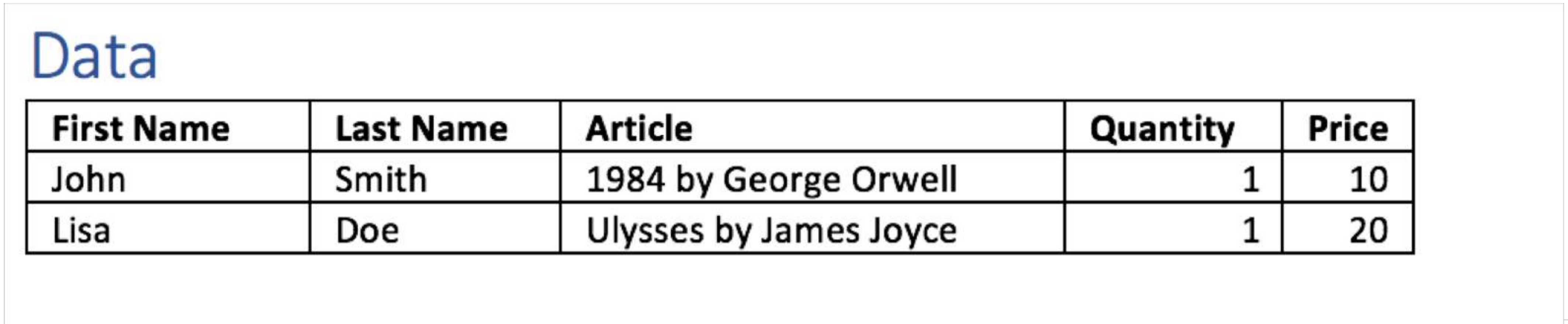
Off-chain

First Name	Last Name	Salt		Hash
John	Smith	87683746776923452362	→	87627648267459265308697
Lisa	Doe	98793603485743636365	→	98796983579348569273643

On-chain

Hash	Article	Quantity	Price
87627648267459265308697	1984 by George Orwell	1	10
98796983579348569273643	Ulysses by James Joyce	1	20
87627648267459265308697	Inside Wikileaks by Domscheit-Berg	1	15

How to Hash Data



Data

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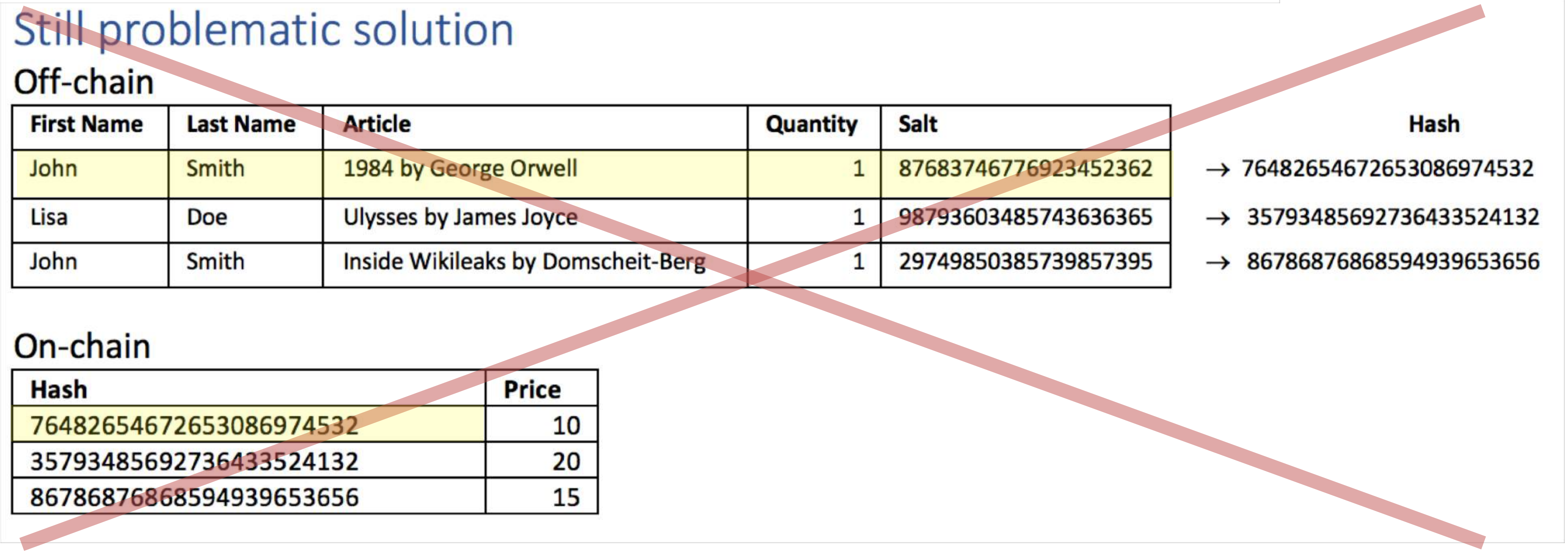


