ABEBox: end-to-end encryption for file sharing cloud services

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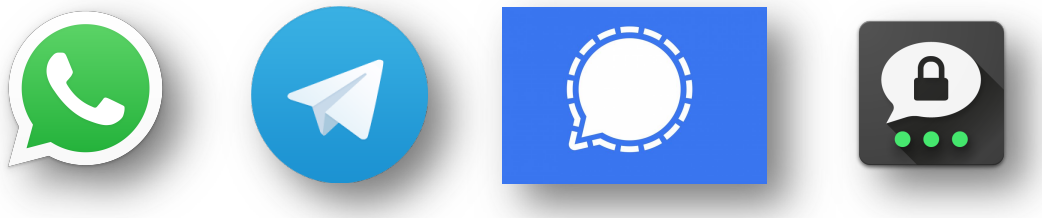
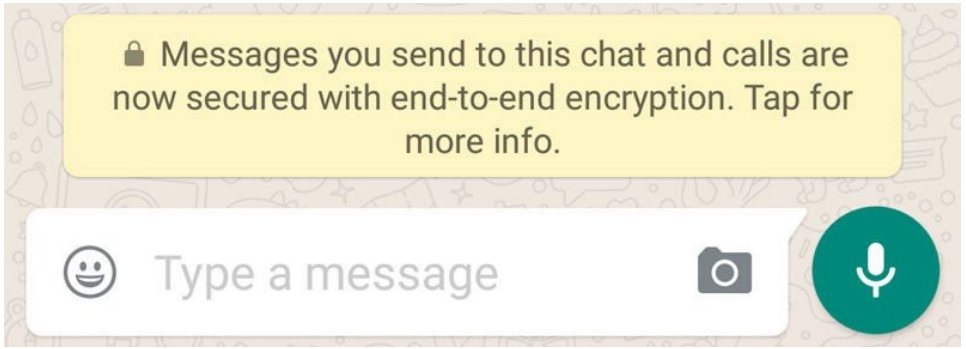
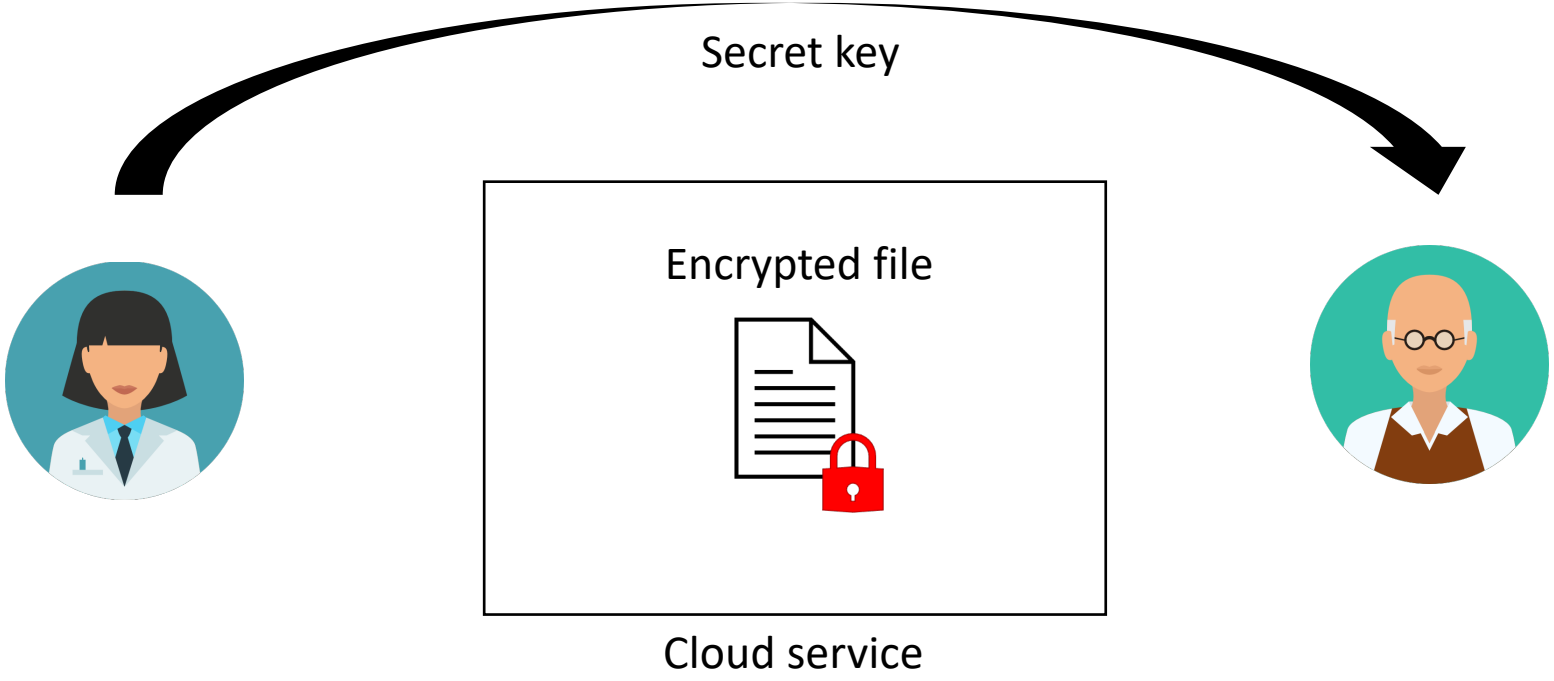
End to end encryption in file sharing



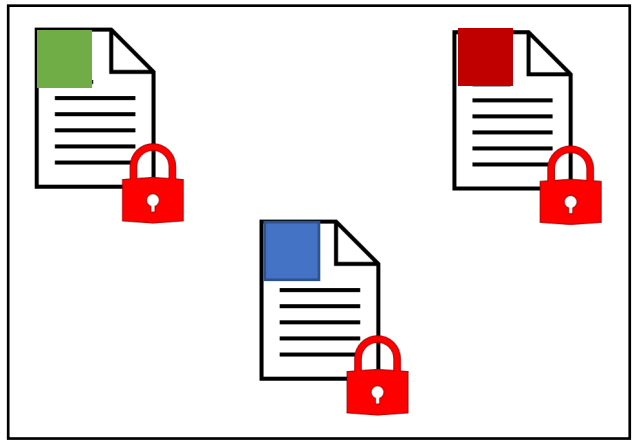


Owncloud EE2E
Nordlocker
Boxcryptor
CryFs

A trivial exercise?



