Secured and Practical Voting Machines

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Abstract Voting machines are used in France in political elections since 2004. Other examples, notably in the USA, have raised a lot of concerns and some criticisms against their use. The purpose of this paper is to propose new conception rules for voting machines, in order to improve their security to achieve the sincerity of the ballot, to obtain transparency of the voting and counting procedures, so as to raise the confidence of citizens. One way to reach this final goal, is to give to the citizens the ability to participate into control operations, which is easier to do in paper voting than in the case of voting machines.

Résumé Les machines à voter sont utilisées en France dans le cadre d'élections politiques depuis 2004. D'autres exemples d'utilisation, notamment aux USA, ont également donné lieu à un certain nombre de critiques, pour certaines justifiées, et alimenté la polémique sur leur utilisation. L'objet de cet article est de proposer des règles de conception nouvelles des machines à voter permettant d'améliorer la sécurité de ces machines pour garantir la sincérité du vote, d'assurer une transparence des opérations de vote et de dépouillement pour augmenter le niveau de confiance du citoyen dans ces équipements, de donner à tous les citoyens la possibilité de participer au contrôle des opérations de vote, rôle habituel dans le cas du vote papier, mais plus difficile à réaliser dans le cas du vote sur machine à voter.

1 Introduction

Voting machines are used in France in political elections since 2004. Their increasing use during some major ballots have caused number of questions on their robustness and the level of confidence one can have. For instance, one of the more detailed statistical analysis on the latest French elections have shown that 29.8% of the electronic voting offices have reported a difference between the number of signatures by hand on the register and the number of votes registered by the machine. Even if the difference may be non significant, this is far more than the 5.3% proportion of the traditional voting offices [1]. Other examples, notably in the USA, have raised a lot of concerns and some criticisms against their use.

We here focus on voting computers, where each elector must go to his/her usual election desk where he or she can register his/her vote on an electronic

voting machine. As we will see, the proposals we make cannot apply on kiosks or internet voting systems. Our purpose is not to choose between the pros and the cons of electronic voting, but to propose new conception rules for voting computers, in order to:

– improve their security to guarantee the sincerity of the ballot,
– obtain transparency of the voting and counting procedures, so as to raise the confidence of citizens,
– give to the citizens the ability to participate into audit operations, which is traditional in paper voting but more difficult to achieve in the case of voting machines.

However, the other constraints we take in account are that voting:

– has to be technically feasible at a non overwhelming cost,
– must be easily usable for the vast majority of citizens!

2   Scientific foundations

Electronic voting have motivated a lot of research to achieve sincerity, confidentiality and auditability of the ballot. A lot of those researches have used cryptographic techniques, but few of them succeeded in designing practical voting schemes. One of the more interesting cryptographic result is the Scratch & Vote protocol [2]. But even if it is designed to minimize cost and complexity, the cryptographic skills that are necessary to understand the process, makes it hard to believe it is secure for a non cryptologist.

Other ideas have been proposed to make voting machines stick to the usual paper process. For instance, it is often suggested to print ballots and use a traditional counting procedure to verify the results announced by the machine. Those ideas suffer from technical potential problems: what if the printer is out of order? But besides of that, this solution insists upon the fact that the electronic voting isn't reliable. What result would be considered correct if paper counting and automatic counting differs? From a juridical point of view, such a question would be a mess... and actually such questions have led to a political mess in Florida in 2000, on the occasion of the US presidential elections.

We believe that a third approach is today possible [3,4]. It aims at separating the complex elaboration of voting interface from the more simple one of voting and counting. The latter, which is the core of the voting process for the citizens to be confident in, can then be published, and formally proved. In such a case, one can prove the sincerity of the voting process by advance.

References

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