Privacy-Preserving Statistical Data Analysis on Federated Databases

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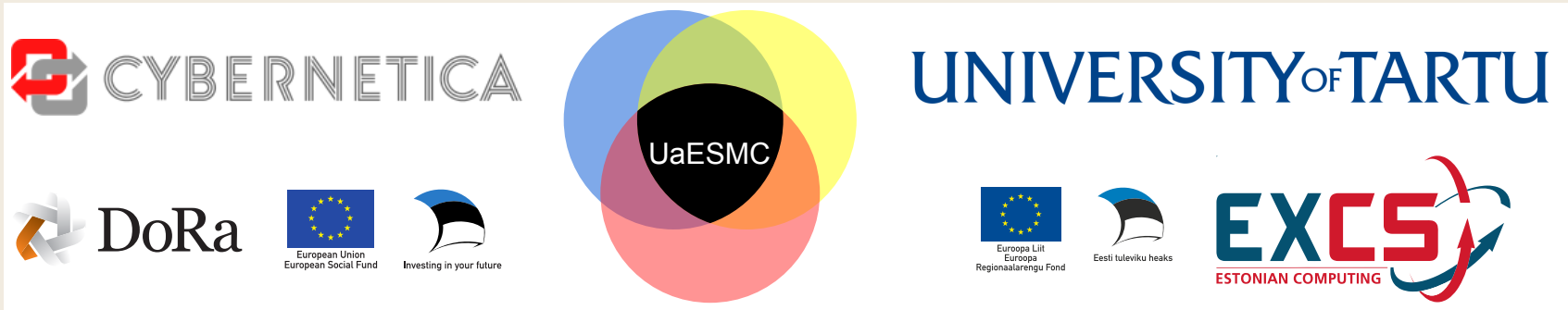
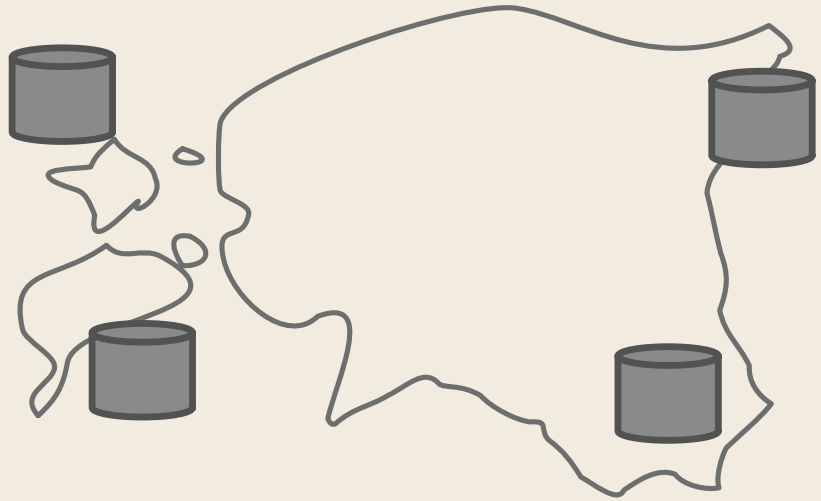


Problem Statement

- State has many databases
- Many of these contain personally identifiable information (PII)



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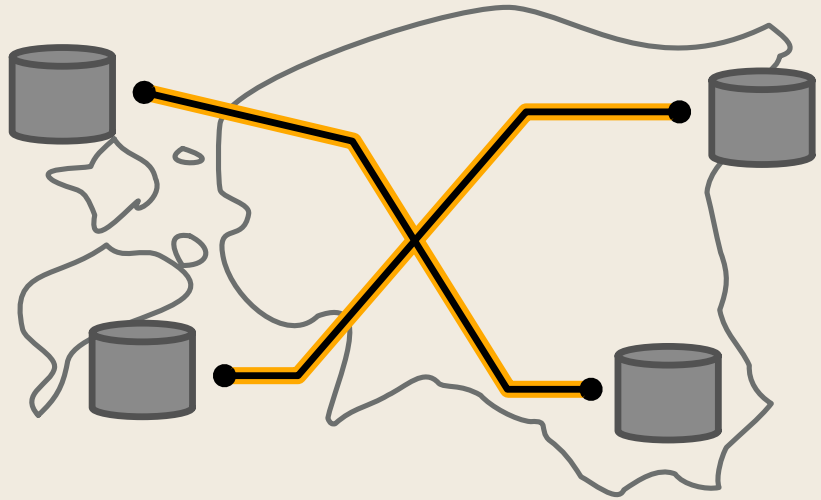
X-Road Infrastructure