It's not about encryption
it's about key management



Cloud service

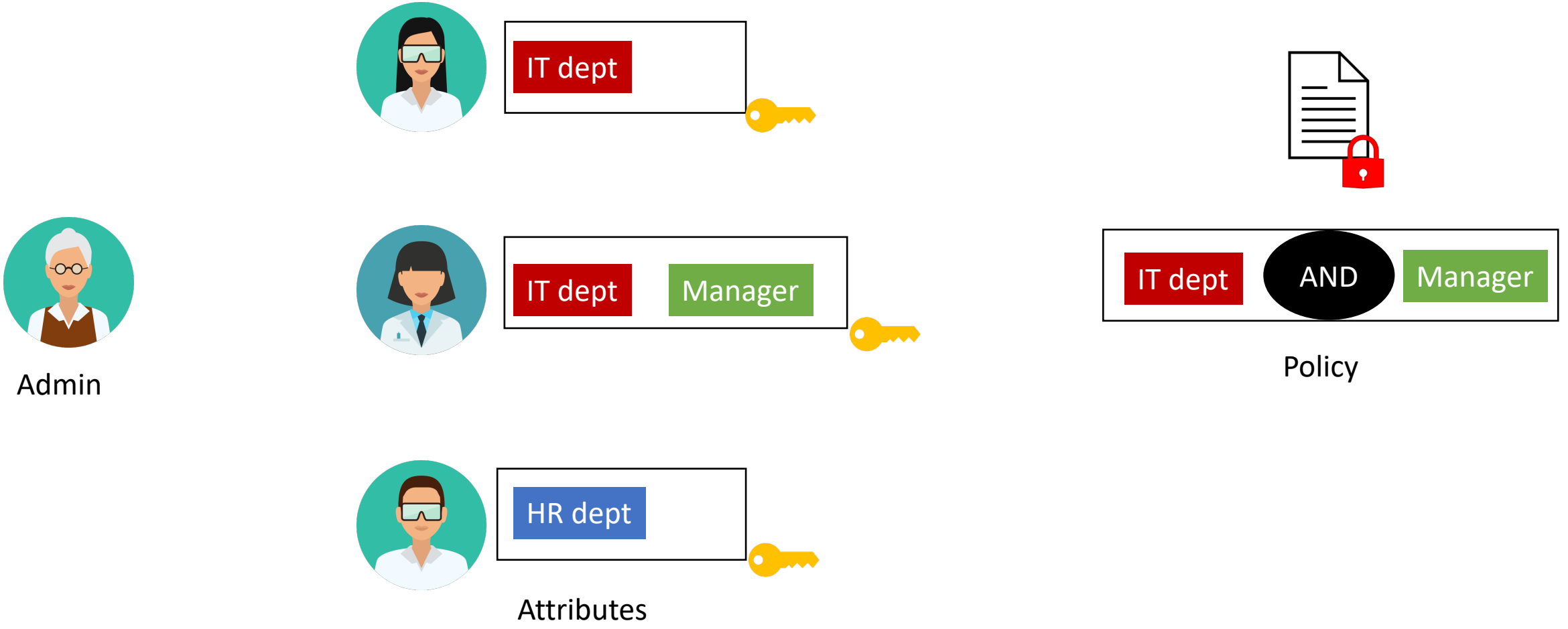
I am leaving

I am the newcomer

ABEBox

- **Key management system** to bring privacy on cloud shared files
  - Without any Trusted Third Party
- It **decouples** *access control* from *data transfering and synchronization*
- It runs **on top** of existing file sharing services
  - Serverless
- Provide solutions for peer **churn**
  - New users and revoked ones

