Vlastimil Klíma and Martin Baroš

Data Protection in the Cloud

Let's move to the cloud - it's trendy!

Does using cloud services
= a loss of control over my data?

Google

Have a question about Google Accounts?

Accounts Help

Google Apps accounts > Privacy and security

Data access by your administrator or service provider

Your Google Apps account can access the majority of Google products using the email address assigned to you by your administrator or Internet service provider. It's important to note that your administrator or service provider has access to any data you store in this account, including your email. Please read the Google Apps Important Privacy Notice for more information.

Provider has access to your data

It’s important to note that your administrator or service provider has access to any data you store in an account, including your email.

Cryptography and its Implementation

① Perfectly encrypted cloud storage from a cryptographic perspective

② Perfectly encrypted cloud storage from a implementation perspective

①

Perfectly Encrypted Cloud Storage from a Cryptographic Perspective

Cloud Solutions Under Scrutiny

Perfect Cloud Storage Conditions [from cryptografic point of view]

1. End-to-end encryption
2. Client-side key generation
3. User-friendly interface
4. Data sharing is truly secure and easy
5. Top Secret security level encryption algorithms
6. All data on the server is encrypted as well

1. End-to-End Encryption

A. client-side encryption/ decryption of data

B. encrypted and authenticated channel for transferring data to the server

E2E encryption vs. Google drive

A. client-side encryption/ decryption of data
   - client-server encryption only

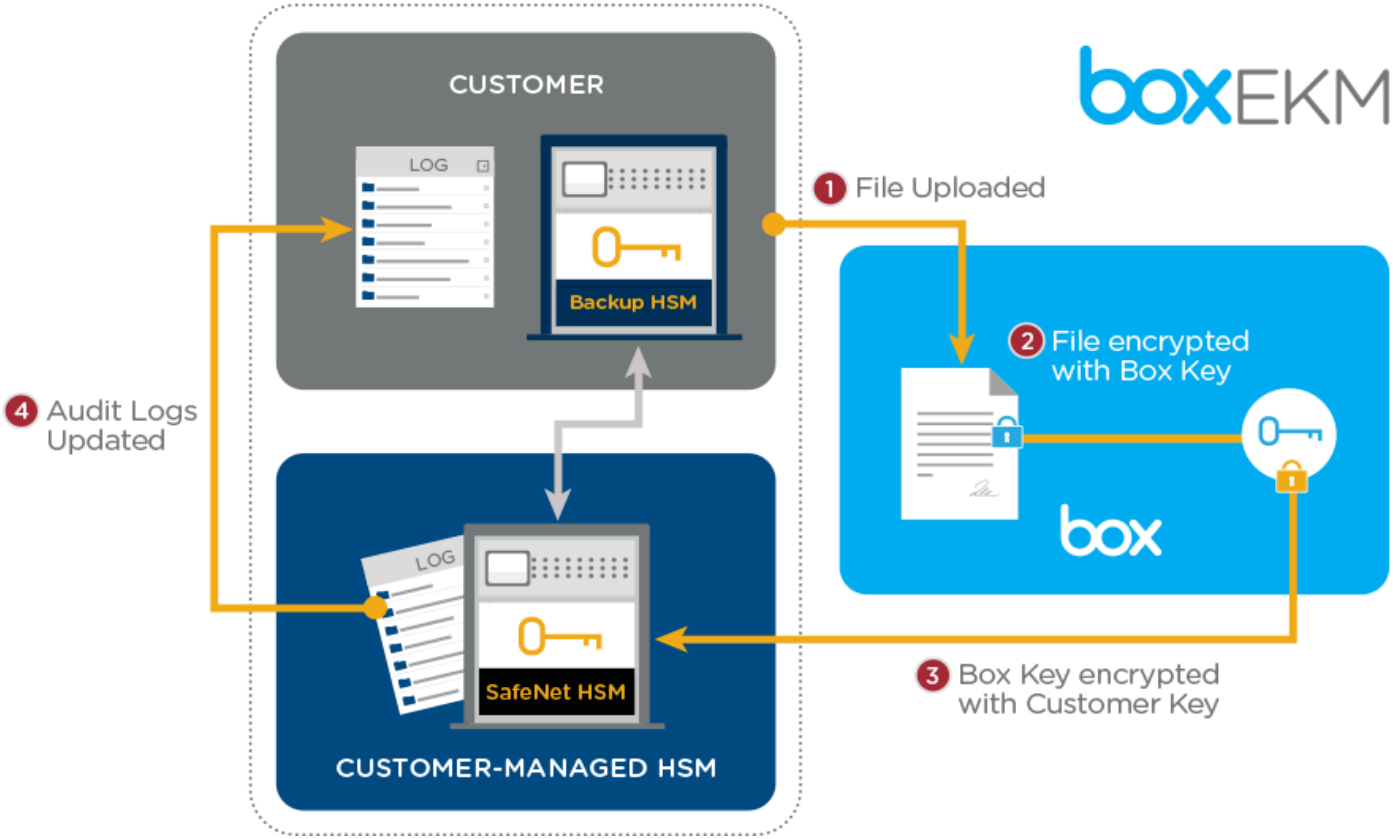
B. encrypted channel for transferring data to the server
   - https

