Network Security - Week 2

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DCC/FCUP

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Cryptography

The art and science of establishing secure communication over an insecure channel

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Confidentiality

- Protect sensitive data from eavesdropping - Encryption

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- The keys can be the same – symmetric cryptography
- or different – public-key cryptography

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- The goal can also be to detect if messages are altered

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- Requires a key to encrypt/decrypt
- The keys can be the same – symmetric cryptography
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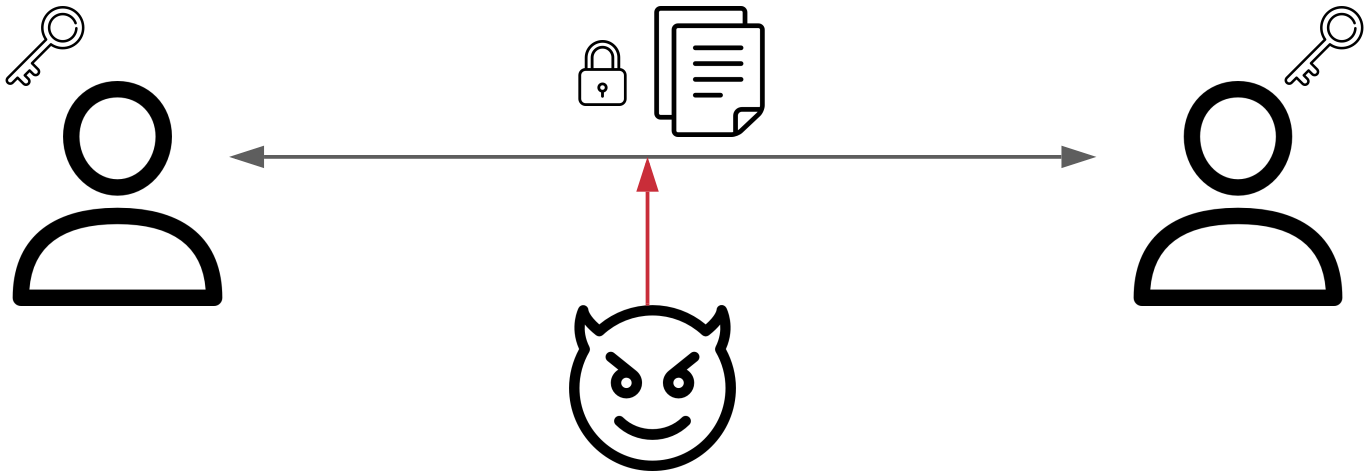
Integrity

- The goal can also be to detect if messages are altered
- For symmetric crypto, we use Message Authenticated Codes
- For public-key crypto, we use Digital Signatures

Symmetric Cryptography - P1



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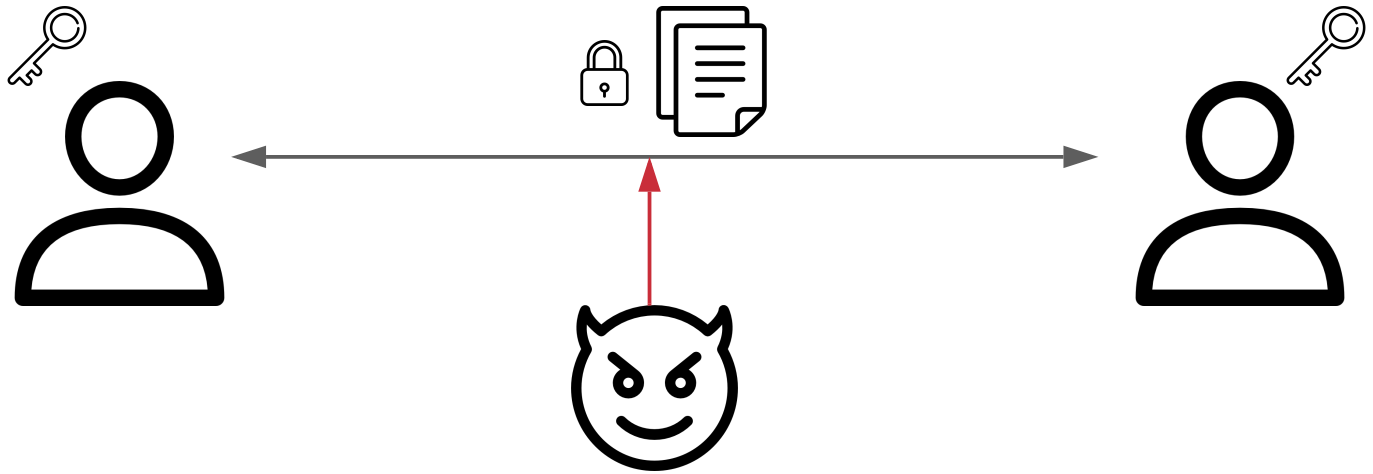

- Users know the same key (pre-shared)

