Secure Multi-party computation for e-voting

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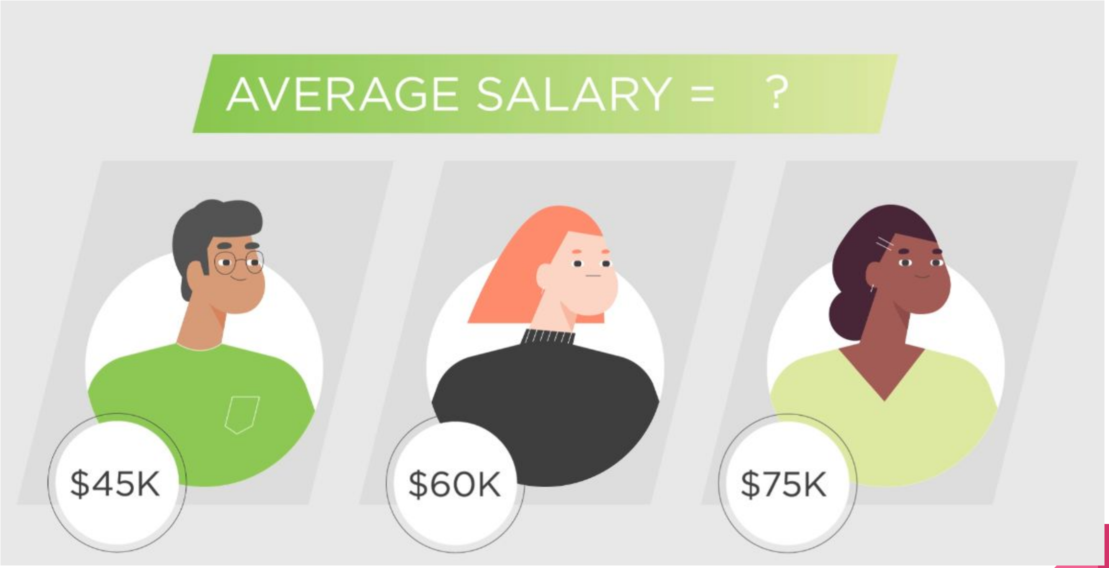
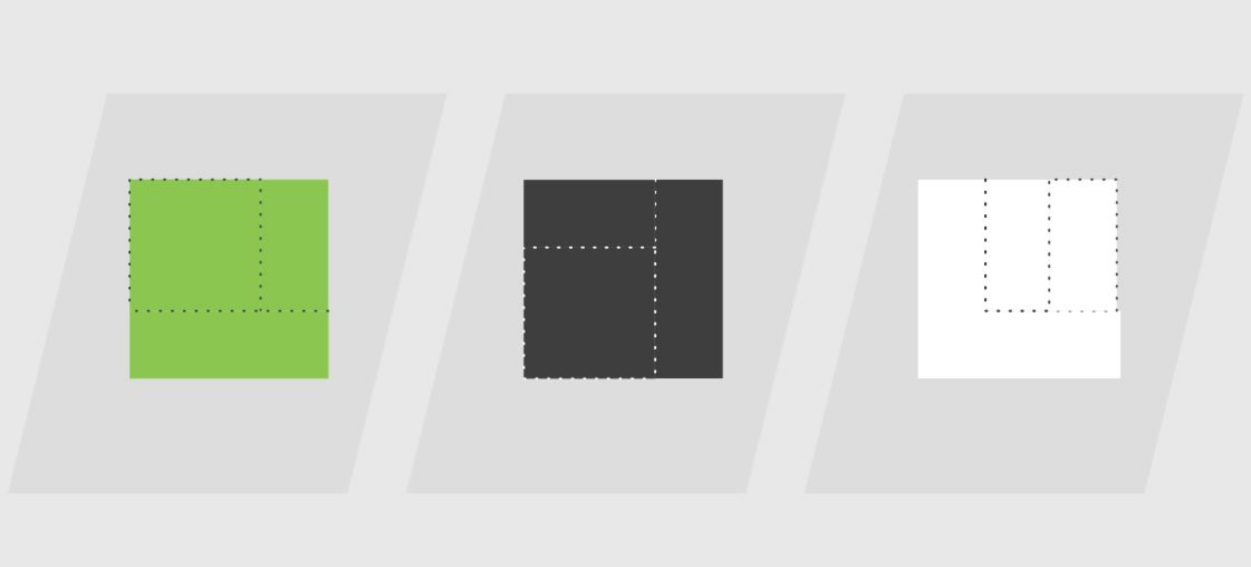
Summary

