CMSC 858K — Introduction to Secure Computation November 4, 2013

Lecture 25

Lecturer: Jonathan Katz *Scribe(s): Xiao Wang*

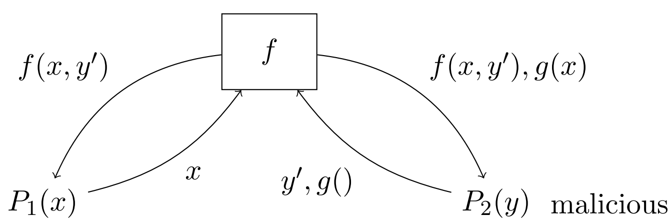
1 Summary

In this lecture we introduced a much more efficient protocol for malicious security given a weaker notation of security. In particular, we talk about efficient GC under 1-bit leakage[1].

In general, we define security by comparing real world to ideal world. When we say a weaker security, we can do the followings:

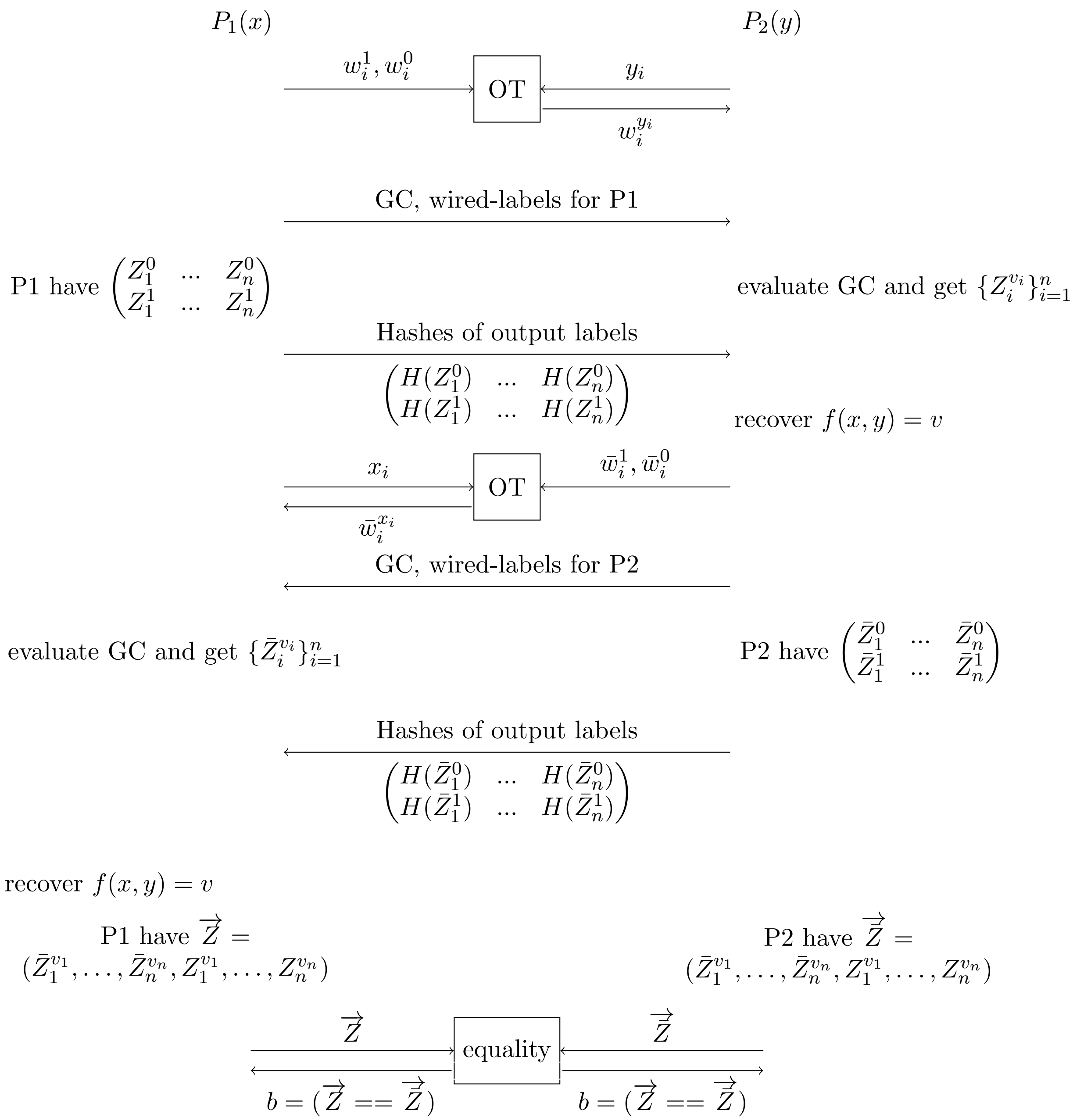
- Weaken the notation of "comparison"
- Weaken the ideal world
  - 1-bit leakage
  - covert security

weaker model of security The malicious party can send a function $g()$ and get $g(x)$ when recieving result from ideal functionality.



2 The protocol for 1-bit-leakage

The protocol is as follows, where Z_i^b is the label for i-th output wire when the value is b.



3 Proof using simulation

WLOG, we assume that P2 is corrupted and we have simulator S:

1) Extract P2's input to OT in first phase $\Rightarrow$ this defines input y

2) send y to ideal functionality and get back v

3) use semi-honest simulation to generate all input-wire labels, Garbeled Circuits, to give to P2. We also output $\{Z_i^{v_i}\}_{i=1}^n$. We choose uniformly random for $\{Z_i^{\bar{v}_i}\}_{i=1}^n$ and send the matrix of hashes.

4) Extract input wired-labels for P2's circuit from OT; receive GC, input wired-labels and matrix.
Extract P2's input to equality test.

5) Define the following $g()$ on input x:

- use the bits of x to select $\{\bar{w}_i^{x_i}\}$
- run GC evaluation as P1 would to get v'
- Define vector $\overrightarrow{Z}$ that P1 would use in equality test
- return 1 iff $\overrightarrow{Z} == \overrightarrow{Z'}$

6) receive $g(x)$ and give it to P2.

7) if $g(x) == 0$ or P2 abort, send "abort" to ideal functionality otherwise send "continue".

References

[1] Huang, Yan, Jonathan Katz, and David Evans. "Quid-pro-quo-tocols: Strengthening semi-honest protocols with dual execution." In *Security and Privacy (SP)*, 2012 IEEE Symposium on, pp. 272-284. IEEE, 2012.