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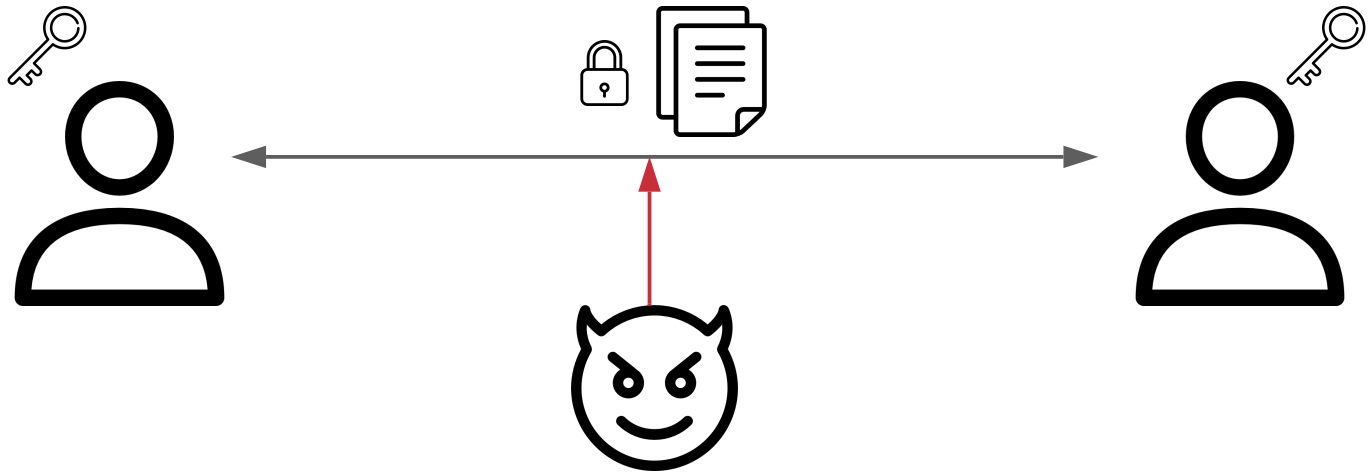

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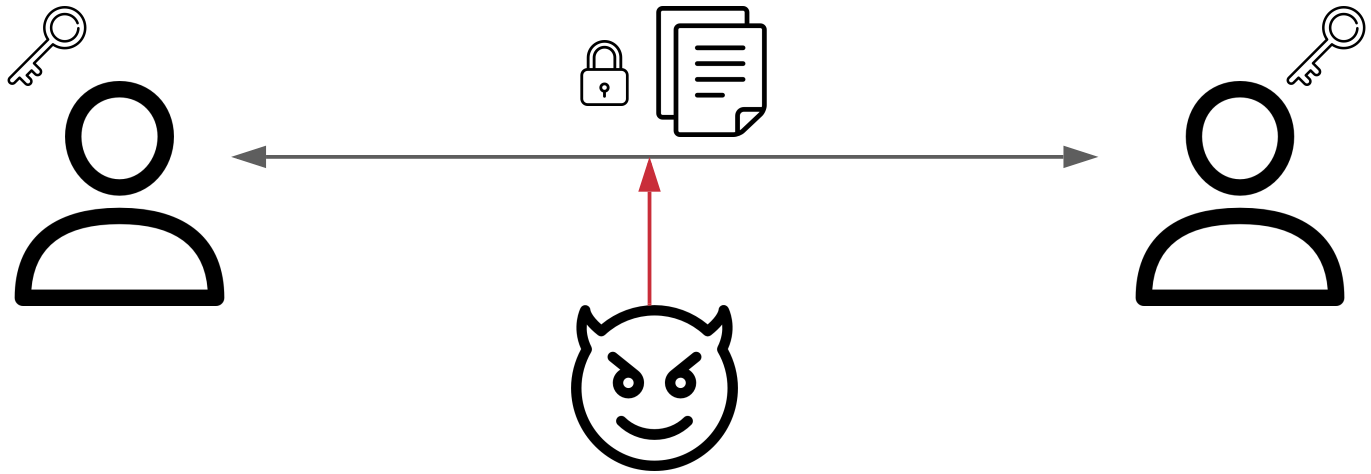