Still problematic solution

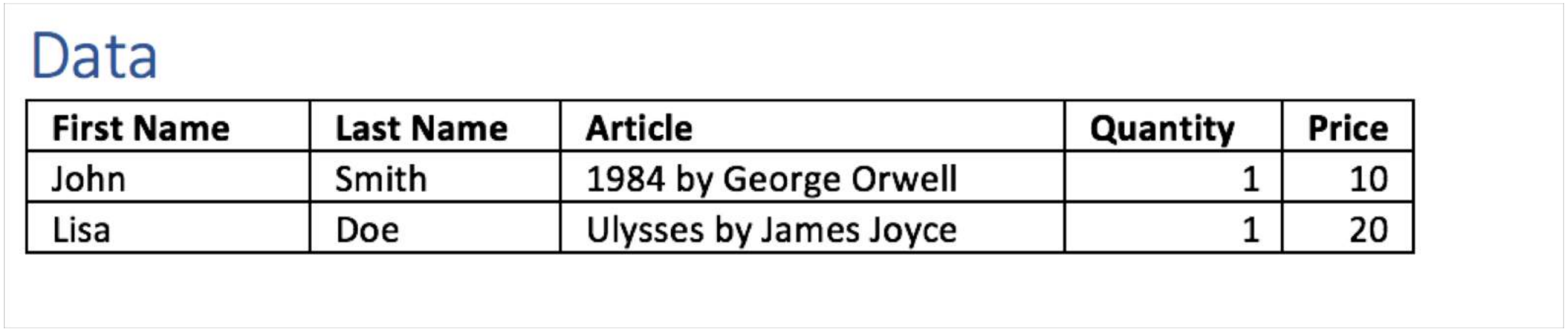
Off-chain

First Name	Last Name	Article	Quantity	Salt	Hash
John	Smith	1984 by George Orwell	1	87683746776923452362	→ 76482654672653086974532
Lisa	Doe	Ulysses by James Joyce	1	98793603485743636365	→ 35793485692736433524132
John	Smith	Inside Wikileaks by Domscheit-Berg	1	29749850385739857395	→ 86786876868594939653656

On-chain

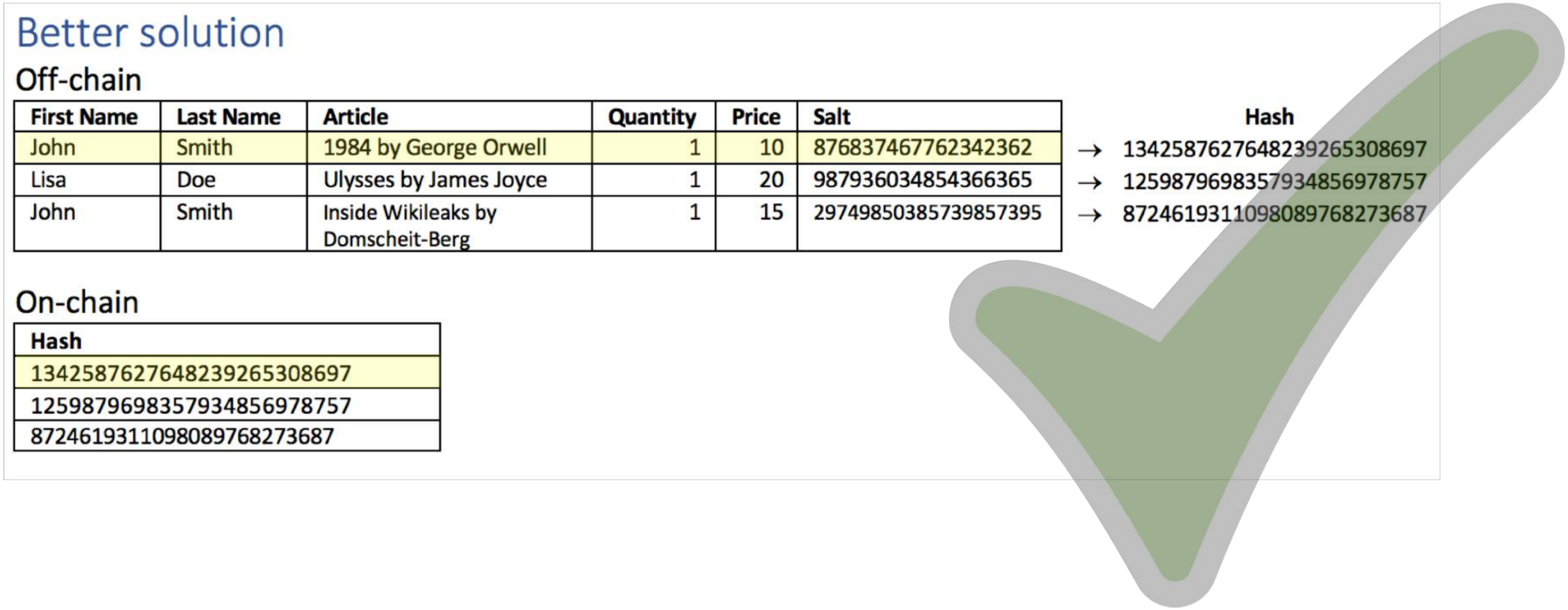
Hash	Price
76482654672653086974532	10
35793485692736433524132	20
86786876868594939653656	15