- Overview of SMC
- Chosen SMC protocol
- Library choice
- Experiments and results
- Project challenges
- Conclusion

Overview of SMC



Overview of SMC



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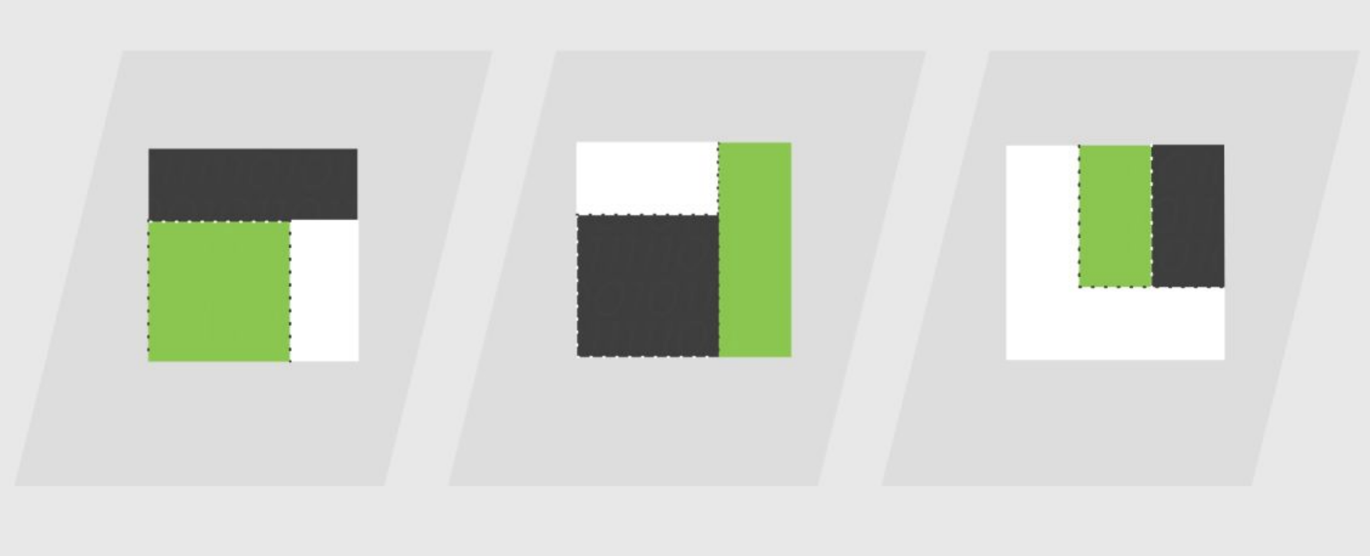

