The Fairest Ransomware

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(Commit ID: ceaac8a)

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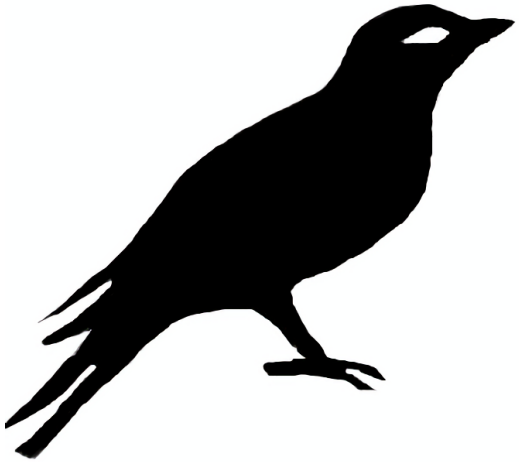
Who am I?



Twitter @_yyu_

Qiita yyu

GitHub y-yu

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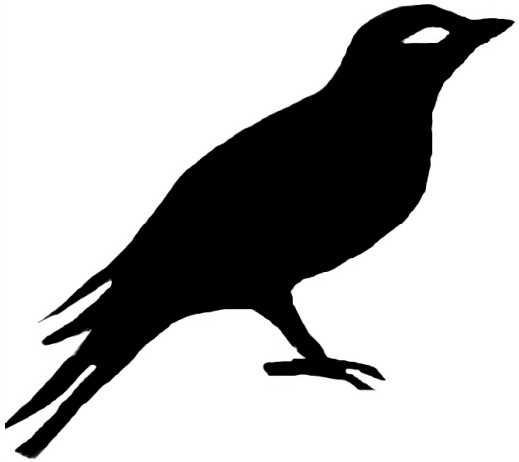

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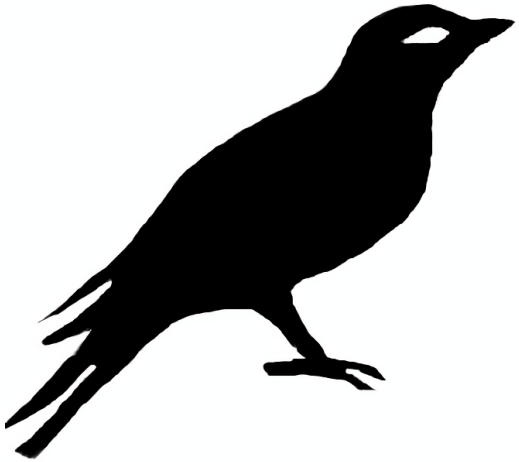

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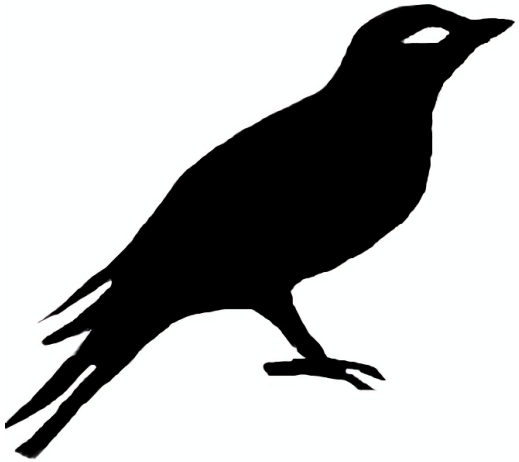

- University of Tsukuba (Undergraduate)
- Authentication Platform Section, DCS Dept
- I'm interesting in Cryptography

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Introduction

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Will ransomwares decrypt the data if the victim pays Bitcoin?

The Fairnest Ransomware

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It's possible using cryptographic technique

Encryption

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Symmetric Key Encryption (SKE) is a cryptographic scheme that uses the *same* key to encrypt and decrypt data like AES. An encryption function is denoted Enc, a decryption function is denoted Dec. The following equation holds for the symmetric key k.

$$x = \mathrm{Dec}_k\left(\mathrm{Enc}_k\left(x\right)\right)$$

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RSA Encryption is a cryptographic scheme that uses the *different* keys between encrypting and decrypting data. The key using encryption is called *public key* and The key using description is called *secret key*. The following holds for a public key (e, N) and the secret key d.

$$x = \left(x^e\right)^d = \left(x^d\right)^e \pmod{N}$$

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- But it's hard to calculate the input x from output $H(x)$

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Preimage Resistance A hash value h, it's difficult to find any message m such that $h = H(m)$.

Second Preimage Resistance An input m_1, it's difficult to find different input m_2 such that $H(m_1) = H(m_2)$.

Collision resistance It's difficult to find two different messages m_1 and m_2 such that $H(m_1) = H(m_2)$.

Zero-Knowledge Proof

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Prover Alice has the secret key d for RSA chipher text c encrypted by public key (e, N). And she has chipher text $s := \mathrm{Enc}_k\left(c^d \bmod N\right)$ and its symmetric key k.

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Bob want to verify as follows:

> “A preimage of the hash value $H(k)$ is a symmetric key k that can decrypt SKE chipher text s.”

without knowing the secret key d or symmetric key k.

Zero-Knowledge Proof

We use *cut-and-choose protocol* where RSA chipher text c encrypted by public key (e, N) and its secret key d.

Thank you for your attention!

Any question?