How to Hash Data



Data

First Name	Last Name	Article	Quantity	Price
John	Smith	1984 by George Orwell	1	10
Lisa	Doe	Ulysses by James Joyce	1	20



Better solution

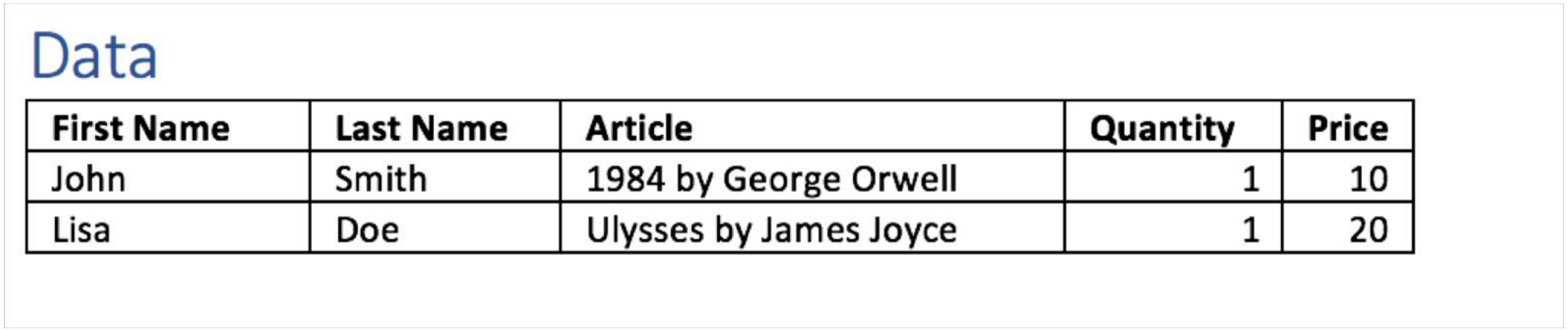
Off-chain

First Name	Last Name	Article	Quantity	Price	Salt		Hash
John	Smith	1984 by George Orwell	1	10	876837467762342362	→	1342587627648239265308697
Lisa	Doe	Ulysses by James Joyce	1	20	987936034854366365	→	1259879698357934856978757
John	Smith	Inside Wikileaks by Domscheit-Berg	1	15	29749850385739857395	→	8724619311098089768273687

On-chain

Hash
1342587627648239265308697
1259879698357934856978757
8724619311098089768273687