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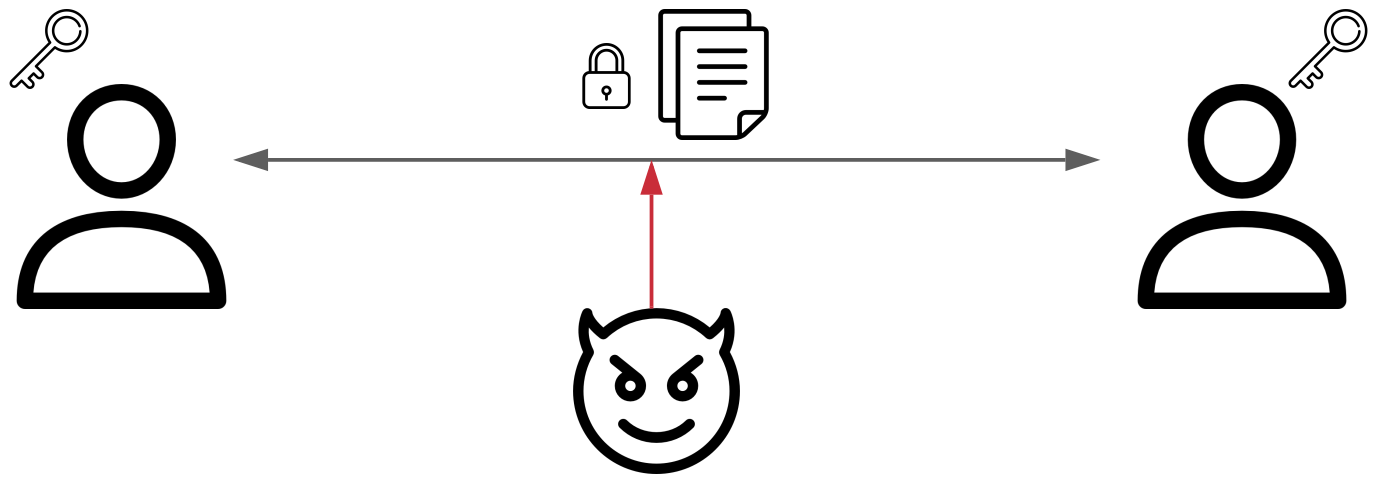

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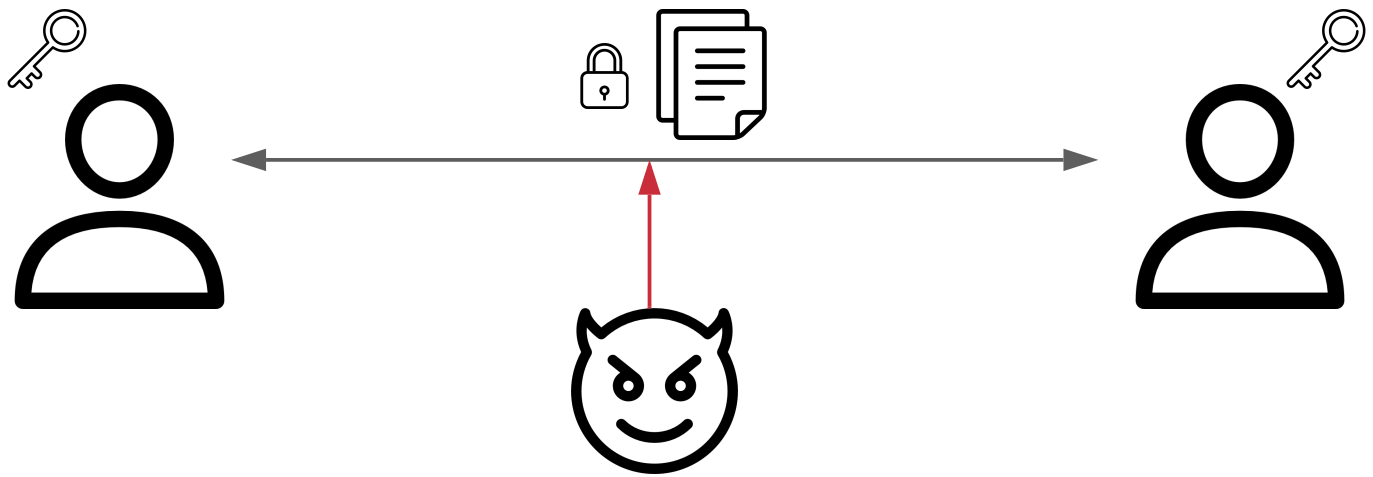

