CYBERNETICA

Fifty Shades of Personal Data

Partial Re-Identification and GDPR

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  - GDPR Art. 4(1) gives a definition of personal data depending only on whether the person can be identified completely (even if this complete identification is indirect).
  - On the other hand, Recital 26 talks about identification as a process that depends on some likelihoods, costs, etc.
  - Additionally, Art. 11 together with Recital 57 describe a situation where the controller's ability to identify a person may change over time. However, it is left unclear whether this change is gradual or instantaneous.

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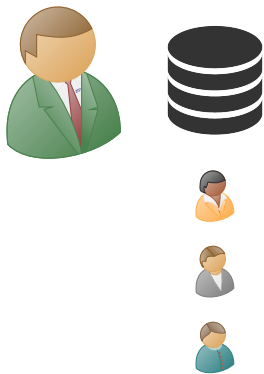
- Because there are *attacks* that are enabled/made easier when someone can be identified.
- However, identification does not have to be full in order for attacks to succeed.
- GDPR does not say directly whether identification has to be 100%, but e.g. five typologic categories of identification identified by Putrova all imply this.

GDPR and risk assessment

- GDPR arguably takes a risk-based approach:
  - Art. 32 is concerned with security of processing,
  - Art. 35 states the data protection impact assessment,
  - several recitals contain further guidelines for risk assessment.
- However, none of them refers to any attacker model (attacker motivation, capabilities, etc.).

An example attack scenario (I)



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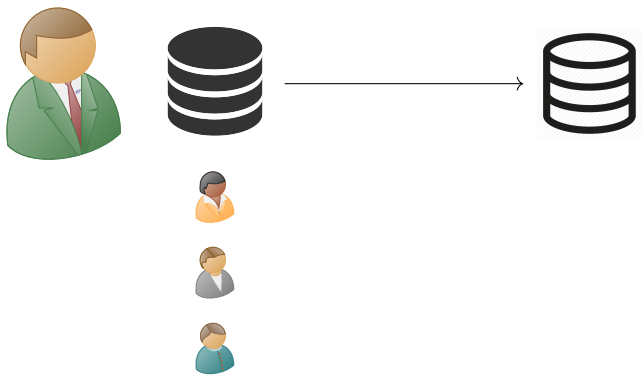

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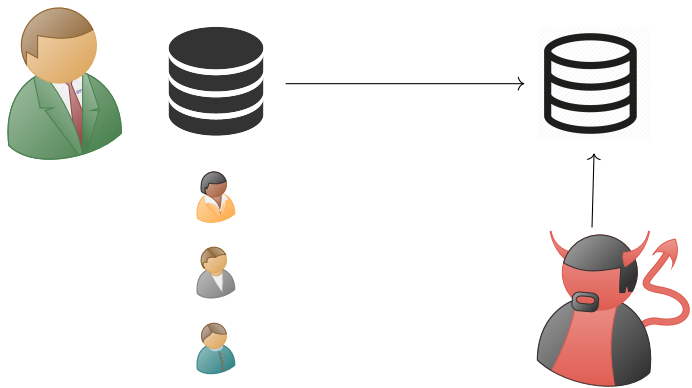

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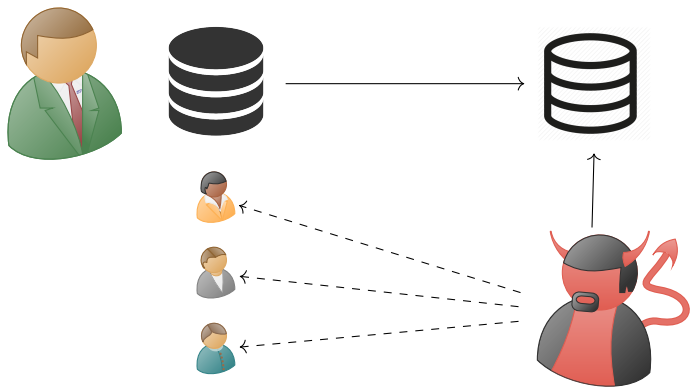

An example attack scenario (II)

- Say, the  contains mobile positioning data without IDs.
- The  can visit the locations and see who passes there.
- Assume that t% of the people in the  who visit locations A, B, C, also visit the red light district.
- The  observes people in locations A, B, C, one of them being a famous politician.
- The  can blackmail the politician for p amount of money and has $\frac{t}{100} \cdot p$ as an expected monetary outcome of this "game".

Two observations

Observation 1

Re-identification does not have to be complete in order to facilitate successful attacks.

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Observation 2

Attacker's success in re-identification of the data subject(s) depends on the effort he is willing to invest.

Cost-benefit considerations (I)

- Let the attacker pay C as the cost of re-identification of a cohort of individuals.
- Assume every data subject S_i has a "fair price" p_i, and that the attacker can identify him/her as a member of group of size g_i. Then the expected outcome of the game is

$$T = \sum_i \frac{p_i}{g_i}.$$

- This game is profitable for the attacker if

$$T > C.$$

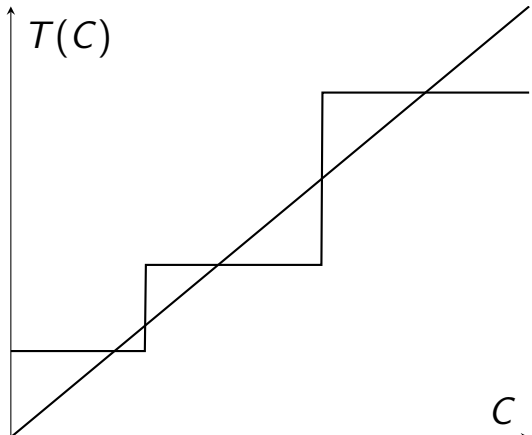
Cost-benefit considerations (II)

Lemma 1

The expected outcome T depends on the investment C in a monotonously increasing manner.

Proof. If the attacker has a strategy that gives him the outcome T as a result of investment C, he still has the same strategy available with resources $C_1 > C$. This means that with the optimal strategy, he can only get a better result $T_1 \geq T$.

An example $T(C)$ graph



Two more observations

Observation 3

The attacker does not necessarily have just one profitable strategy, but he may have several.

Observation 4

If the attacker is able to achieve even a marginal partial re-identification with zero cost, and there exists a subject S_i with positive attacker profit p_i, the attacker already has a profitable strategy.

Discussion

- The model presented can be developed further by e.g. also considering attacker penalties.
- Publishing sanitised datasets carries social benefits, whereas expenses of breaches are carried by individuals. Consequently, the society must offer compensation mechanisms to the suffering individuals.

Back to the GDPR

- Several aspects are not explicitly addressed in the GDPR, even though they should:
  - the issue of partial re-identification,
  - many possible levels of identifiability,
  - more clarity in the risk assessment, including
    - incentives of the attackers and cost-benefit considerations,
    - acknowledging that even a marginal success probability may be sufficient to mount a profitable attack.

Thank you!

- Questions?