How to Hash Data



Data

First Name	Last Name	Article	Quantity	Price
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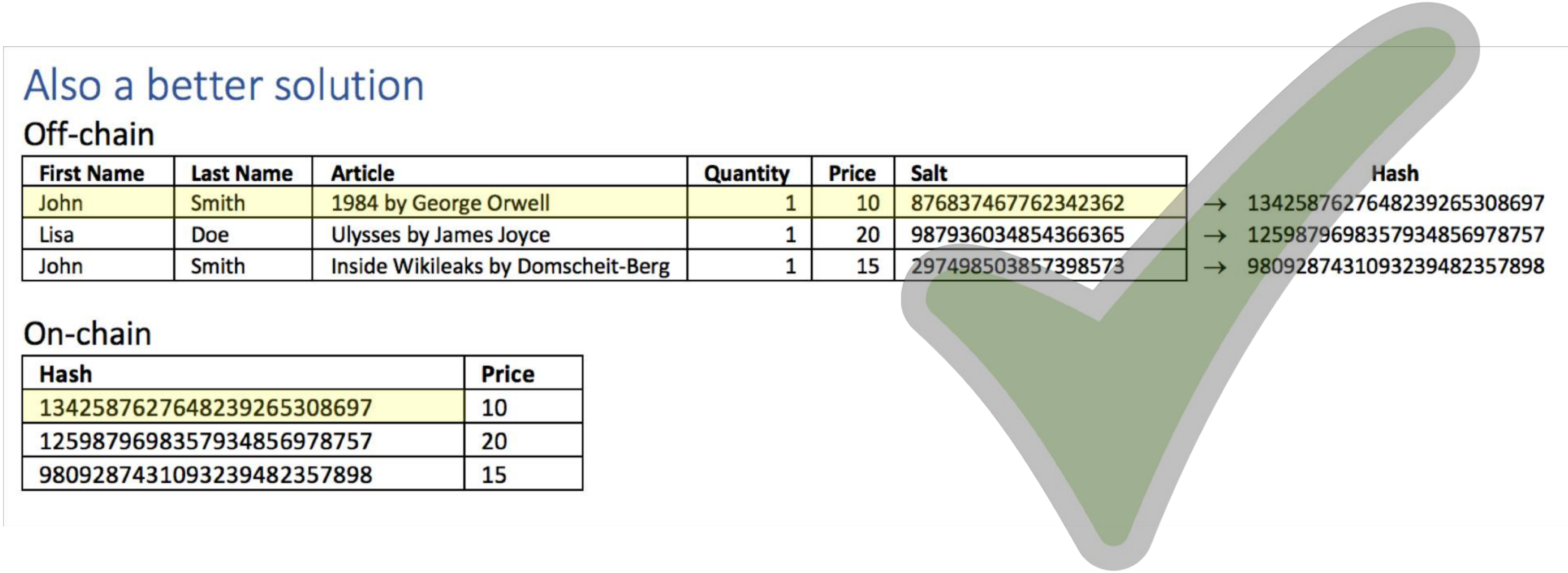


Also a better solution

Off-chain

First Name	Last Name	Article	Quantity	Price	Salt		Hash
John	Smith	1984 by George Orwell	1	10	876837467762342362	→	1342587627648239265308697
Lisa	Doe	Ulysses by James Joyce	1	20	987936034854366365	→	1259879698357934856978757
John	Smith	Inside Wikileaks by Domscheit-Berg	1	15	297498503857398573	→	9809287431093239482357898

On-chain

Hash	Price
1342587627648239265308697	10
1259879698357934856978757	20
9809287431093239482357898	15

Test: Does the Blockchain Leak Personal Data?

Does the system disclose personal data by itself?

What if

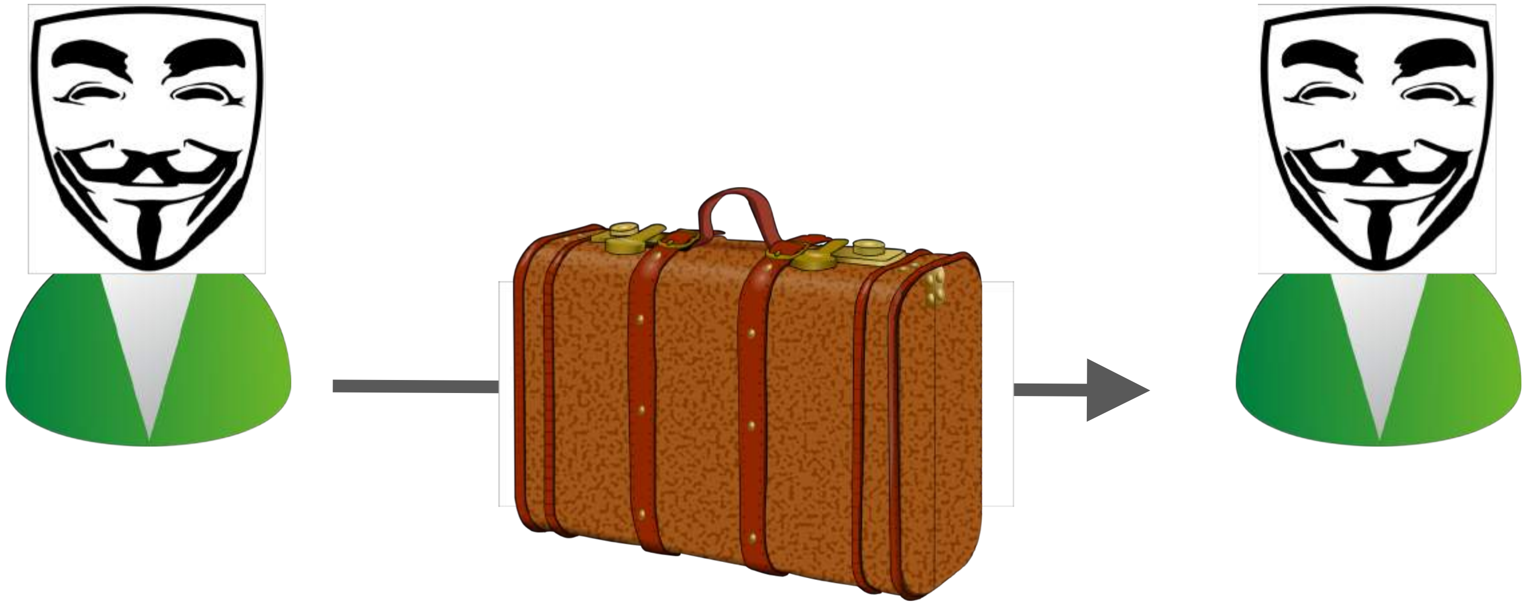
- somebody knows one transaction, can she see further transactions of the same person?
- somebody knows part of a transaction, can she see further details?
- somebody knows personal details of a person, can she discover information about the person's activity?

