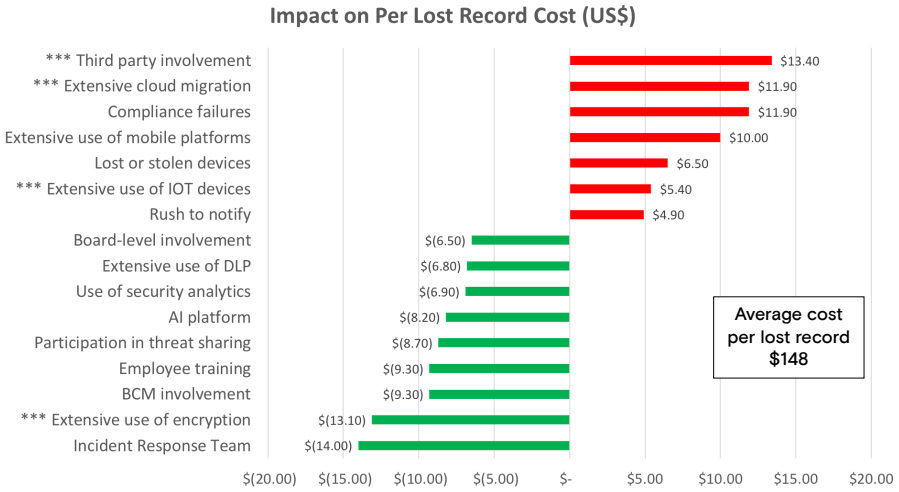
NuCypher

Derek Pierre, Business Development Lead

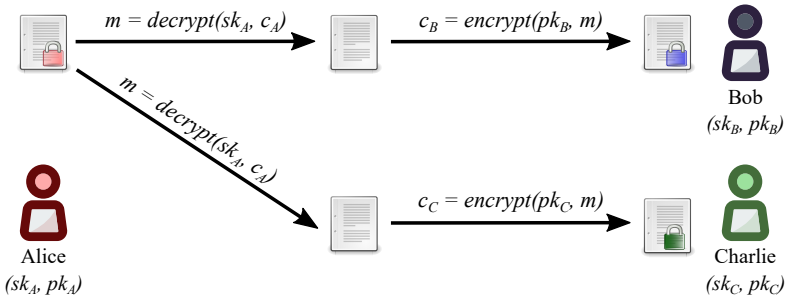
Target Vendor Day, 16 Aug 2018

Impact of Data Breaches



Source: IBM 2018 Cost of a Data Breach Study: Global Overview, `https://www.ibm.com/security/data-breach`

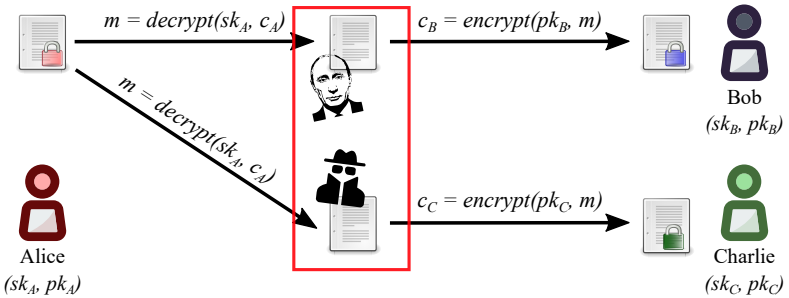
Public Key Encryption (PKE)



Limitations

- Decryption required before sharing
- Not scalable
- Complex access revocation

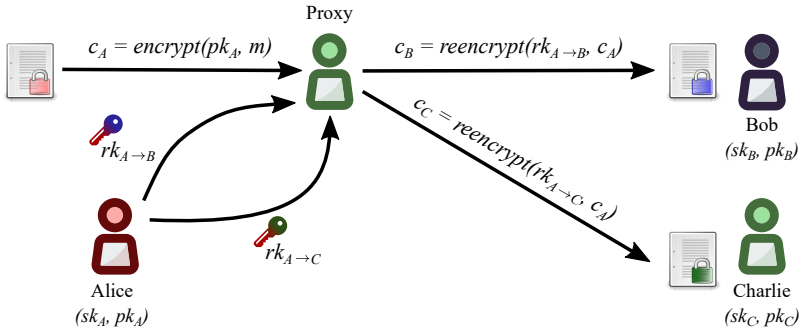
Public Key Encryption (PKE)



Limitations

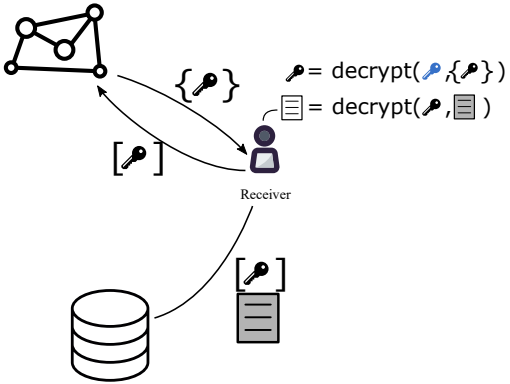
- Decryption required before sharing
- Not scalable
- Complex access revocation