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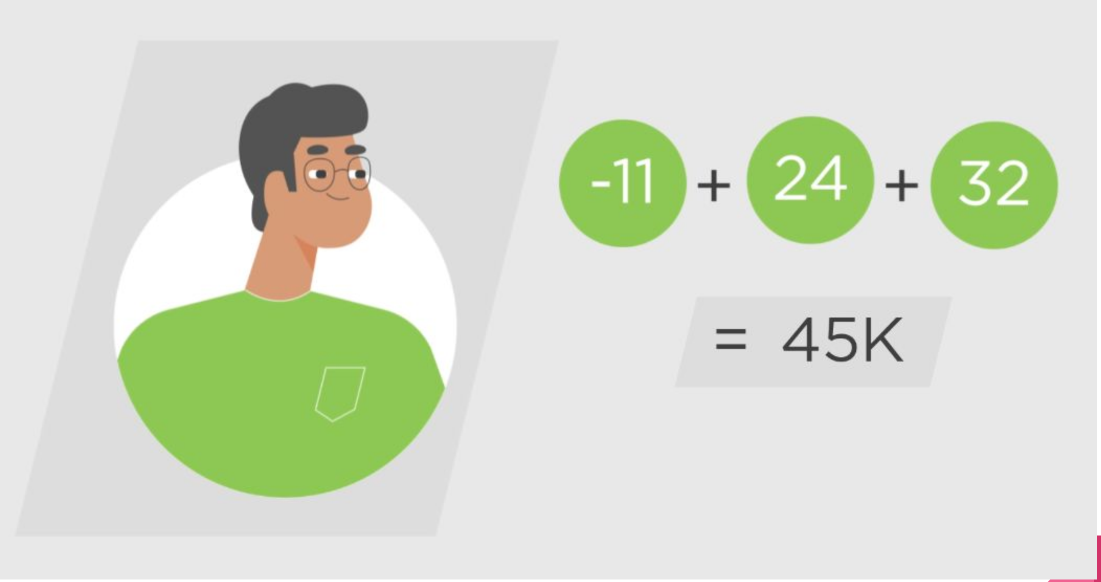

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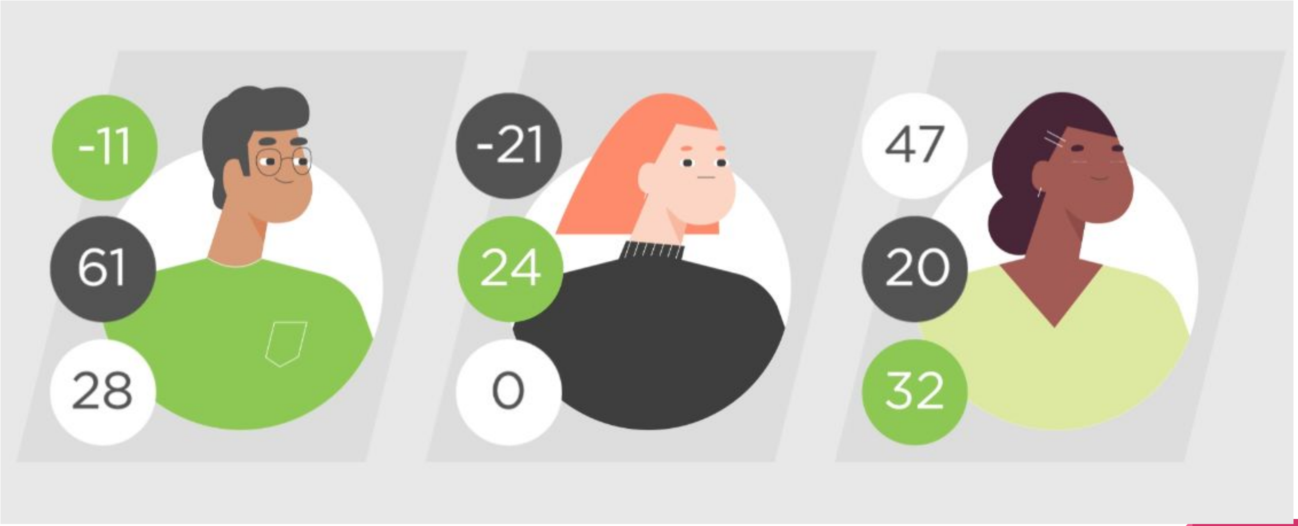