Zero-Knowledge Proof

Proof of knowing something without revealing it

Zero-Knowledge Proof – Zcash

- Limiting the purpose of using personal data by technical means
- Only the correctness of the transaction can be proven
- Privacy by design



Advantages

- Protection also against insiders (e.g. admins)
- Access rights cannot be modified retroactively
- Protection against intruders that breach the firewall
- Data is protected against manipulation

Still personal data?

- In a pre-GDPR opinion, DPAs said yes (Art. 29 WP, 05/14)
- GDPR says, it depends
- So does the Austrian Datenschutzbehörde
- Risk that immutable data on blockchains become personal data later

Opinion of the CNIL

Order of Preference

- Zero-Knowledge Proof
- Hashes with secret key (peppered hashes)
- Encryption
- Hashes without additional secret key
- Clear text

Lawfulness of processing (Art. 6)

- Consent (Art. 6.1 a)
- Performance of a contract (Art. 6.1 b)
- Compliance with a legal obligation (Art. 6.1 c)
- Legitimate interest (Art. 6.1 f)

Controllers, Processors, Data Subjects

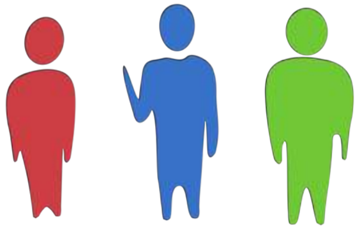
Controller

Determines the purposes and
means of processing

Processor

Processes data
on behalf of the controller

Data-Subjects

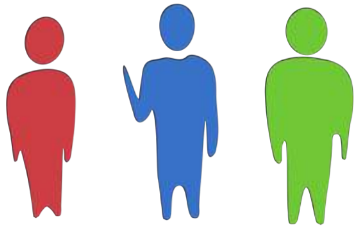


Controllers, Processors, Data Subjects

Joint- Controller

Determines the purposes and
means of processing

Data-Subjects



Who is “Controller” and who is “Processor”?

- Node operators?
- Miner who mines a specific block?
- All miners together?
- User who signs a transaction with her private key?
- Exchange or wallet service that signs a transaction on behalf of a user?
- Entity that administrates permissions for a permissioned blockchain?

Opinion of the CNIL on Controllers and Processors

- User of a public blockchain is a controller ☺
- Somebody who creates and controls a permissioned blockchain is a controller
- Members of a consortium can be joint controllers
- Node operators are processors
- Smart contract developers can be processors, if they retain control

Duties of Controllers and Processors

- Controllers must identify themselves
- Controllers are responsible towards data subjects
- Controllers must have processing agreements with processors
- Controllers must control processors
- Processors must process data only on documented instructions from the controller

Public Blockchains vs. Permissioned Blockchains

Public Blockchains

! Who sends and signs a transaction is a controller

? Anonymity

? Processing agreements

? Liability

Permissioned Blockchains

! Who attributes permissions is controller

! Processing agreements

! Liability

? Joint controller

Five Ways to Cope with GDPR

- Do not put any personal data (at all) on a blockchain
- Use Privacy Enhancing Technology and ensure that it does not leak personal data in any undesired way
- Obtain a justification that is permanent
- Let users put the data on a public blockchain themselves
- Build specialized blockchains that forget

Blockchain

GDPR Quick Check

beta test V0.2

https://erbguth.ch/QuickCheck

Thank you for your attention!

Questions?