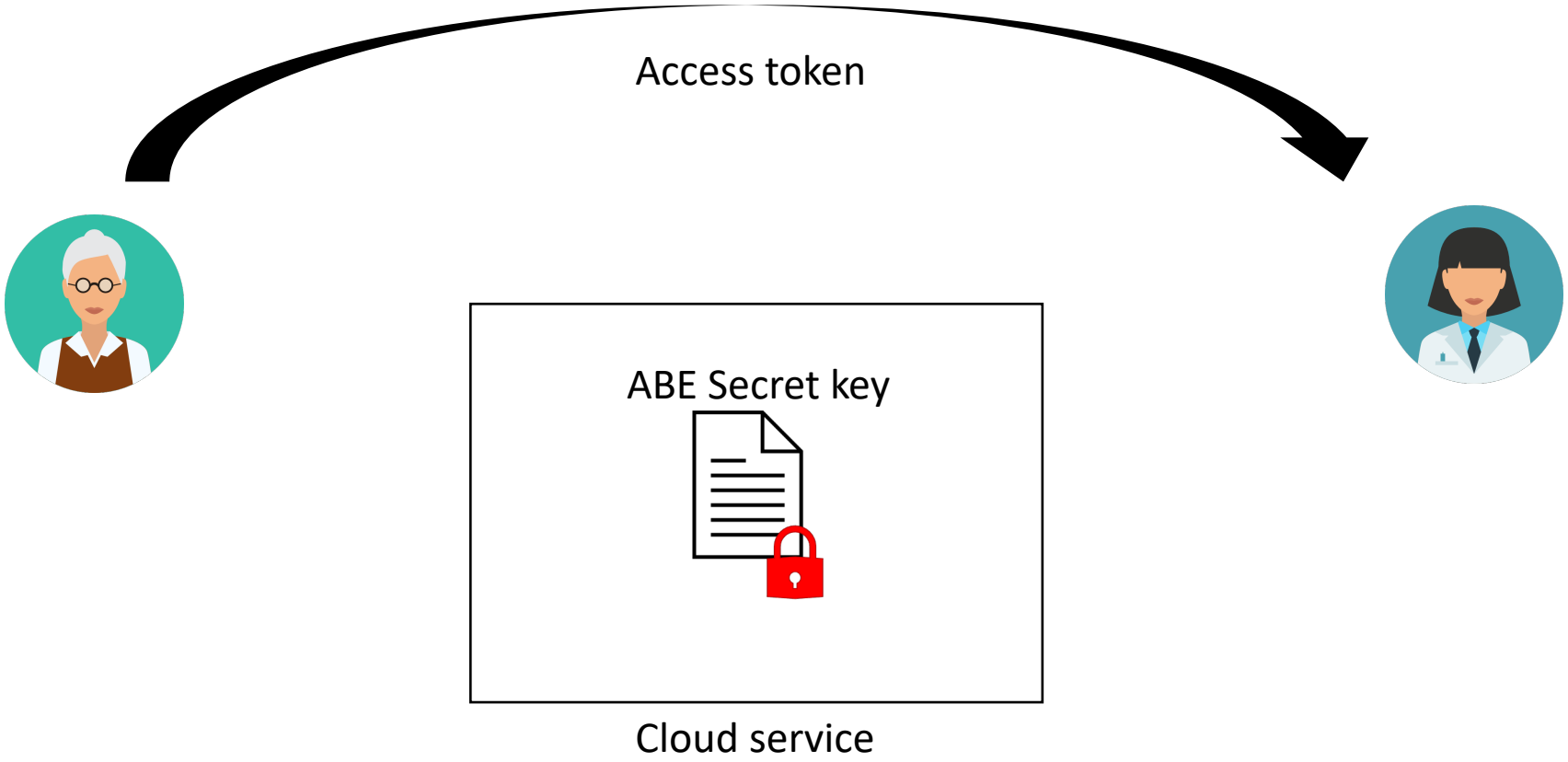
CP-ABE: Ciphertext-Policy Attribute-Based Encryption



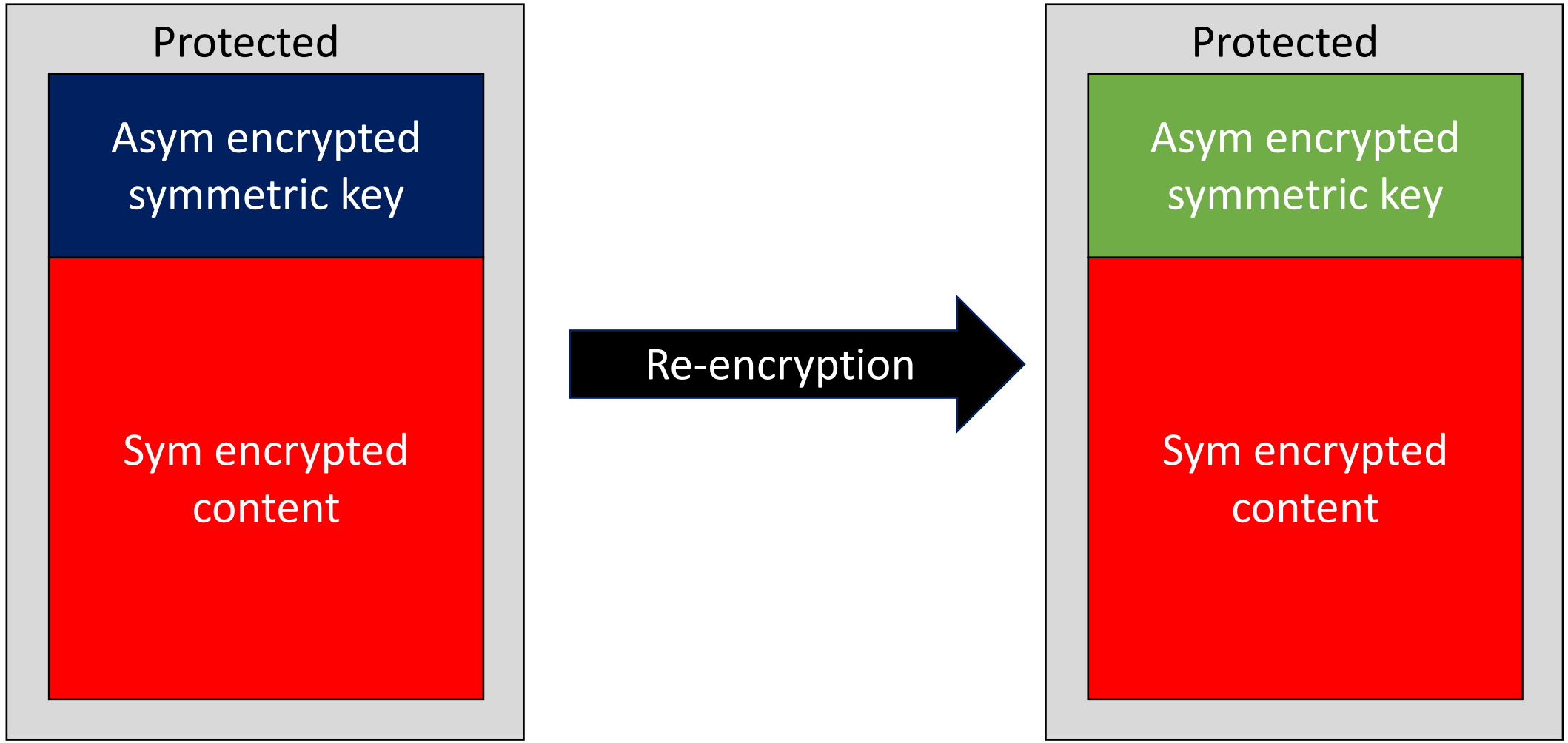
CP-ABE for file sharing

- **Pro**
- Attribute Based Access Control (ABAC) fits nice the needs for flexibility
- Newcomers can be just provided with a single key with the right set of attributes
- **Cons/Still missing**
- How can we send ABE secret key to users?
- Revocation is still not addressed
- CP-ABE is tremendously SLOW (~1000 times slower than RSA)