2. Client-Side Key Generation

A. includes entropy generation
B. Keys are never stored on the server
C. optimal physical separation of keys from the data

Key Generation vs. Box

keys are generated on the server



3. User-Friendly Interface

A. no knowledge of encryption necessary

B. easy to store

C. easy to share

4. Data Sharing must be Truly Secure and Easy

A. the process of sharing does not require expert knowledge

B. sharing does not weaken the protection of data

sharing vs. spider oak

zero-knowledge loss while sharing

"... ShareRoom is not Zero-Knowledge ..."

Secure Backup

Sync Anywhere

Share Privately

5. Cryptographic functions on maximum security level

A. Algorithms approved by NSA for Top Secret data protection (AES-256, EC P-384)

6. All Valuable Information must be Encrypted

A. file and directory names

B. file authors and recipients of shared files

C. file directory structure

All Information Encryption vs. Wuala

“Upward Inheritance of Access Rights”

- white paper Cryptree

attack ready approach is essential

"16 vulnerabilities in debian in 2014"

- National Vulnerability Database

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Perfectly Encrypted Cloud Storage from a Implementation Perspective

Perfect cloud storage premisses [from technologic point of view]

Connect anywhere

Perfect cloud storage premisses [from technologic point of view]

Native lang for mobile + java for desktop

- Android, iOS, Windows = 99,1
- Windows, Mac OS, Linux

HTML 5 + CSS + JavaScript

- supported by web browsers
- supported by mobile devices

Desktop browser performance

Google Chrome vs. Mozilla Firefox

tested algorithms:

- AES-256
- EC (DH, shared secret, sign, verify)
- PBKDF2

Browser	Speed
Chrome	Identical
Firefox	

Native language vs. JavaScript

Objective C vs. JavaScript (1 MB data file) on iPad Air

	JavaScript	Objective C	JavaScript / Objective C
AES-256 ENC	8 228 ms	30 ms	274
AES-256 DEC	9 126 ms	30 ms	304

Cryptography in JavaScript

JavaScript encryption in web browser
(50 KB data file, time: [ms])

	Ipad 2	Ipad Air 2	HTC One	Iphone 5S
AES-256 ENC	401	174	192	236

Implementation conclusions

	Mobile devices Native languge	Mobile devices JavaScript	Desktop JavaScript
Chat service	YES	YES	YES
Small files (<1 MB)	YES	YES	YES
Bigger files (photos)	YES	NO	YES

Perfect cloud conclusion

- Defined 6 premises
- Suitable technology is availale
- No product that reach this level of security
- Implemented proof of concept – Cryptelo Drive

Thank you for your attention

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