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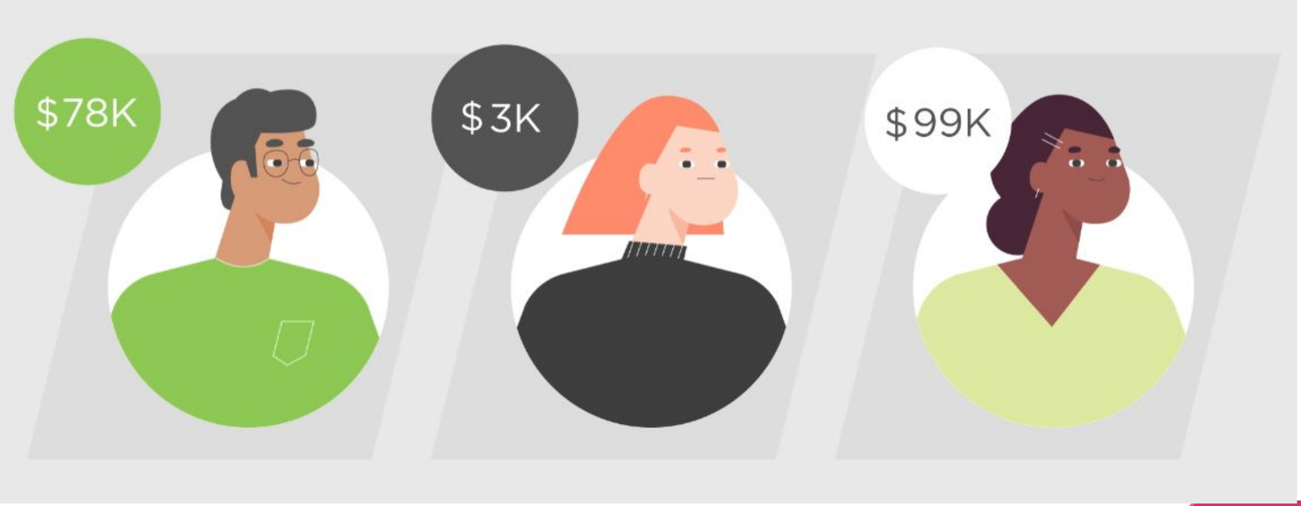

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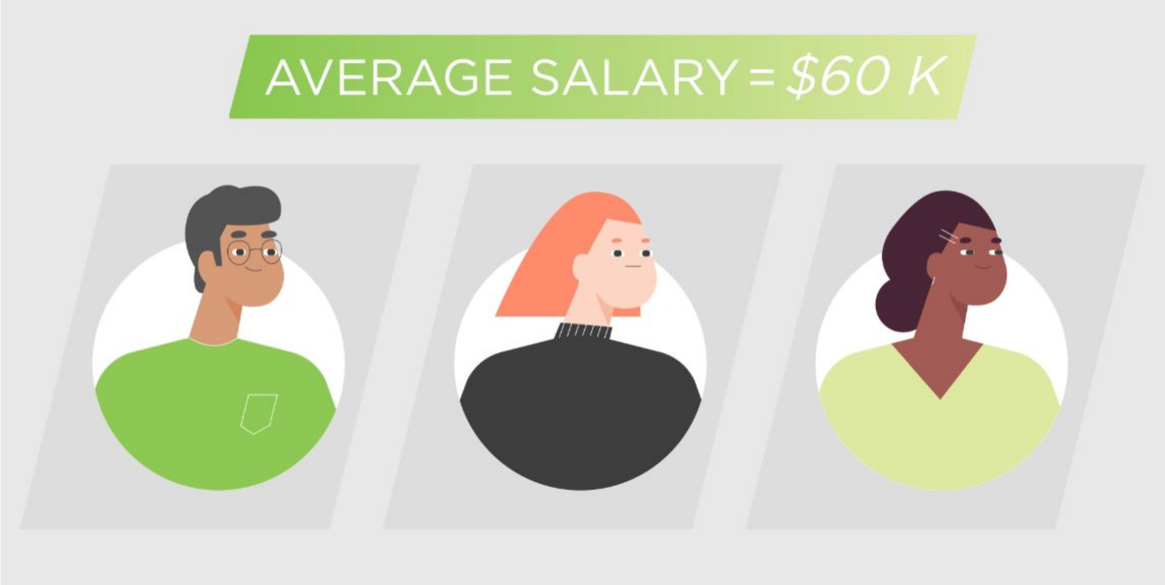