Providing ABE secret key

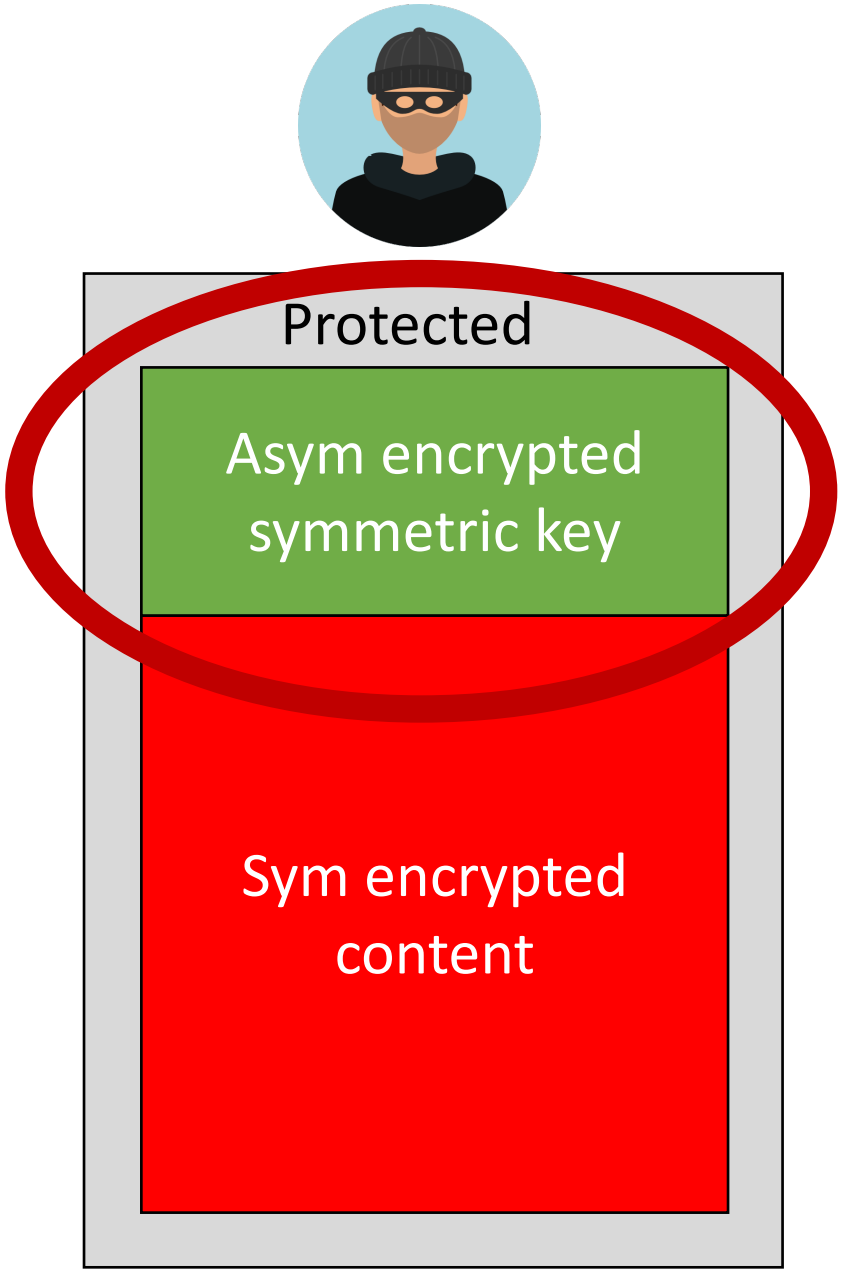


Hybrid Encryption and Revocation

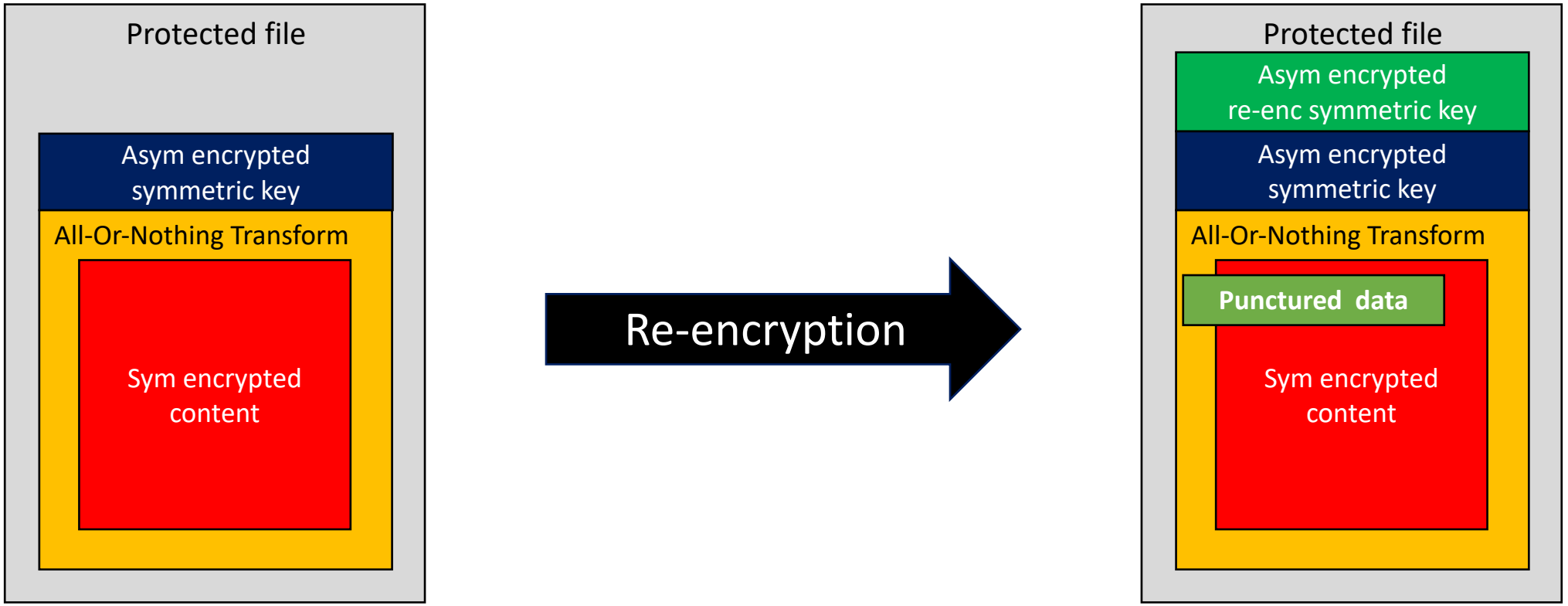


Key scraping attack

1. Pre-fetch all the asym encrypted sym keys
2. Decrypt the sym keys
3. Have access to file conent, even after the re-encryption



