Secure Two Party Computation

Preliminary presentation

Nick Tutte

Prof. Nigel Smart

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Presentation overview

My project focuses on Secure Multiparty Computation, in particular the two party case using Yao Garbled Circuits. By the end of this presentation you should know,

- What is Secure Multiparty Computation?
- What can it be used for?
- What “Secure” means in this context.
- A grounding in Yao Garbled Circuits.
- How much progress I've made so far.

What is Secure Multiparty Computation

In the problem of Secure Multiparty Computation we have a set of parties, each of whom has a secret input. The parties wish to co-operate to compute a function upon their collective inputs without revealing said inputs.

Applications of Secure Multiparty Computation

- The Millionaires problem.
- Distributed secrets.
- Sugar Beets.
- Database query.

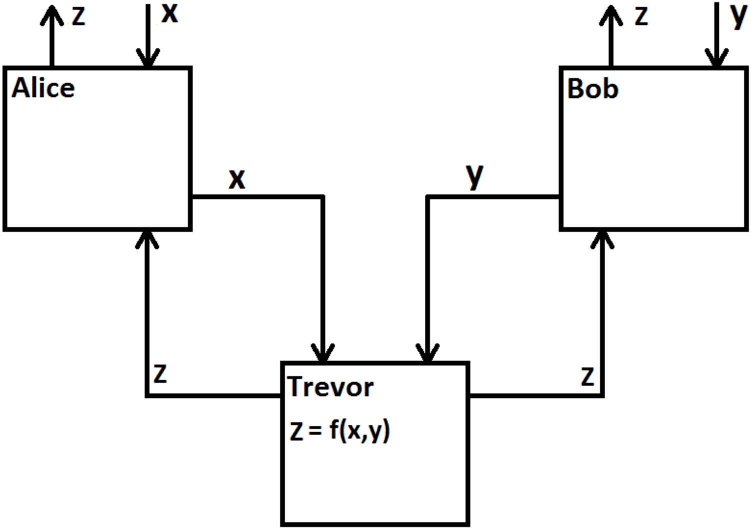
For many more potential applications of Secure Multiparty Computation see (Du and Atallah, 2001).

Desired security properties

Before we go any further we need to define what properties we want an SMC protocol to fulfil before we consider it Secure.

- Privacy, the only knowledge parties gain from participating is the output.
- Correctness, the output is indeed that of the intended function.
- Independence of inputs, no party can choose it's inputs as the function of other parties inputs.
- Fairness, corrupt parties receive their outputs if and only if the honest parties also receive their outputs.

The Ideal Model



Security Definitions

- We measure the security of an SMC protocol in terms of what adversaries it is secure against, we define adversaries in terms of their capabilities.
- We say that an SMC protocl is secure against an adversary if the adversary can achieve no more than they would be able to achieve attacking the Ideal Model.
- We focus on three adversaries,
  - Semi-Honest
  - Malicious
  - Covert

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Semi-Honest Adversaries

- Semi-Honest(SH) adversaries are the weakest adversary we shall consider.
- They are sometimes also called “honest, but curious”.
- SH adversaries are limited to looking at information given to them in the process of the protocol.
- They have to follow the protocol (they cannot cheat).
- SH adversaries are very similar to traditional “Passive” adversaries.

Malicious Adversaries

- Malicious adversaries are the strongest adversary.
- Malicious adversaries can perform

Oblivious Transfer

A key component we will need later is Oblivious transfer(OT).

Receiver

Inputs : $b \in \{0, 1\}$

Outputs : X_b

Sender

Inputs : X_1, X_2

Outputs : $\emptyset$

Figure : Definition of the functionality of a one-out-of-two OT protocol.

Security levels for OTs