What is proxy re-encryption (PRE)



Solution

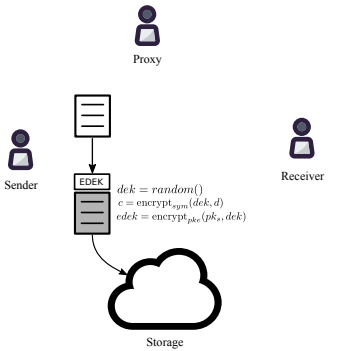
Proxy Re-encryption + KMS



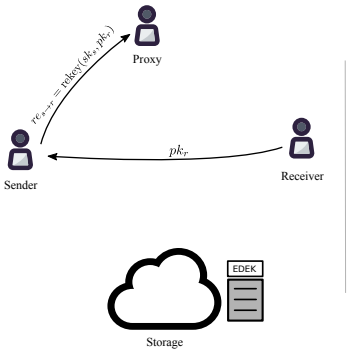
Benefits

- Data not decrypted to facilitate sharing
- Scalable and performant
- Access revocation through re-encryption key deletion

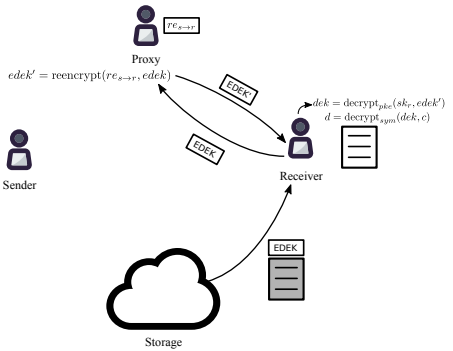
Centralized KMS using PRE



Encryption



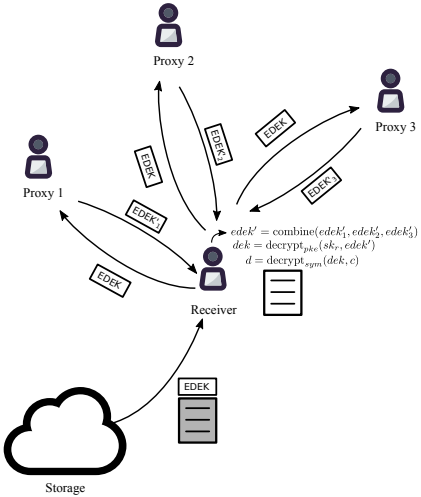
Access Delegation



Decryption

Blockchain-based Decentralized KMS using PRE

Using threshold split-key re-encryption (Umbral)



NuCypher PRE Properties	• Unidirectional • Single hop • Non-interactive
KEM/DEM Approach	• Umbral KEM for threshold re-encryption • ECIES for key encapsulation • DEM can be any AE (ChaCha20-Poly1305)
Verification of Correctness	• Verification through non-interactive ZK-proof • Incentive layer via NU staking token • Re-encryption validated by challenge protocol