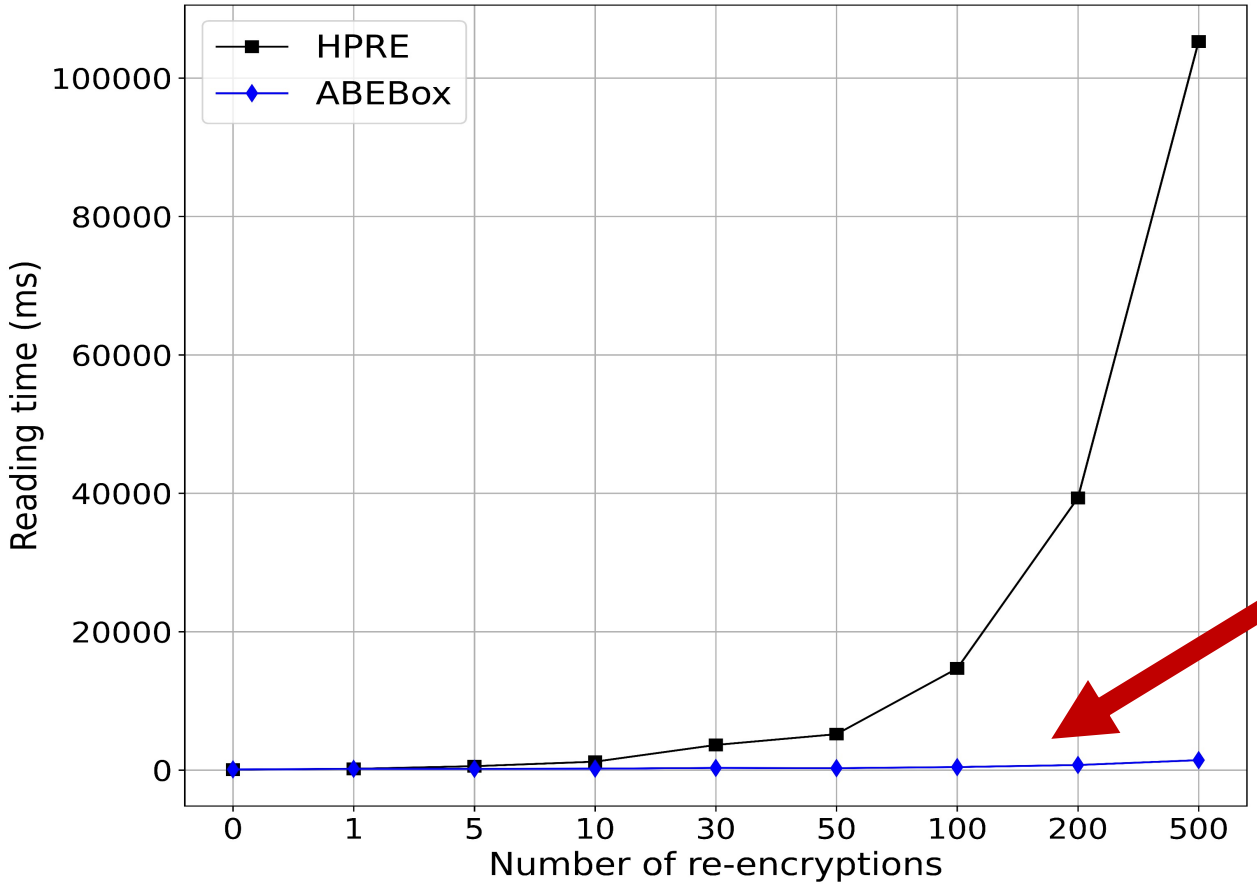
Meyers and Shull's solution



Bellare, Mihir, and Phillip Rogaway. "Optimal asymmetric encryption." *Workshop on the Theory and Application of of Cryptographic Techniques*. Springer, Berlin, Heidelberg, 1994.