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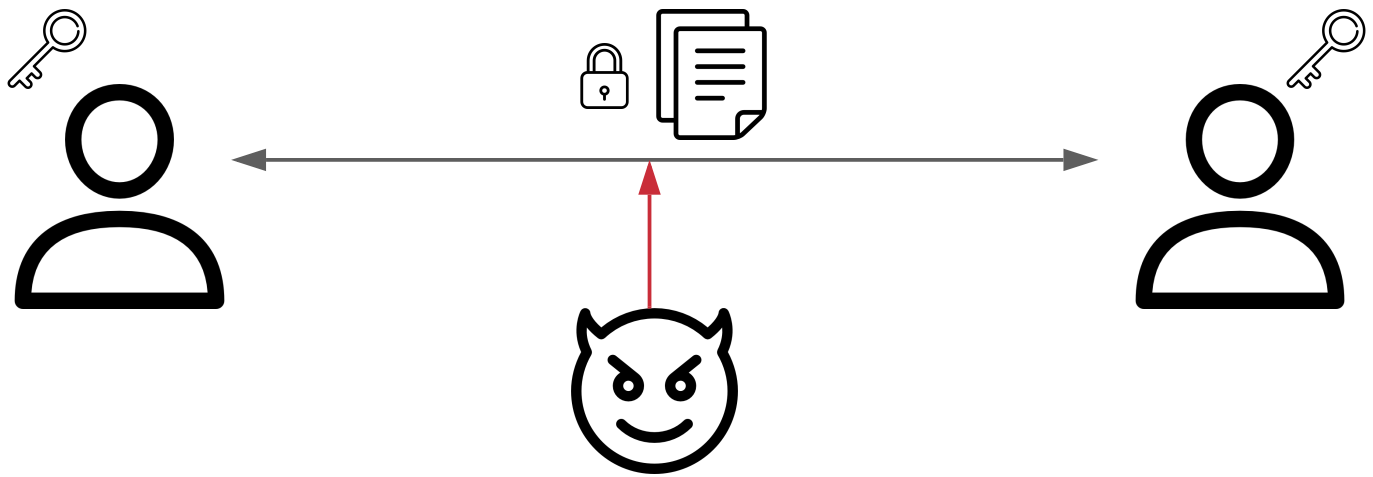

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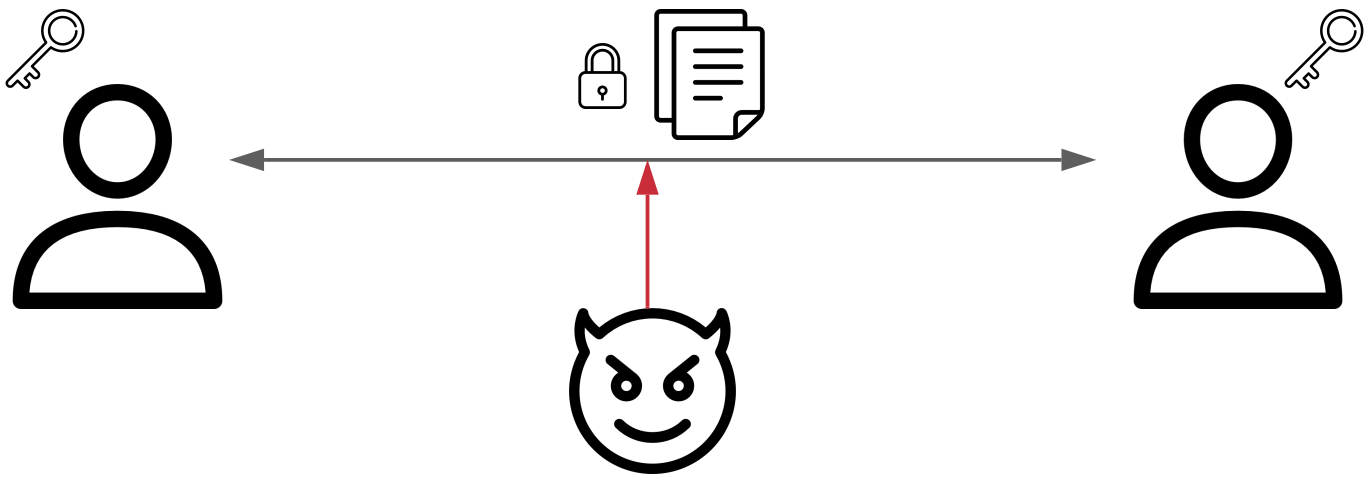

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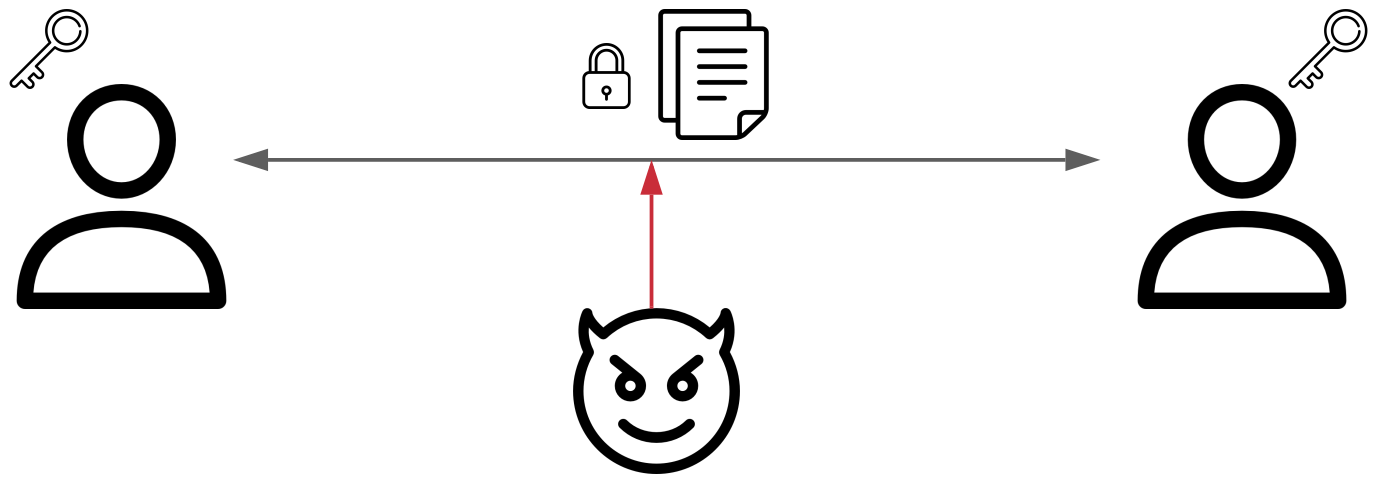