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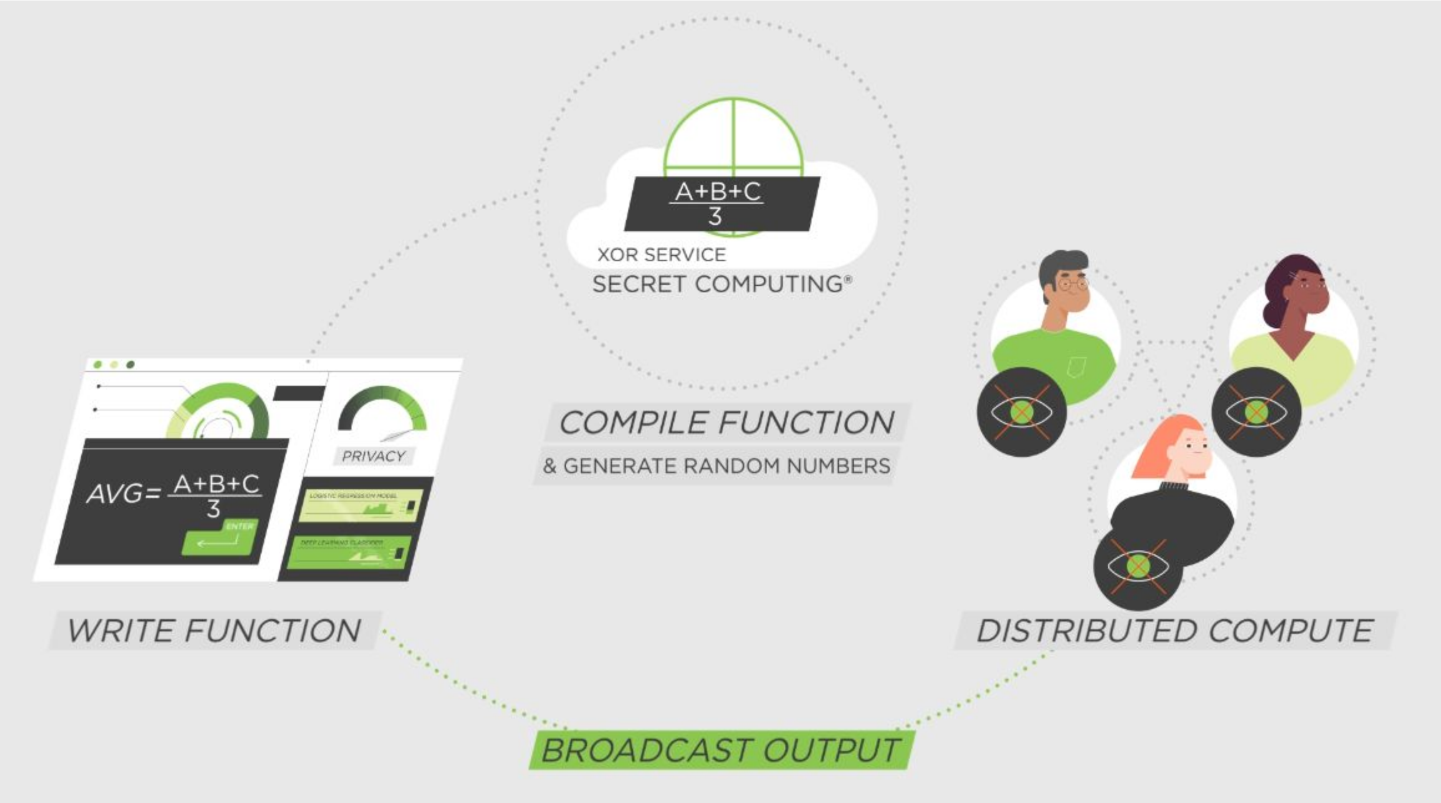

