NIST National Institute of Standards and Technology U.S. Department of Commerce

Privacy vs. Data Utility: Crypto to the Rescue

NIST Privacy-Enhancing Cryptography (PEC) Project

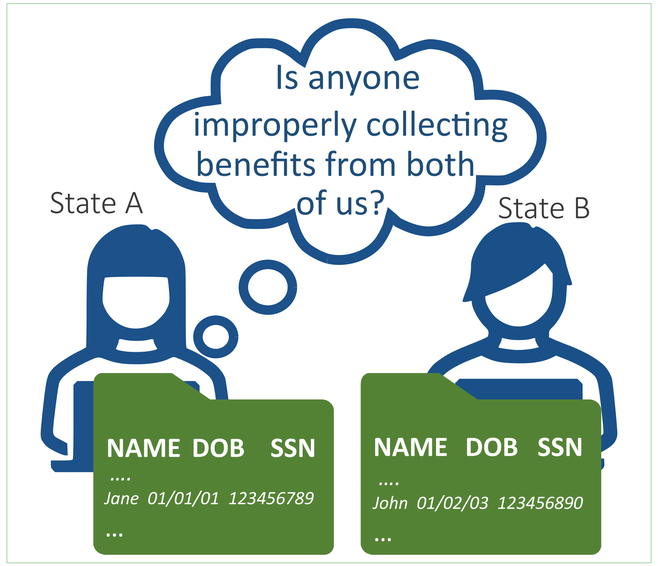
ITL INFORMATION TECHNOLOGY LABORATORY

Utility of Data Intersection

Determining the overlap of sensitive information between sets of private data is widely beneficial:

- discovery of common contacts
- customers using leaked secret passwords
- persons improperly claiming benefits in two states

One approach involves granting dataset access to a trusted third party. Privacy-enhancing crypto offers a better solution; private data is not shared.



Private Set Intersection

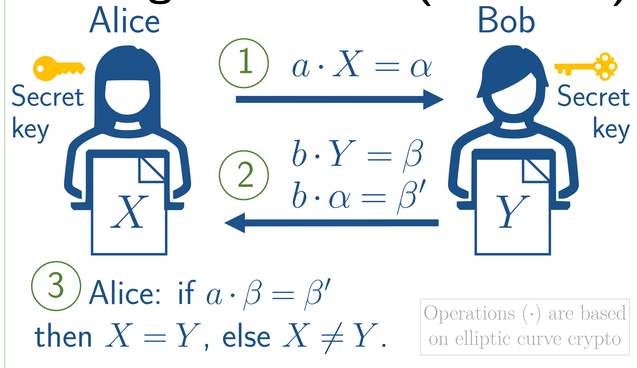
With **P**rivate **S**et **I**ntersection (PSI), two parties compute the intersection of their sets, without revealing or disclosing the non-intersecting elements.

If Alice has the set {p,r,i,v,a,t,e} and Bob has {s,e,c,r,t}, then they get the set {r,t,e}. Instead of letters, each party may have PII.

PSI on numerical data may be used for useful computations on intersections: averages, sums, etc.

PII = private identifiable information (e.g., names DOB, SSN)

Toy example: One-sided PSI for single elements (X and Y)



PSI Properties and Variants

Caution: Exchanging hashes is not good! Anyone can compute the hashes of all possible SSNs and birthdates.

Good solution: Reveals nothing, even predictable elements.

Variants: Real scenarios may involve more parties, larger datasets, input consistency checks, statistics of the intersection.

NIST role: Future guidance may facilitate secure deployments.

Other PEC tools

FHE Fully Homomorphic Encryption

FnE Functional Encryption

GRS Group and Ring Signatures

PIR Private Information Retrieval

StE Structured Encryption

SMPC Secure Multiparty Computation

ZKP Zero Knowledge proofs

Can enhance privacy in many applications

Poster produced by Luís T. A. N. Brandão and Angela Robinson for the NIST-ITL Science Day 2021 (October 28). Find more details about the PEC project at https://csrc.nist.gov/projects/pec

(Brandão is at NIST as a contractor from Strativia)