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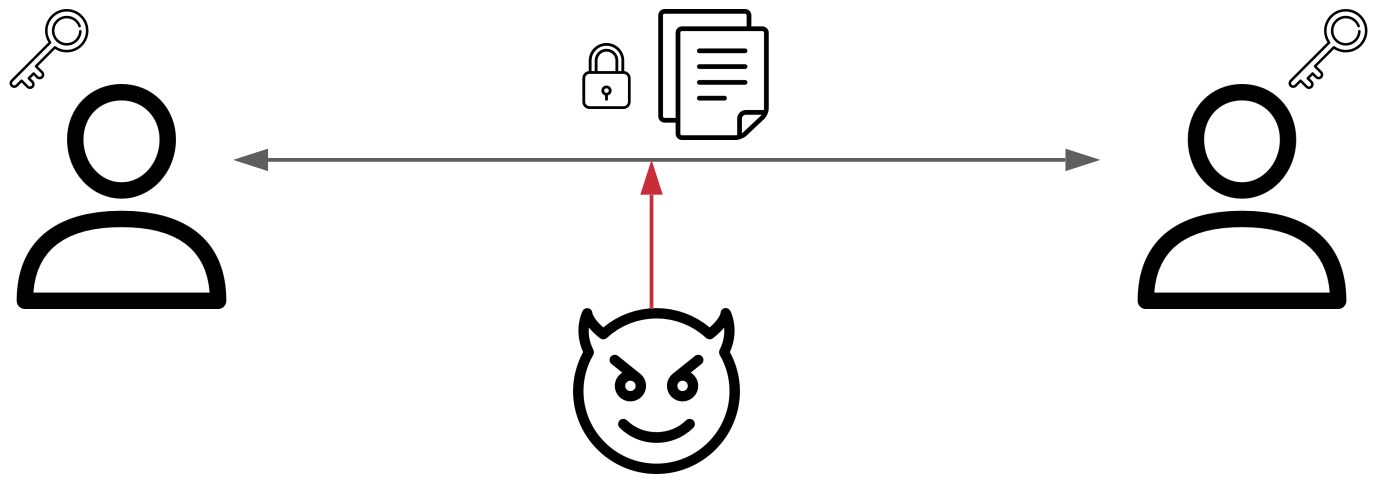

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  - Authentication: $t = \text{MAC}(k, m)$
  - Verification: $T/F = \text{Verify}(k, m, t)$

Symmetric Cryptography - P2

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  - AES-GCM, Poly-ChaCha

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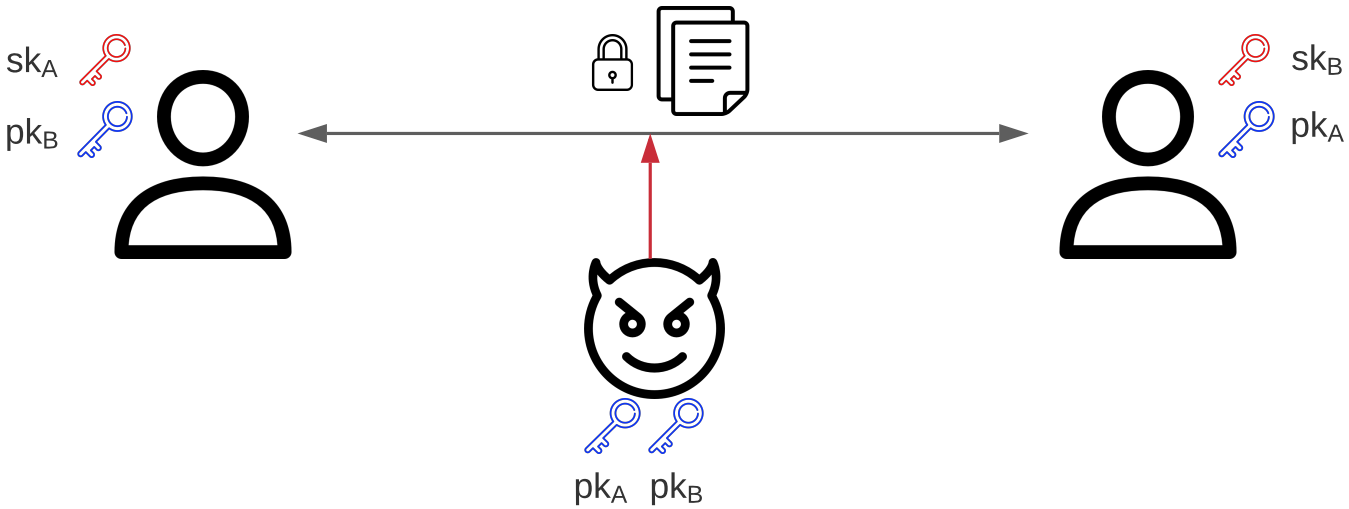