- Today, state databases are
  - interconnected by secure authenticated channels
  - interoperable using standardized protocols and data formats



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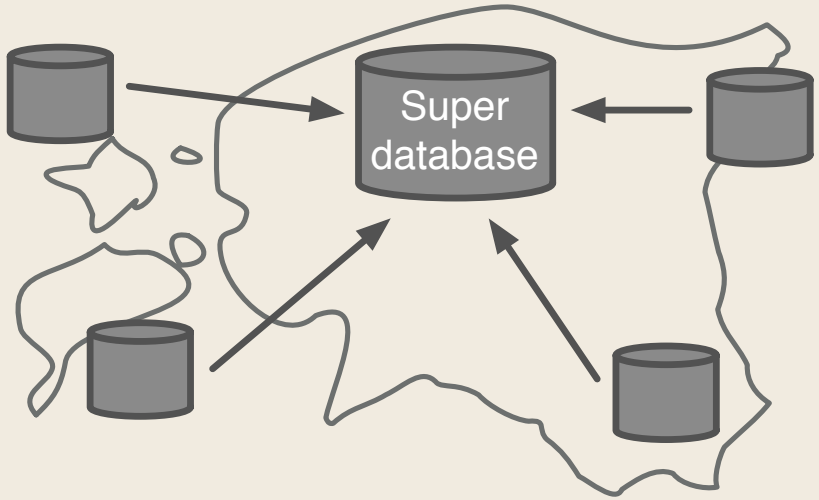
The Risks of Linking Databases

- Combining them would support state decisions



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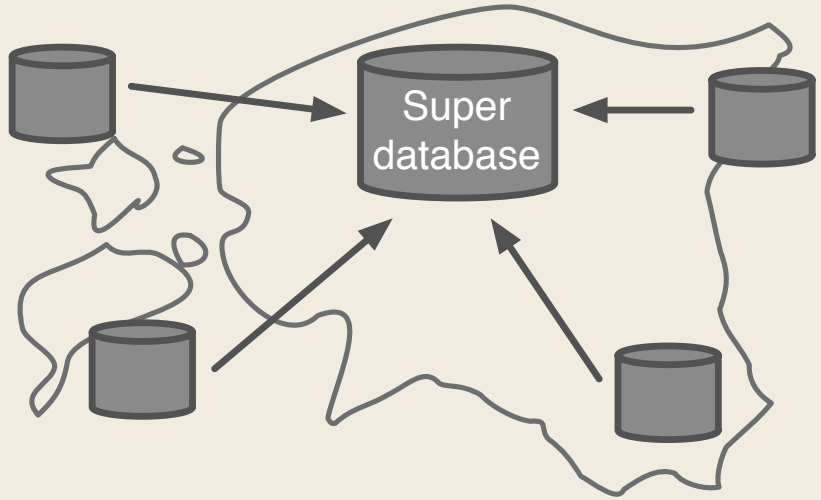

- Creating "super databases" is a privacy risk
  - Data is decrypted for analysis