Faster decryption

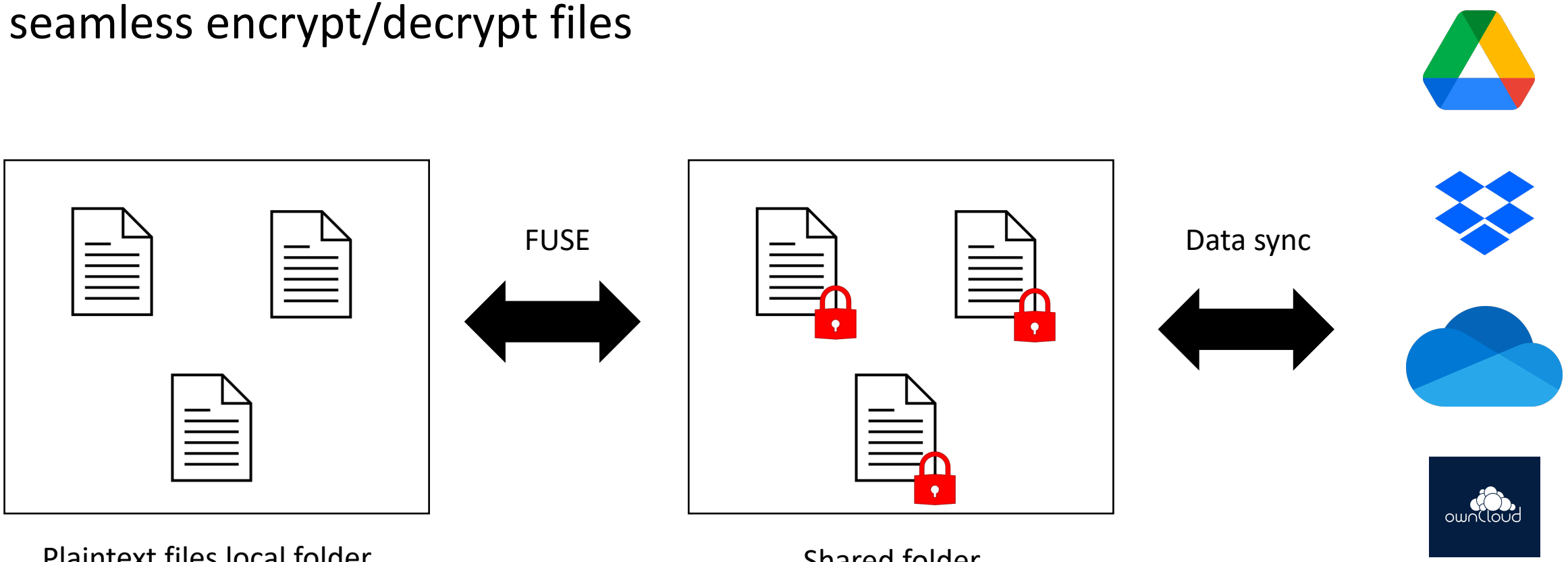
Use Reverse Hash Chain to derive new re-encryption keys



Only <u>one</u> ABE decryption is necessary!

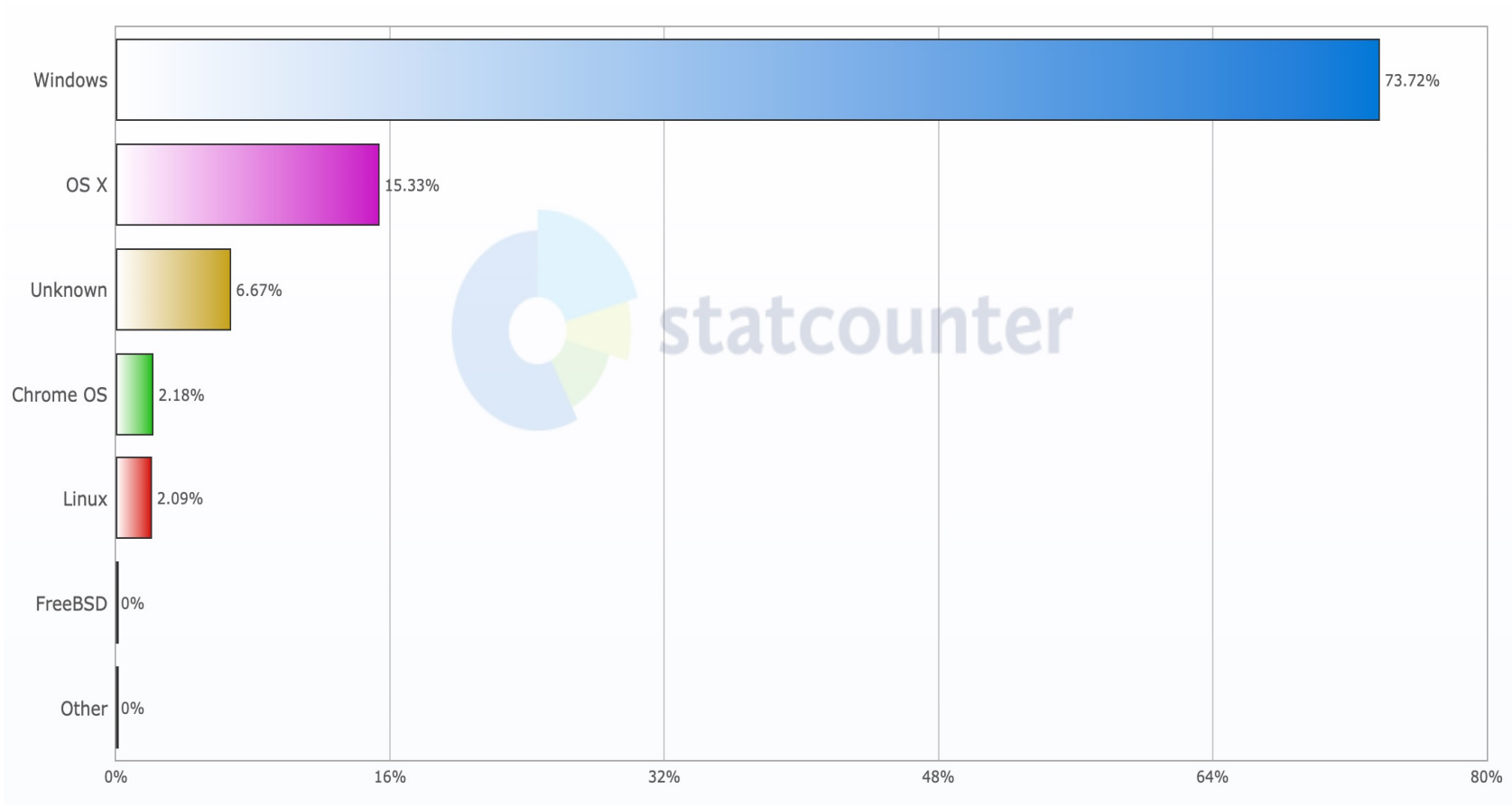
Implementation

ABEBox v1 uses FUSE (Filesystem in User Space) for seamless encrypt/decrypt files



Desktop Operating Systems (Dec 2021)