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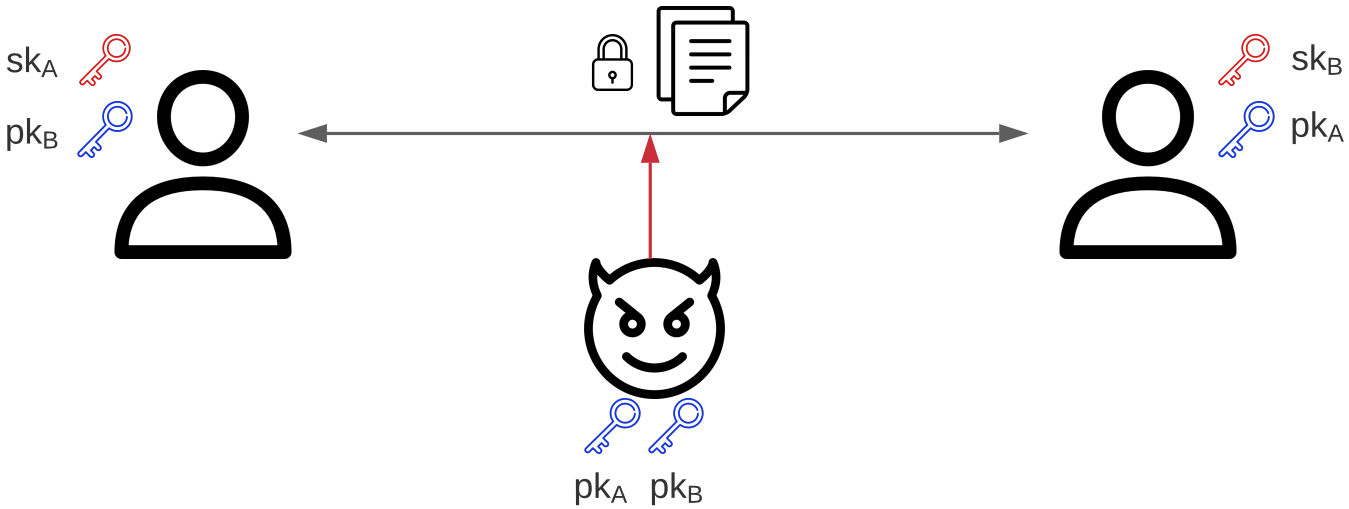

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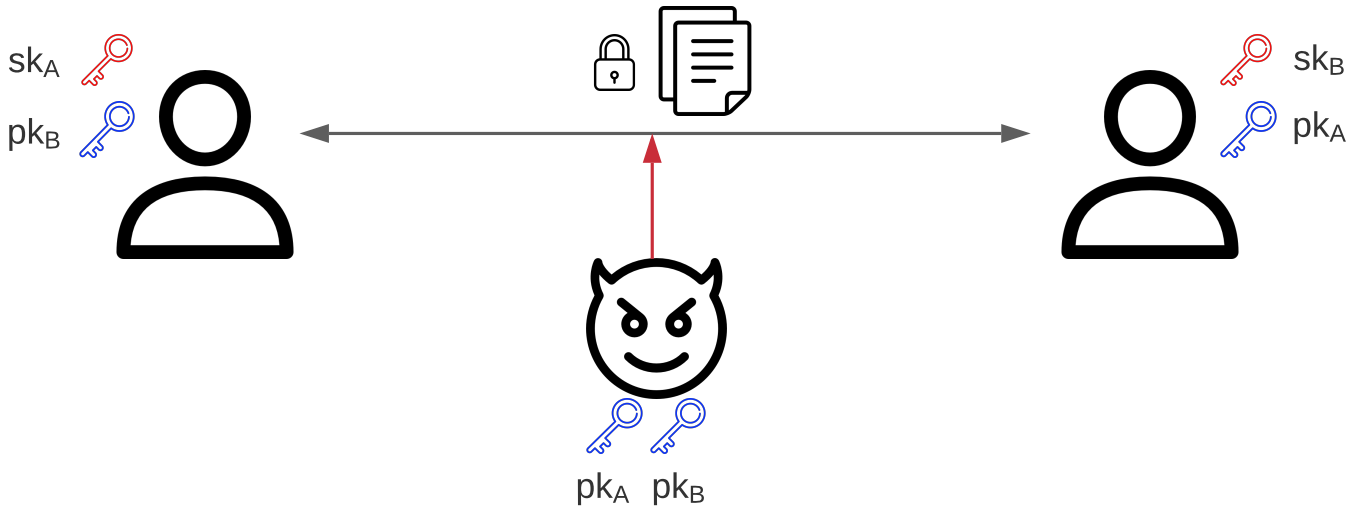