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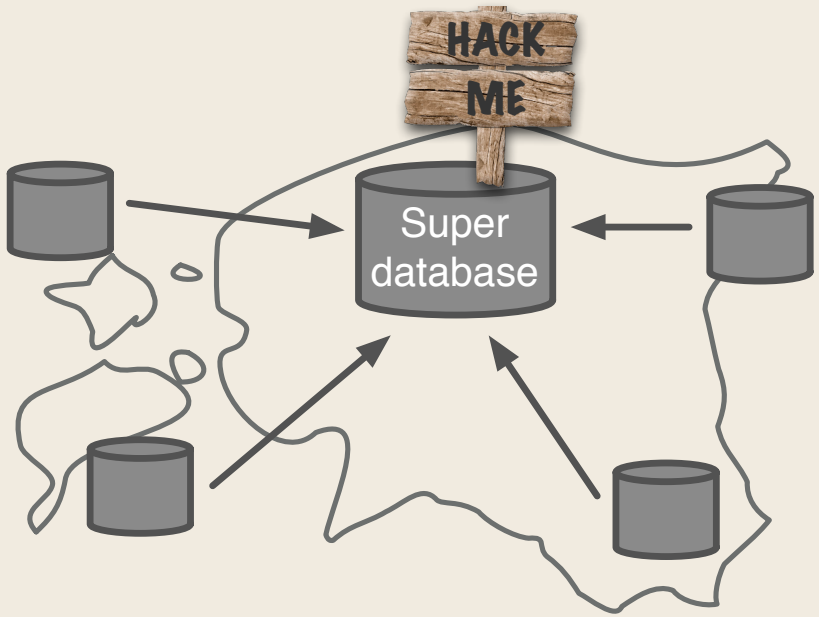
The Risks of Linking Databases

- Combining them would support state decisions



- Creating "super databases" is a privacy risk
  - Data is decrypted for analysis
  - Interesting target for attackers

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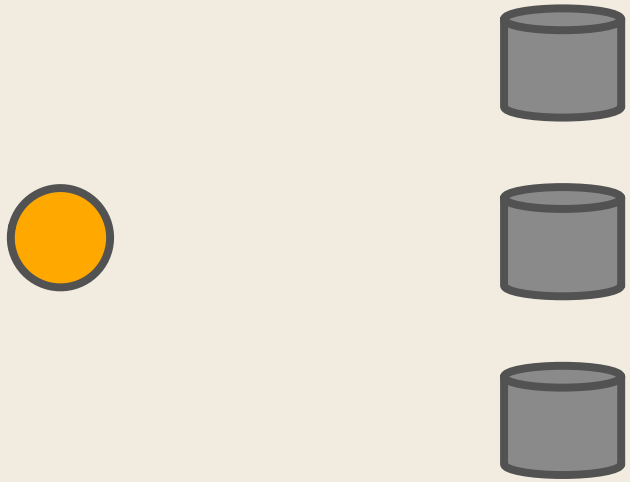
Secure Multi-party Computation

- Solution that does not require creating super database and preserves data utility
- Allows to compute on encrypted data
- All values are *secret shared*



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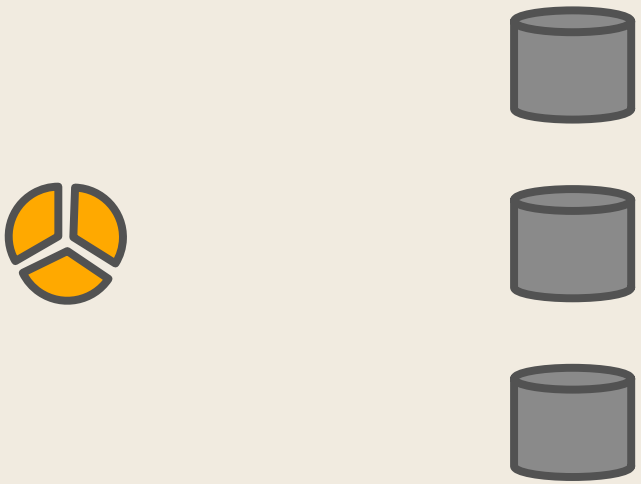

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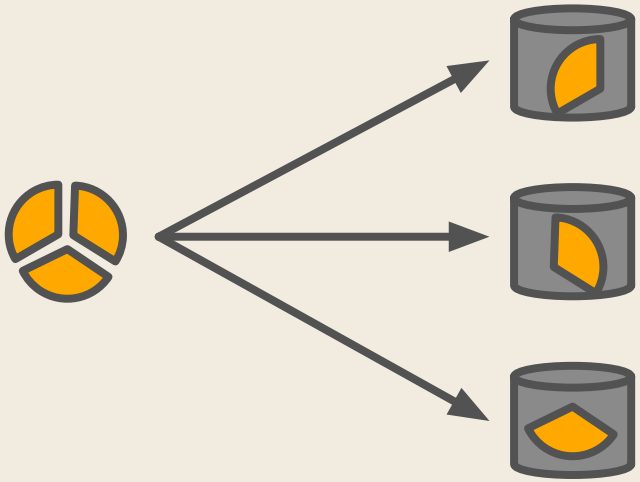