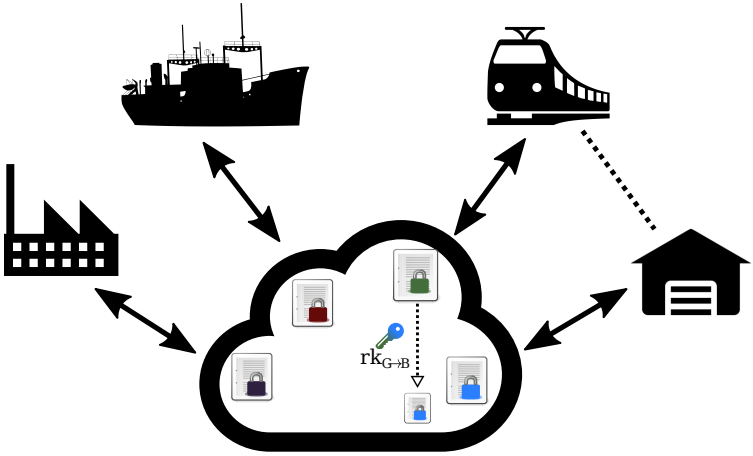
Blockchain Smart Contract Agnostic

Public Blockchains

Private/Permissioned Blockchains

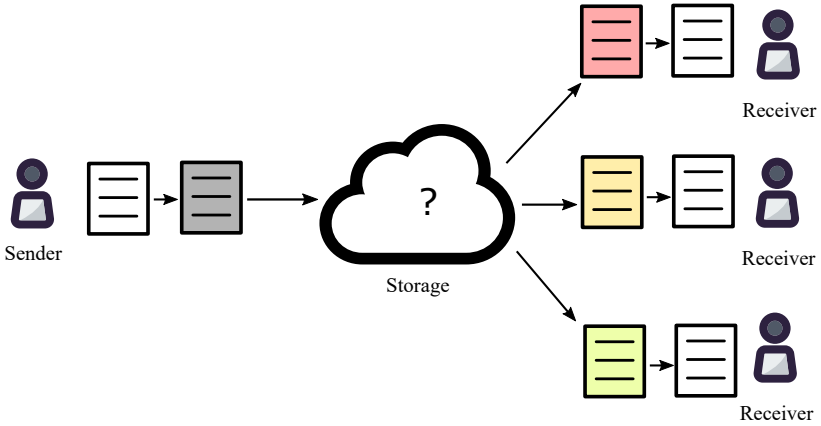
Use Cases

Supply Chain Secure Data Sharing



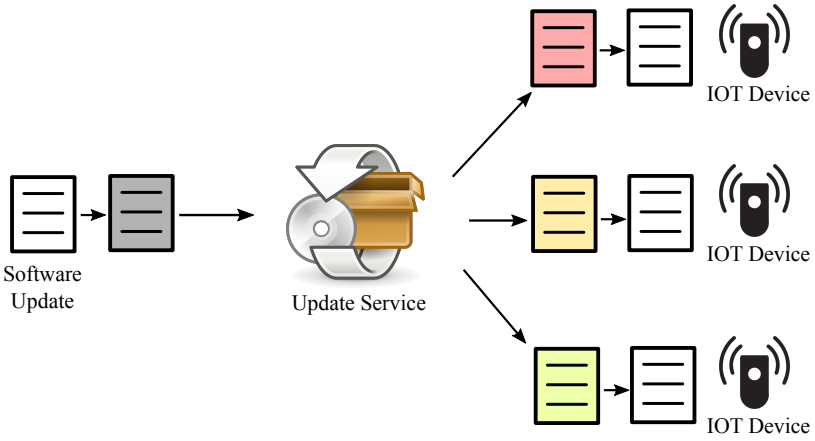
Use Cases

Auditable, Access-Controlled Data Sharing



Use Cases

Scalable, Secure IOT Updates



Early Users

Decentralized Marketplaces

Decentralized Databases

Medical Data Sharing

Internet of Things

Sharing Economy

Genomic Data

Competing Technology

Data Masking and Tokenization

- Less secure for data with underlying patterns
- Reduce the value of data by obfuscating it

Multi-Party Computation (MPC)

- Early Research Stage
- Slow Performance

Fully Homomorphic Encryption (FHE)

- Early Research Stage
- Slow Peformance
  - NuCypher has made investments in this area

Investors

AMINO Capital

BASE

Blockchain Partners Korea

CoinFund

compound

FIRST MATTER

Satoshi•Fund

Team

Founders

MacLane Wilkison

Co-founder and CEO

Michael Egorov, PhD

Co-founder and CTO

Advisors

Prof. Dave Evans

University of Virginia

Prof. Giuseppe Ateniese

Stevens Inst. of Technology

John Bantleman

Rainstor

Tony Bishop

Equinix

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Cryptographer

John Pacific (tux)

Engineer

Justin Myles Holmes

Engineer

Sergey Zotov

Engineer

Kieran Prasch

Engineer

Bogdan Opanchuk, PhD

Engineer

Ryan Caruso

Community

Derek Pierre

Business Development

Arjun Hassard

Product & Partnerships

More Information

Website: `https://nucypher.com`
Whitepaper: `https://www.nucypher.com/whitepapers/english.pdf`
Github: `https://github.com/nucypher`
PyUmbral on Github: `https://github.com/nucypher/pyUmbral`
Demo Network: `https://github.com/nucypher/mock-net`
Discord: `https://discord.gg/7rmXa3S`
Email: derek@nucypher.com
Email: hello@nucypher.com

Appendix: Umbral - Threshold Proxy Re-Encryption

Designed by: David Nuñez, University of Malaga, NICS Lab

- "Umbral" is Spanish for "threshold"
- PRE properties: Unidirectional, single-hop, non-interactive
- It follows a KEM/DEM approach:
  - UmbralKEM provides the threshold re-encryption capability
  - The DEM can be any authenticated encryption (currently ChaCha20-Poly1305)
- IND-PRE-CCA security
- Verification of re-encryption correctness through Non-Interactive ZK Proofs
- Code: `https://github.com/nucypher/pyUmbral/`
- Documentation (WIP): `https://github.com/nucypher/umbral-doc`

Appendix: Fully Homomorphic Encryption