Strengthening Cryptosystems by Re-Keying

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1 Introduction

In light of the disturbing efficacy of the recently-discovered deletion attack of Knudsen and Mirza [2], we propose a subtle strengthening procedure to avoid their method. We call our approach "strengthening by re-keying."

The basic technique employed is called the "PUT IT BACK" algorithm. The fundamental idea here is this: when Knudsen and Mirza delete the key, we put it back. Details follow.

2 One-Time Pad Revitalized

The well-known one-time pad [3] was devestated by [2], but fortunately the intellectual gold-mine that *is* U.C. Davis has come to the rescue.

Normally we are given plaintext P and a secret key K such that $n = |P| = |K|$. Then we produce an encryption of P by computing $C = P + K$ in the finite field $\mathrm{GF}(2^n)$. (Note that this can be done *without* the generation of irreducible polynomials! See [1].)

Now [2] uses the following clever attack: they set $K = 0$. (The alert reader will note that their attack is phrased somewhat differently, but the effect is the same.) Now we have $C = P$, which leaks information about the plaintext.

We propose the following fix: PUT IT BACK again! Explicitly, we set K back to its original value and compute $C = P + K$ again. This admittedly ingenious method now revives all the security promised by [3].

3 Iterated Attacks

Of course we must worry about repeated applications of the deletion attack. The obvious question arises: what if K is set back to 0 again. Well, again we have devised an ingenious remedy: we PUT IT BACK again.

Theorem 3.1 *No matter how many times they delete it, we can always PUT IT BACK.*

Proof: Assume the deletion method is applied n times. The proof is by induction on n: for $n = 1$, we clearly just PUT IT BACK (see Section 2). Now assuming the key has been deleted and put back n times, we see that deleting it $n+1$ times requires we put it back only *one further time* (i.e., the method is efficient). ∎

4 Acknowledgements

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The author would also like to thank his mother for teaching him to always put things back.

References

[1] John Black. *One-Time Pad without Irreducible Polynomials.* In Preparation. 1999.

[2] Lars Knudsen and Fauzan Mirza. *Deletion Cryptanalysis. Journal of Craptology* **1** (1999).

[3] Claude Shannon I think?! Not sure, but probably someone else thought of it first anyway.