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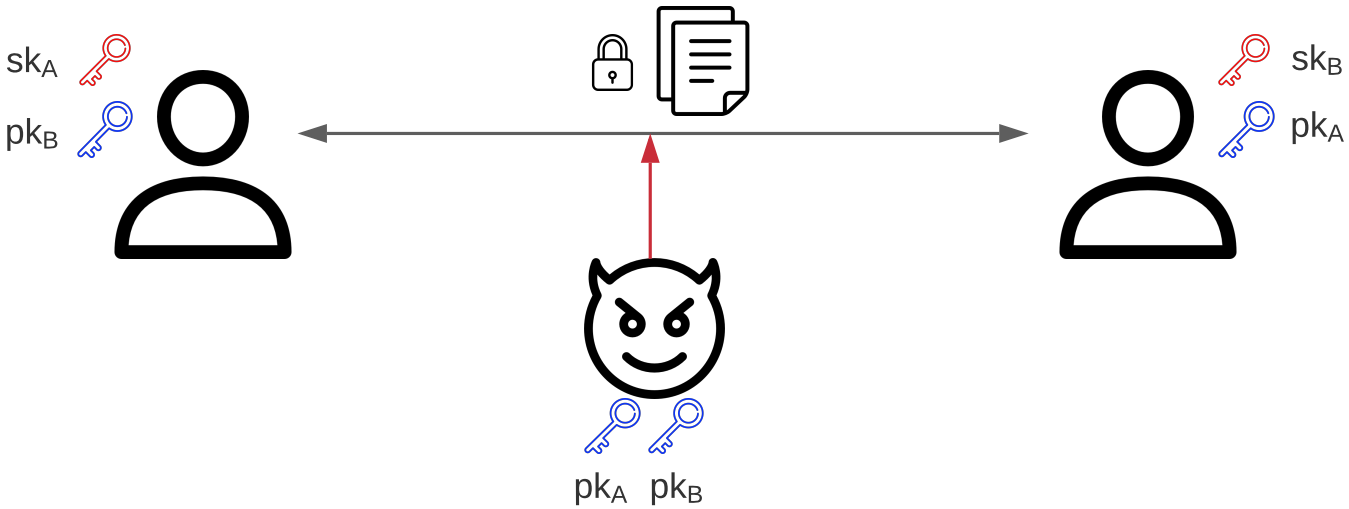

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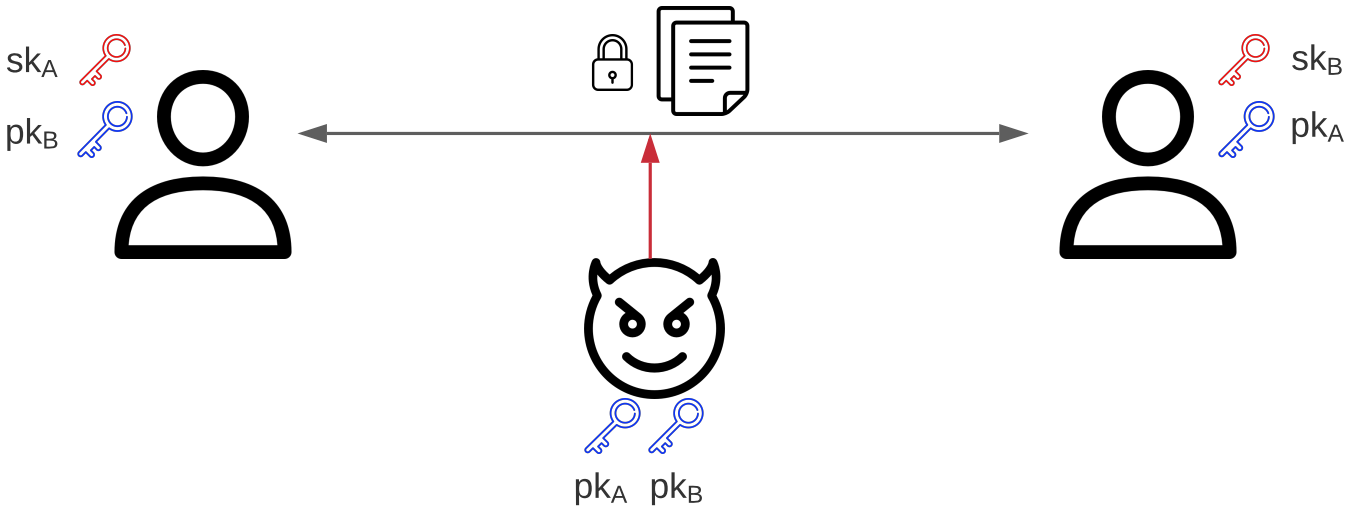