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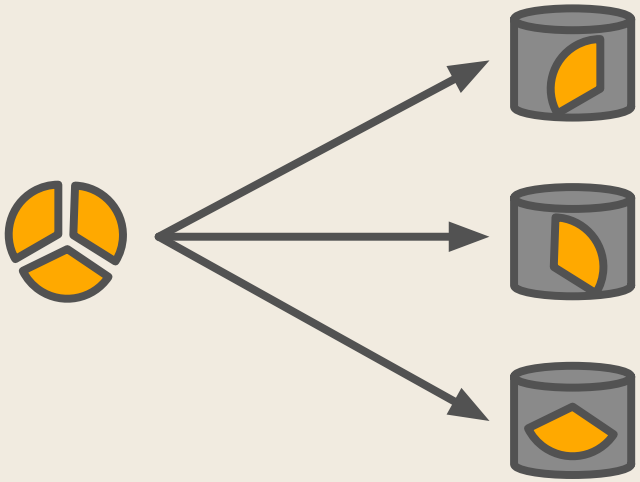

- Distributed responsibility
  - No individual computation party has control over any inputs

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Our Practical Results

- We asked end-users whether they can see themselves using such a technology and the results were positive
- We used the Sharemind secure multi-party computation platform to implement a statistics suite
- Database linking is performed without declassifying the data
- We implemented a set of statistical functions and tests using Sharemind secure floating point operations

Privacy-Preserving Linking and Analysis

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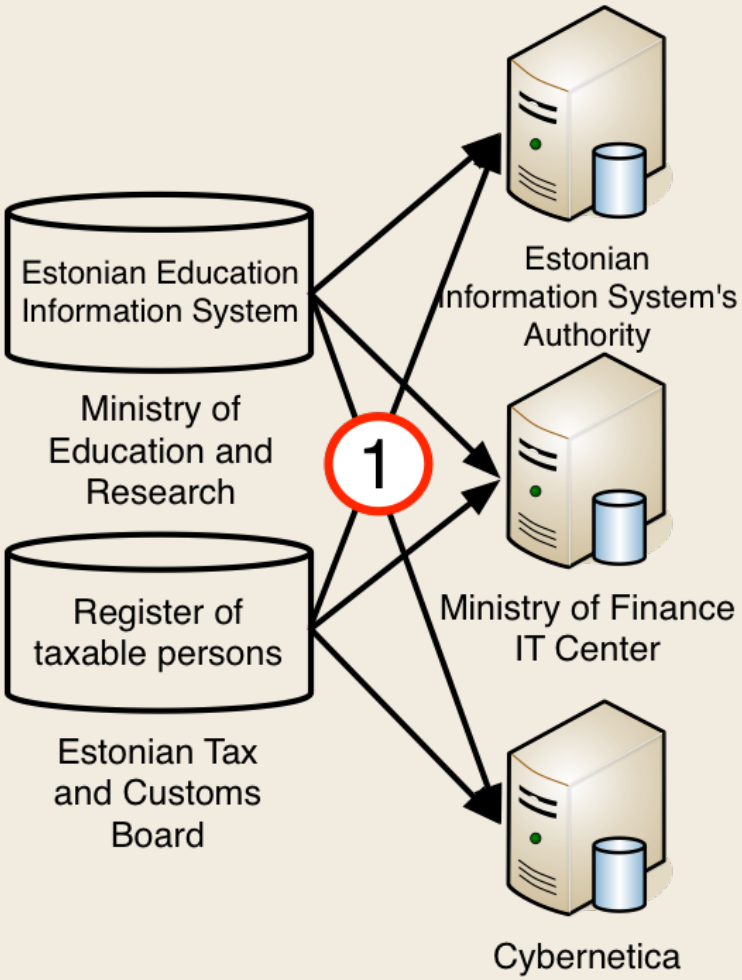

