



Chasm: Fault-Tolerant, Information-Theoretic Secure Cloud Back

Alex Grinman, Akshay Ravikumar, Julian Fuchs, Kevin Li

I'm sure there are plenty of existing
"secure" back-up solutions...so why?

- **Existing Secure Back-up Solutions:**
 - TBD > Kevin
- **Bad usability:**
 - Passwords (to remember & forget)
 - Keys (to lose when computer crashes, or you write it down and someone steals it)
- **Bad Security**
 - what is the threat model?

Threat model




- **Adversaries:**

1. Cloud Storage Service is curious, wants to gather information to sell
2. Nation state compels Cloud Service to reveal user data by means of law
3. Hacker's break into a Cloud Service and steals user

- **Threats:**

- Cloud Services are computationally powerful!
- Can Brute force passwords or password-derived encryption keys
- Denial-of-Service by removing access to encrypted/plaintext data

How does Chasm work?

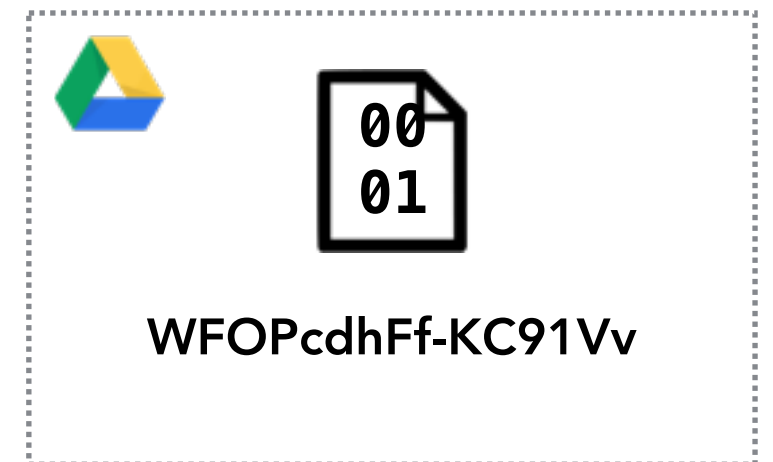
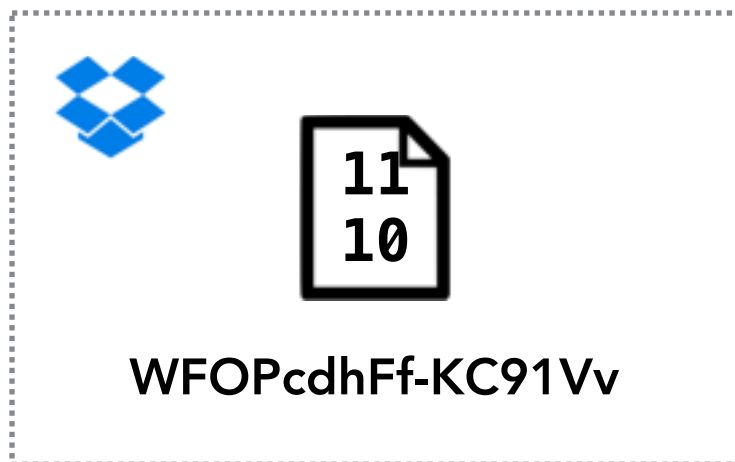
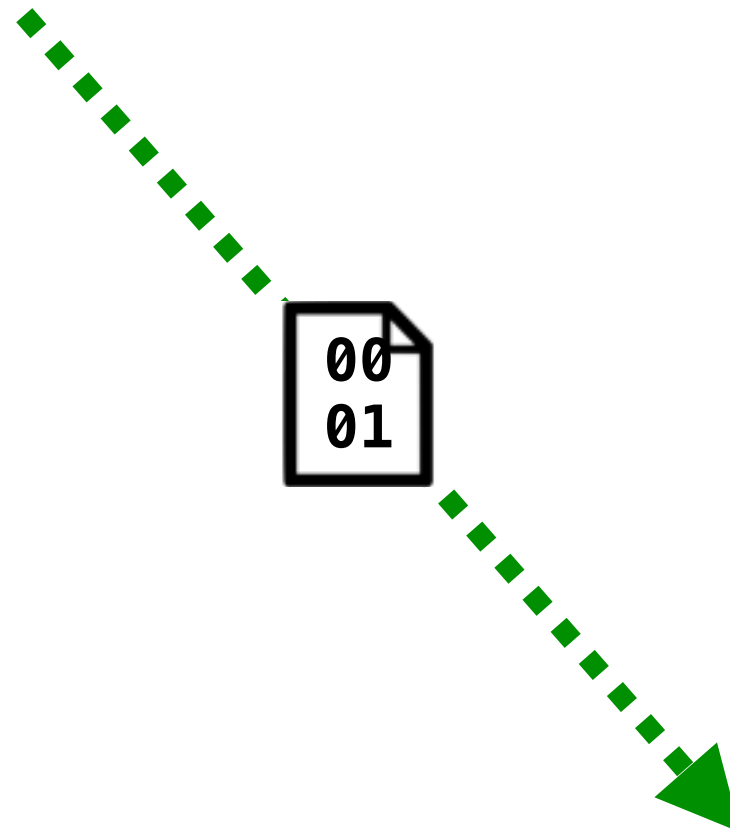
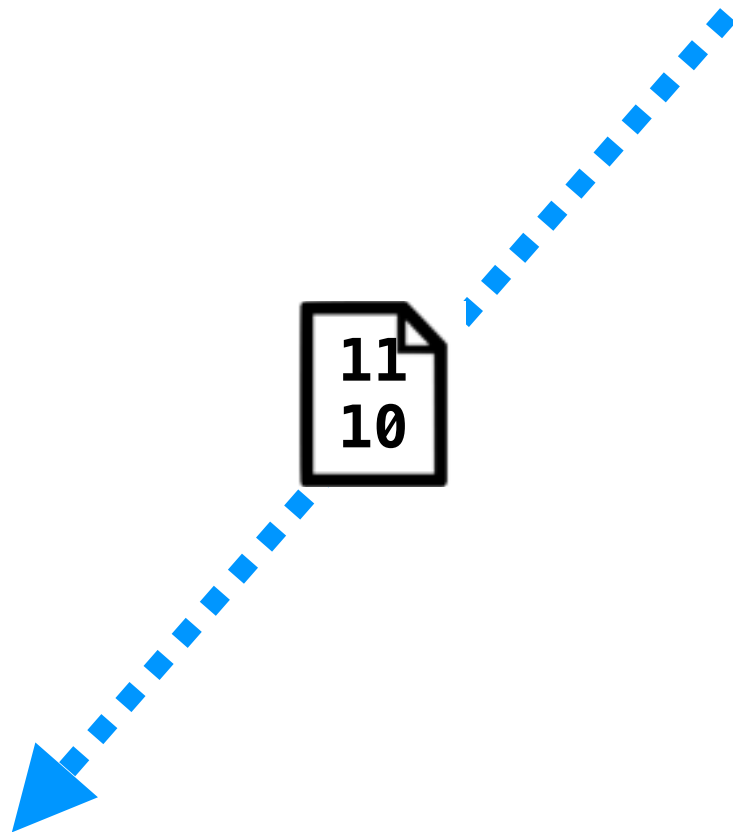
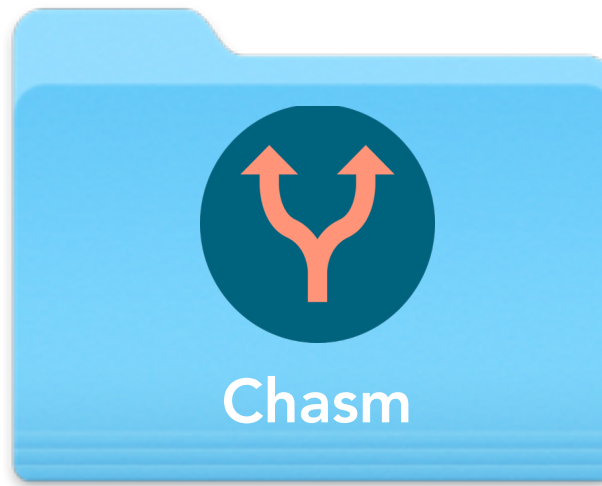
1. **You** specify **> 2** cloud stores like:
 -  Dropbox
 -  Google Drive
 -  iCloud Drive
 -  Microsoft One Drive
 -  AWS
2. **Chasm** creates a “secure” **chasm folder** in your home directory
3. **You** can now simply drag & drop files into the folder

How does Chasm work?

- Chasm listens for file-system events on the **chasm folder**
- When a new file is added to the **chasm folder**, the file is secret shared using a **K-out-of-N** Shamir's **Secret Sharing Scheme**
- Each share is sent to a different cloud store
- **N** = # of cloud stores
- **K** = recoverability threshold (by default **N**)



bank_accounts.pdf



DEMO  TIME!

System Guarantees

- **Information-Theoretic Confidentiality** of data if less than K -out-of- N cloud services collude
- **Fault-tolerance** lost data is recoverable if at least K -out-of- N cloud services available
- **Integrity** of data if less than K -out-of- N cloud services corrupt shares

Win on Usability

- No passwords to remember
- Easy setup & restore
- Drag & drop to secure
- Most user's already have existing cloud services like Dropbox, Drive, iCloud, etc...

Vulnerabilities

(& how we can fix some of them)

- Cloud stores can determine the number of files and the size of each file
 - Use fixed size blocks!
- A network adversary can potentially combine outbound shares as they are being sent
 - Most cloud stores operate over TLS
- I use the same password for everything?
 - ...please turn on 2FA.

Related Systems

- TBD > Kevin

Questions?