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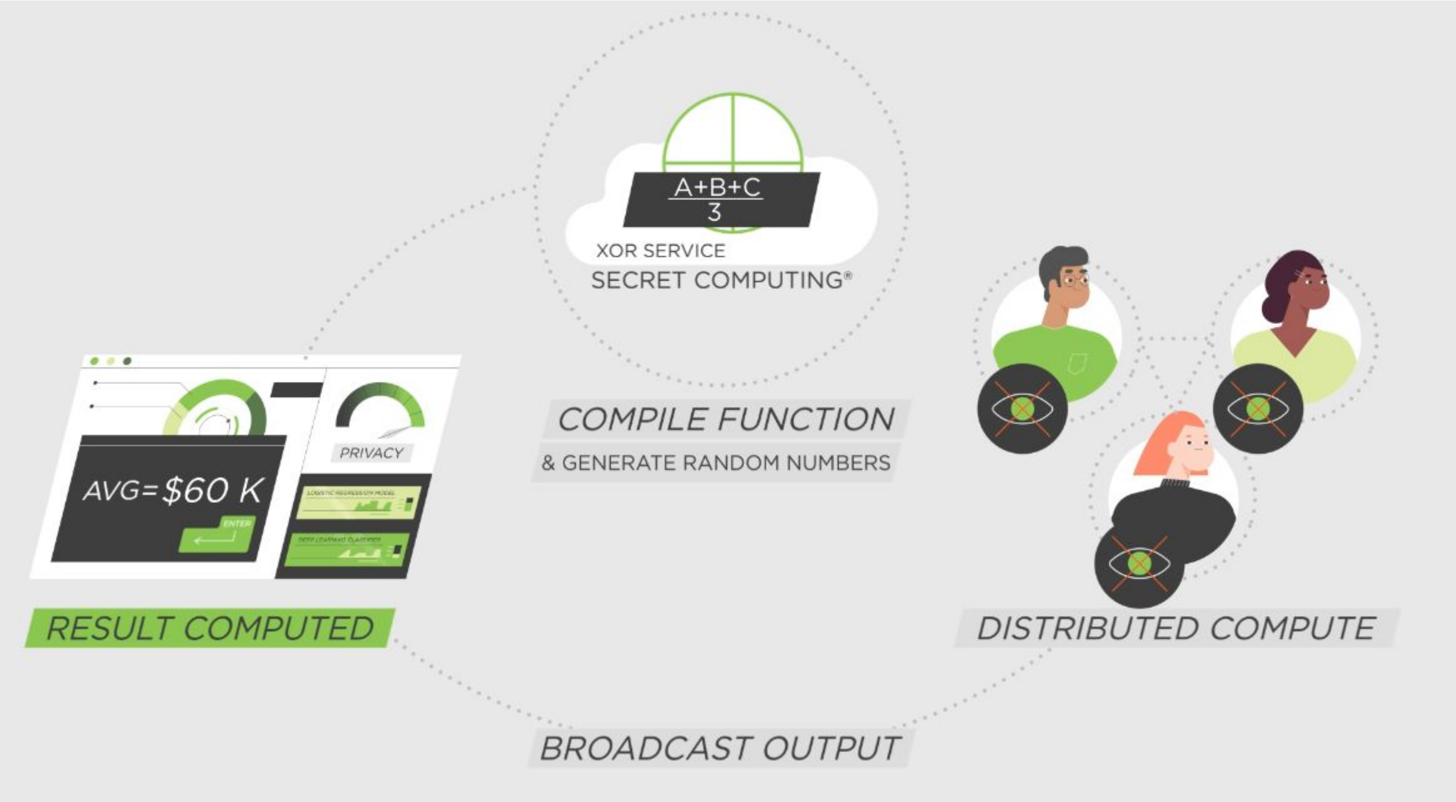
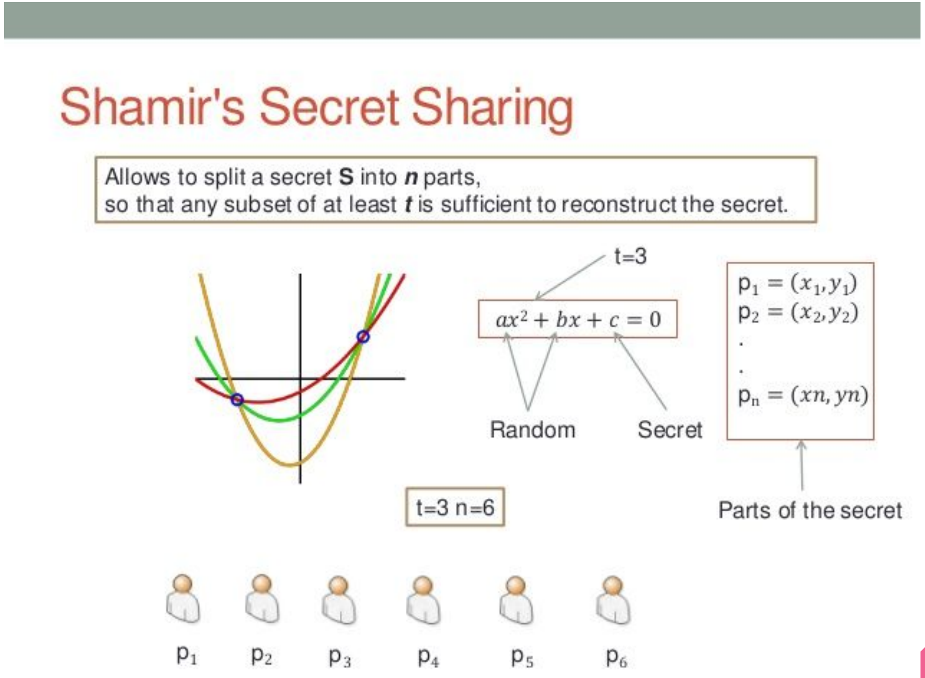