1 Encrypt and upload data

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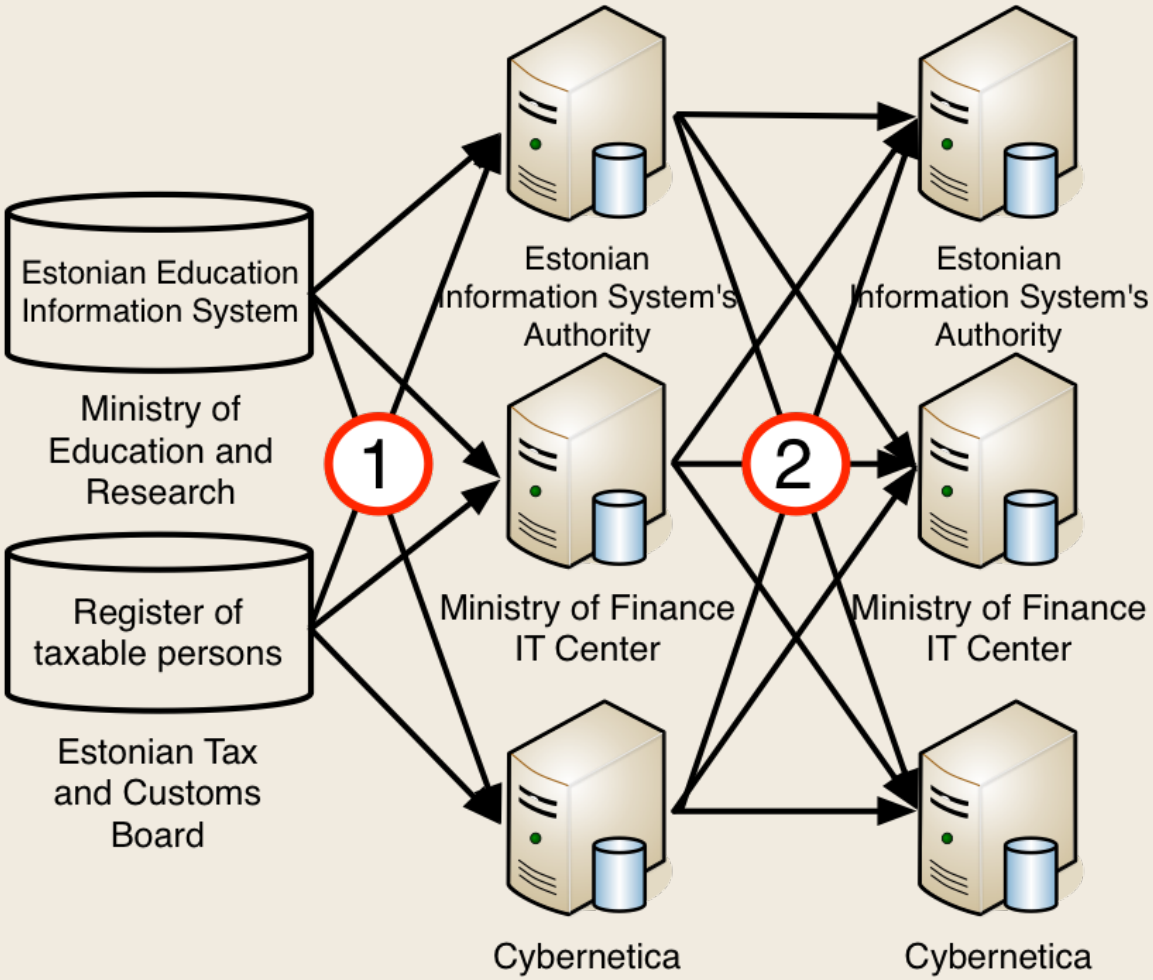
Privacy-Preserving Linking and Analysis