FUSE not supported

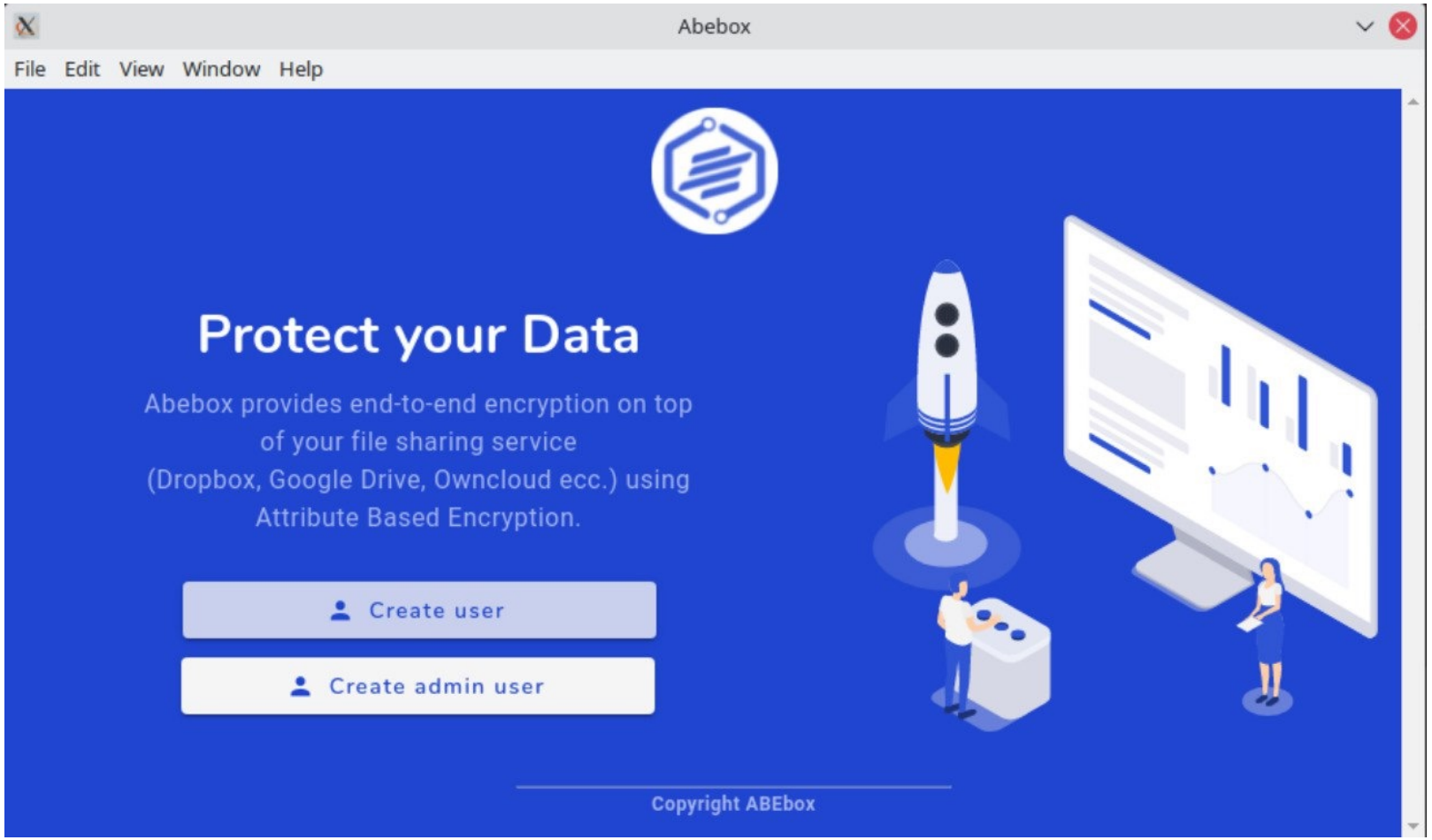


Desktop Operating Systems Stats (Dec 2021)