Chosen SMC protocol



Shamir's Secret Sharing

Allows to split a secret **S** into ***n*** parts,
so that any subset of at least ***t*** is sufficient to reconstruct the secret.

t=3

$ax^2 + bx + c = 0$

Random

Secret

$p_1 = (x_1, y_1)$
$p_2 = (x_2, y_2)$
.
.
$p_n = (xn, yn)$

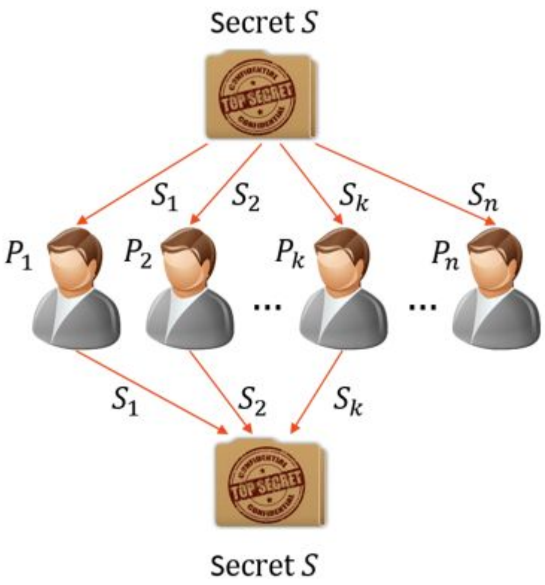
Parts of the secret

t=3 n=6

p_1 p_2 p_3 p_4 p_5 p_6

Chosen SMC protocol: Shamir

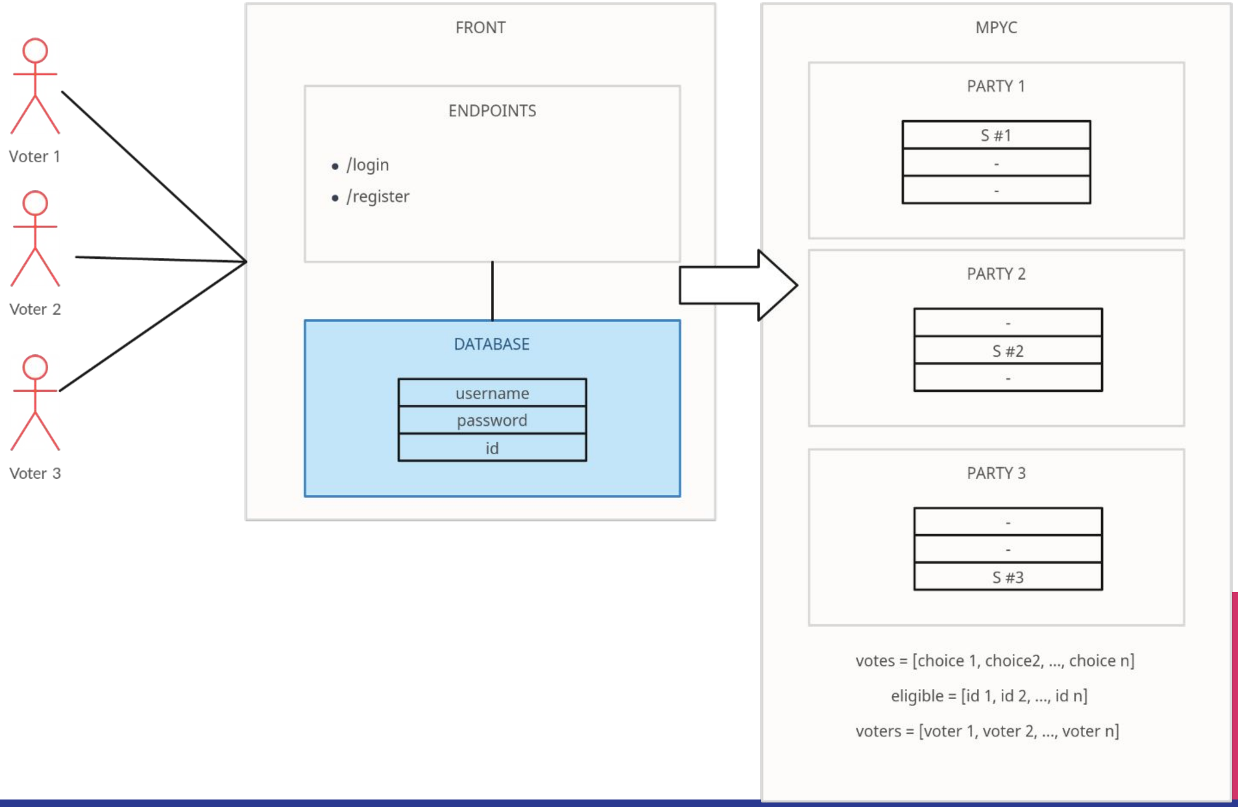
- protocol features information-theoretic security
- lightweight
- n / 2 corrupted to find the secret
- n / 3 corrupted to corrupt the secret



Library choice

Library Name	Language	Advantages	Weaknesses
OblivC	C	Simple and lightweight language	Low-level, particular syntax to learn
MpyC	Python	Shamir implementation with high level of abstraction and highly configurable	Limited types. No native client / server structures. The script is considered to be the client.
Sharemind	C++	Entire implementation of e-voting	Open-source but proprietary with limited OS support (Debian)
MP-SPDZ	C++ / Python	Large protocol support	Hard to install, complex to use
JIFF	Javascript	Web-oriented, multiparty protocol	Project is not being actively supported
ABY	C++	Gates based	Only two party protocol

Experiments and results



Voter 1

Voter 2

Voter 3

FRONT

ENDPOINTS

- /login
- /register

DATABASE

username
password
id

MPYC

PARTY 1

S #1
-
-

PARTY 2

-
S #2
-

PARTY 3

-
-
S #3

votes = [choice 1, choice2, ..., choice n]

eligible = [id 1, id 2, ..., id n]

voters = [voter 1, voter 2, ..., voter n]

Project challenges

- Find the correct library to implement the wanted solution
- Maintain a level of security throughout the voting process

Conclusion