Can we motivate employees to share personal data by means of an automated incentive mechanism?

Master's Thesis

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Context

In the Inverse Transparency research project,[1] we work towards evolving employee data privacy. Thereby, we tackle both negative and positive factors influencing a user's decision to share data. On the one hand, by making visible data usages to individuals, the *perceived risks* of data sharing, such as data misusage, can be targeted. This could reduce concerns that inhibit data sharing for sensible use cases. On the other hand, we need to consider the *perceived benefits* of data sharing, to motivate individuals to share data in cases where they do not directly benefit—even if the risks associated with sharing are low. To that end, we identified three dimensions to consider: *values*, *benefits*, and *incentives* [1].

While values and benefits of a software tool are encoded in production and relate to the immediate usage of it, incentives can be developed and applied independently of the tool and use case. Yet, how to most effectively and efficiently identify, realize, and distribute incentives in the workplace is not addressed in literature. First, to address identification of incentives, an incentive classification is necessary. Second, for realization and distribution of incentives we require the design of a robust incentive mechanism resistant against exploitation. Finally, the influence of internal and external factors on a user's sharing decision needs to be understood. To that end, theory from behavioural economics (decision making) and psychology (theory of motivation) need to be studied and incorporated. Importantly, we need to ensure that the incentive distribution does not lead to demotivation or reactance.

In computer science, various related works have developed *incentive mechanisms* that can serve as models. Each has individual strengths and weaknesses based on the theories underlying its implementation. Examples are based on incentive theory [2], gamification [3], game theory [4], mechanism design [5], auction systems [6], or various other technical underpinnings, designing for differential privacy [7, 8], and finally incorporating psychological theory of motivation [2], behavioral economy [9], or other models [9]. Various surveys [11–14] and classifications [11, 15] give an overview of the field.

Goal

This work has two goals: (1) Provide a thorough oveview of the related research in form of a taxonomy. (2) Develop an automated incentive mechanism integrated into the Inverse Transparency toolchain [16]. This encompasses theoretical research, implementation, and evaluation.

Theoretical research: Cover the research fields of incentive engineering, mechanism design, market design, and their associated sub fields by a literature survey and summarize the results in a taxonomy. The scope will be limited step by step according to the findings and in correspondence with the advisor. The resulting artifact should represent a compact summary of the related research and allow classifying approaches in relation to other works.

Implementation: Develop an incentive mechanism integrated into the Inverse Transparency toolchain. At this point, we assume that a two-step system will be necessary: A high-level mechanism selection based on the use case, with a second-level incentive selection (= mechanism). Supported use cases should be at least those covered in [16]. Integration into the toolchain means that usage logs from Overseer are the data source for the *evaluation* step, with the Clotilde interface serving as a representation of the *rewarding action* (e.g., by showing a score). Beyond software quality goals taught in our courses, the implementation should be extensible, modular, and flexible to allow changing the evaluation scope, conditions, and rewarding actions at least on deployment (e.g., through configuration files or compilation flags).

[1] https://www.in.tum.de/en/i04/research/inverse-transparency/

Evaluation: The evaluation highly depends on the implementation and the availability of resources, but at this point we plan with three evaluation steps: (A) Technical evaluation of performance and scalability (no. of calculated reward actions per minute), (B) theoretical analysis of gameability and practicality (may be moved to Discussion), and (C) comparative evaluation with a baseline system from literature of average reward payout cost for fixed use cases (if feasible).

Work Plan

1. Research the related fields by means of a literature survey.
2. Develop a taxonomy of incentive mechanisms for our use case based on the results.
3. Conceptualize and develop an automated incentive mechanism (two-step).
4. Implement the conceptualized mechanism integrated into the toolchain.
5. Evaluate technical performance, theoretical considerations, and mechanism efficiency.
6. Document the work in the thesis.

Deliverables

- Taxonomy of related research fields (as part of the thesis document).
- Source code and binary artifacts of the implementation.
- Raw data and results from the evaluation.
- Thesis written in conformance with TUM guidelines.

References

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