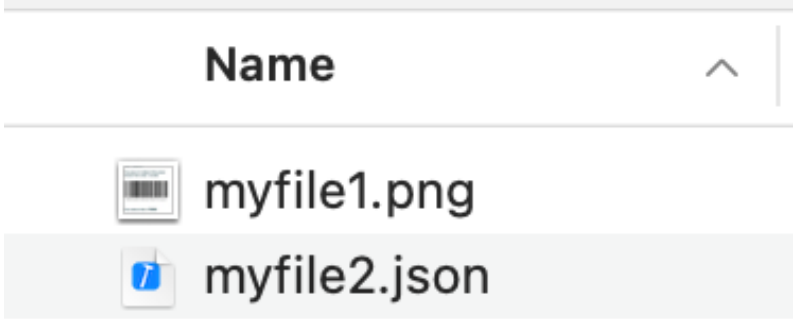
Electron version

ABEBOX

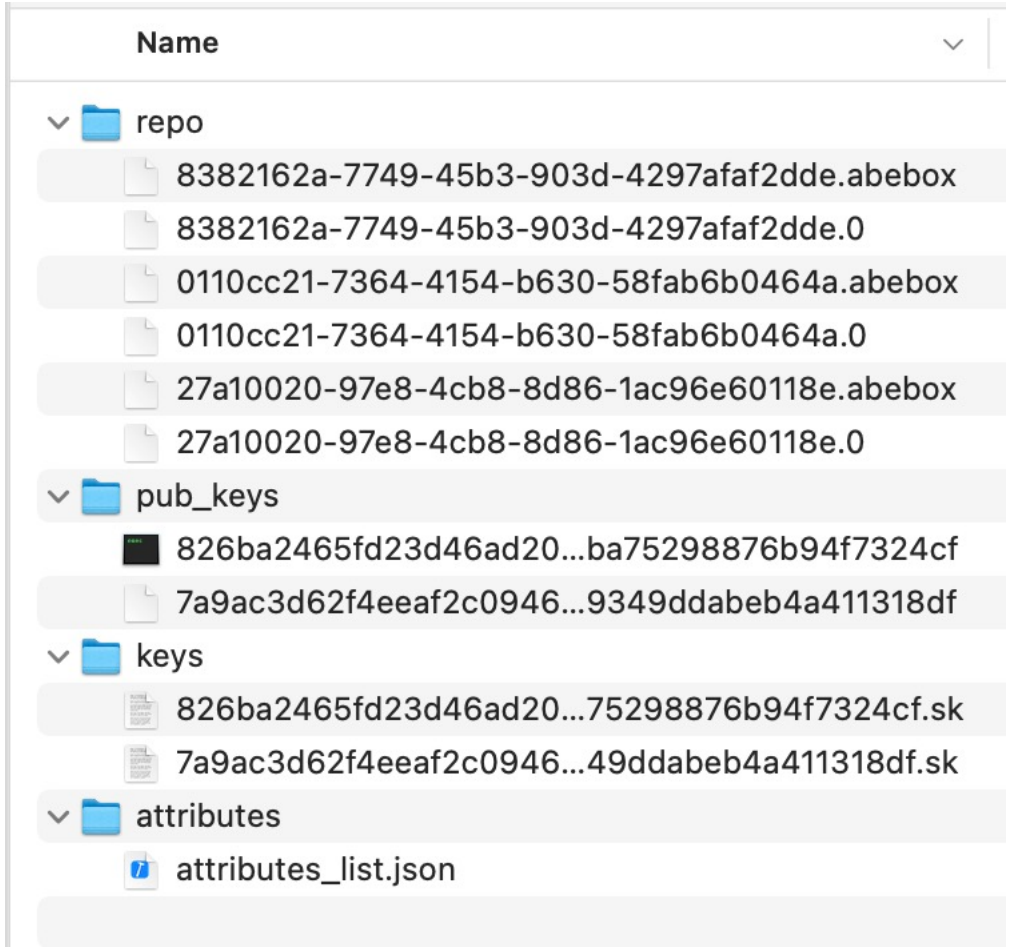
- Multi platform app
  - Win, linux, mac
- GUI for configuration
  - policies, attributes, users



ABEBox



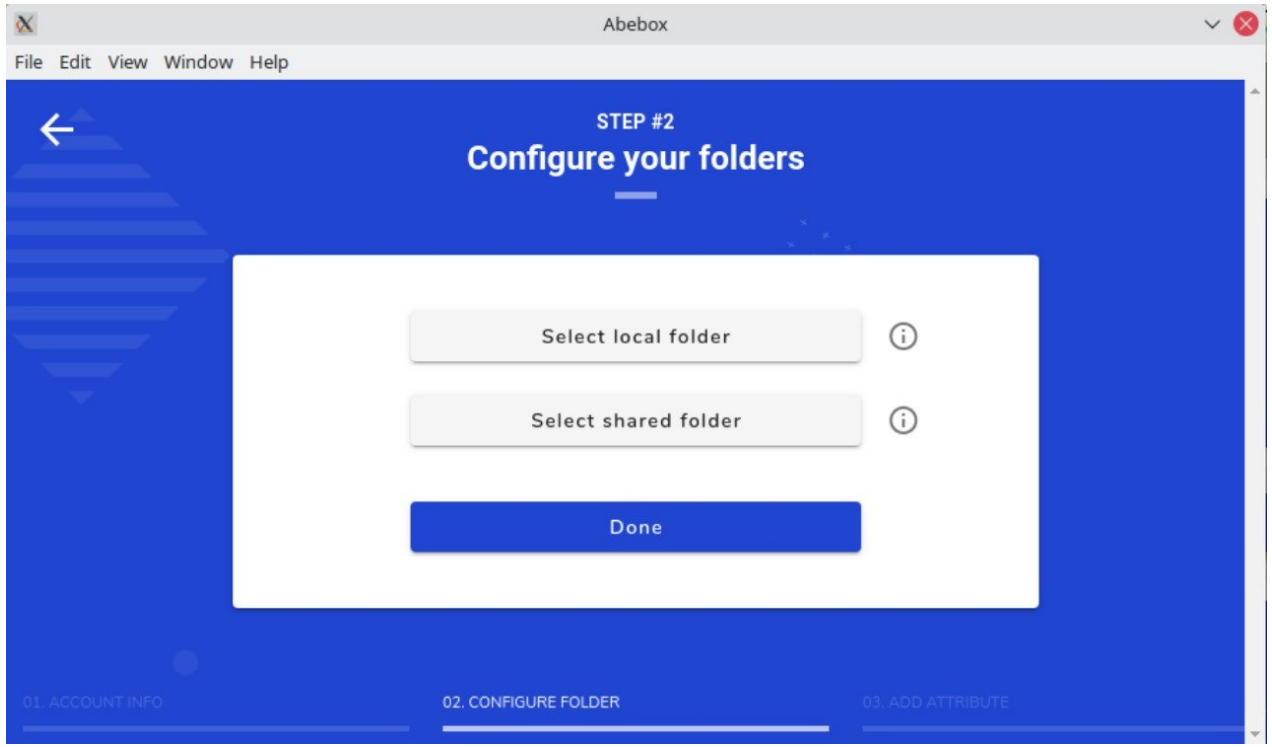
Plaintext files local folder



Shared folder

ABEBox operational flow

- Invited User or Admin?
- Users
  - Select folders
  - Insert token
- Admin
  - Set attributes
  - Add users, assign them attributes and get their tokens
  - Select folders



Testing

- Testing groups:
  - 50 Computer Science 101 students (Electronic and Internet Engineering)
  - 6 e-health students (Electronic Engineering)
- Testing methodology
  - Interview & Questionnaires
- Result (summary)
  - Almost all succeded in accessing a shared file
  - Setup problems installing a new (uncertified) app on some OSs (OS security policies)
  - Major bug reported and patched

Conclusion

- E2E encryption for cloud file sharing systems is more a **key management problem** than an "encryption" problem
- **Attribute Based Encryption** can solve part of problems
- We propose some solutions for the **revokation** problem
- We implemented such solution on a **multi-platform application** and release the code as **open-source**

http://abebox.netgroup.uniroma2.it/ *binaries*

https://github.com/netgroup/abebox-electron *code*

Thanks!

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