Non-monotonic Security Protocols and Failures in Financial Intermediation

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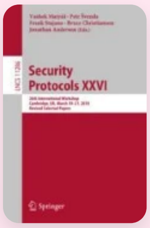

Security Protocols XXVI

(Security Protocols 2018)

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Abstract

Security Protocols as we know them are *monotonic*: valid security evidence (e.g. commitments, signatures, etc.) accrues over protocol steps performed by honest parties. Once's Alice proved she has an authentication token, got some digital cash, or casted a correct vote, the protocol can move on to validate Bob's

evidence. Alice's evidence is never invalidated by honest Bob's actions (as long as she stays honest and is not compromised). Protocol failures only stems from design failures or wrong assumptions (such as Alice's own misbehavior). Security protocol designers can then focus on preventing or detecting misbehavior (e.g. double spending or double voting).

We argue that general financial intermediation (e.g. Market Exchanges) requires us to consider new form of failures where honest Bob's actions can make honest good standing. Security protocols must be able to deal with *non-monotonic security* and *new types of failures* that stems from rational behavior of honest agents finding themselves on the wrong side.

This has deep implications for the efficient design of security protocols for general financial intermediation, in particular if we need to guarantee a *proportional burden* of computation to the various parties.

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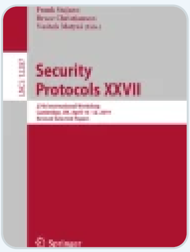

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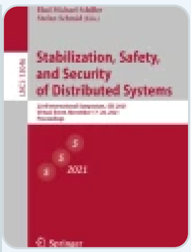

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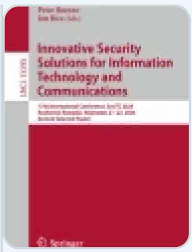

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Notes

1. Obviously the server would have had more load than a client, but this only happens because the server participates to several authentications with several clients at once.

2. The largest claimed example is the Danish sugar beet auction where 1229 Danish farmers auctioned their production [3]. However, an actual technical reading of the paper reveals that there were only three servers performing MPC over the secret shares generated by the 1200 bidders. As we will illustrate in Sect. 3 it is actually a good example of a monotonic security protocol.

3. See an additional discussion in [15] and a concrete implementation in [14].

4. Security evidence created during a protocol run should not extend beyond the protocol run. Several protocol failures are indeed due to protocol design errors where a credential could be used across sessions [1].

5. A formal definition of a Futures Market is given in [15] (Sect. 4).

6. See additional discussions on non-monotonic security in [14] (Sect. 5, Remark 1).

7. The 1229 parties full MPC variant is still out of reach for the foreseable future as experimental papers typically reported MPC with less than 10 parties [5].

8. See Sect. 7 of [14].

9. This does not violate the proportional burden requirement as each trader has the responsibility to prove the solvency if s/he still wants to be in the game.

10. https://tickhistory.thomsonreuters.com.

11. In some cases this fixed order might interfere with the security goal, if the order of actions may leak some information on who started the process.

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