1 Encrypt and upload data

2 Analyse encrypted data

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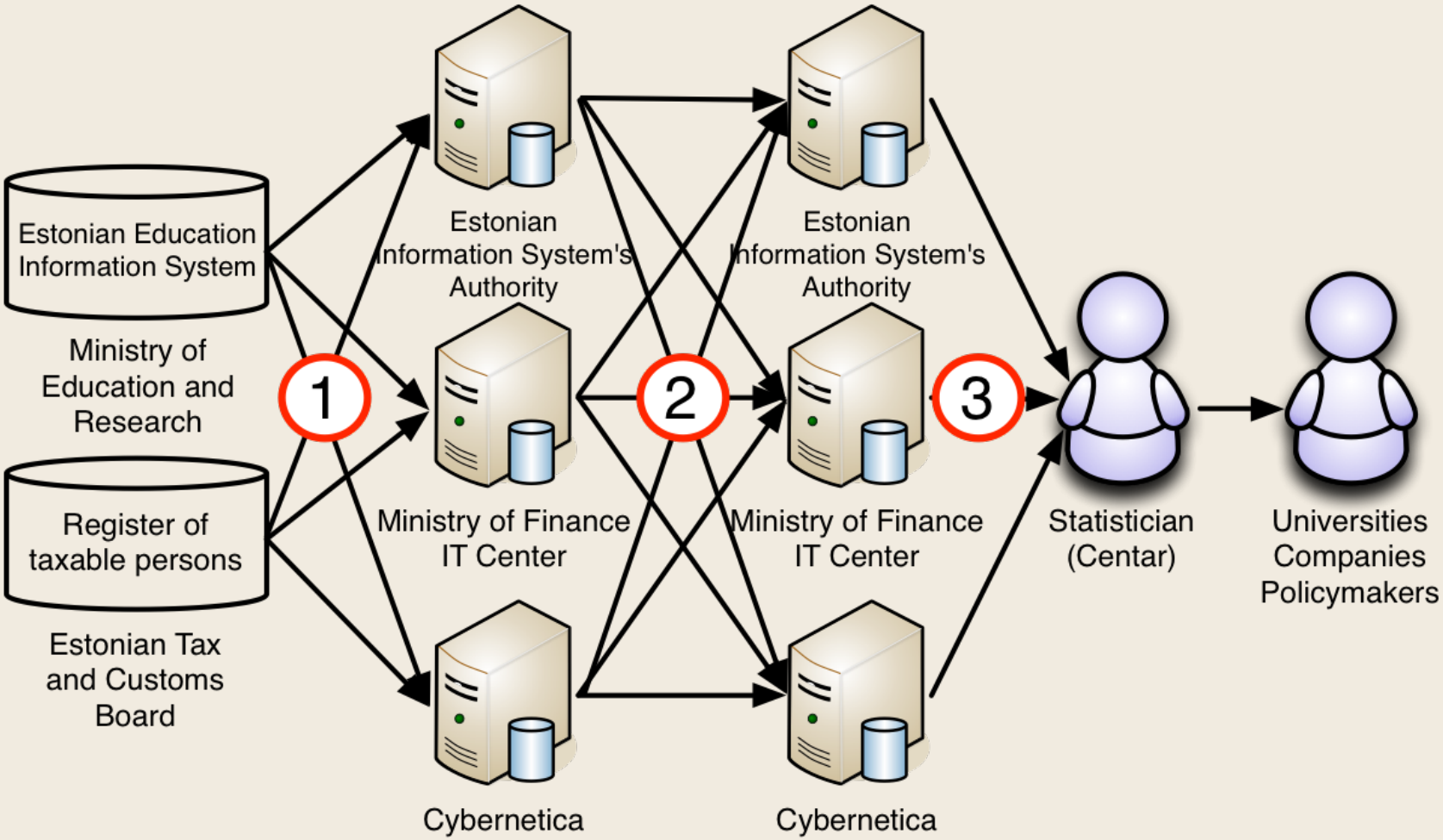
Privacy-Preserving Linking and Analysis



1 Encrypt and upload data

2 Analyse encrypted data

3 Receive encrypted result and decrypt

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Future Work

The PRIST study will be carried out in the autumn of 2014.

Our goal is to help researchers, companies and governments understand the possibilities of secure multi-party computation technology.

We believe that secure computation can be used for sharing confidential data so that leaders in both private and public sectors can make better decisions without compromising privacy.

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Thank you!

https://sharemind.cyber.ee

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http://cyber.ee/en/research/research-projects/prist/

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