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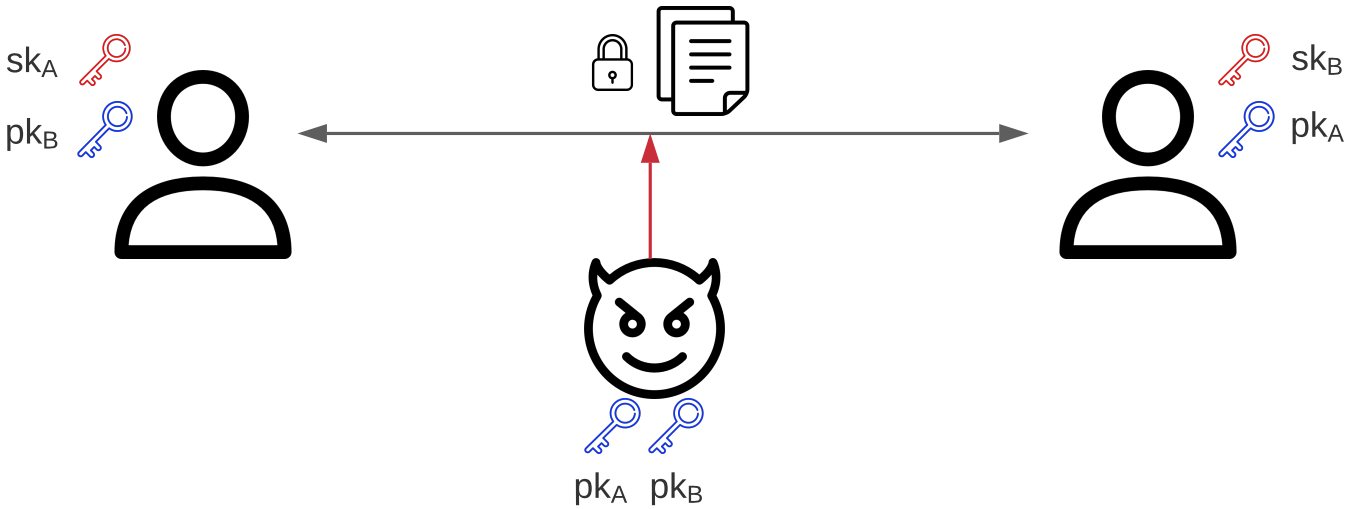

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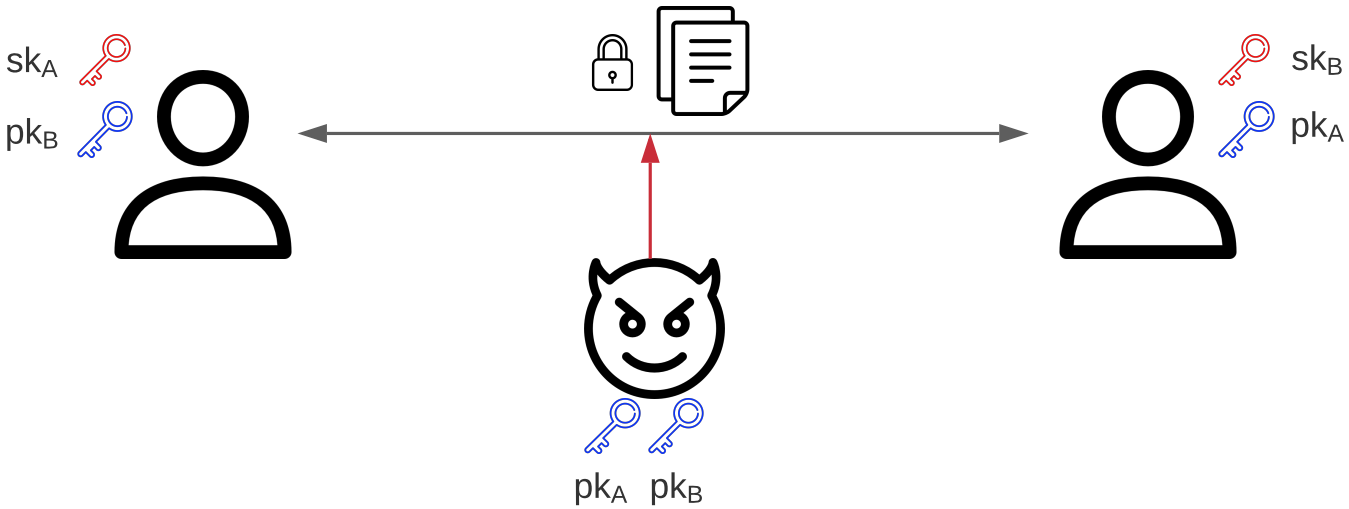

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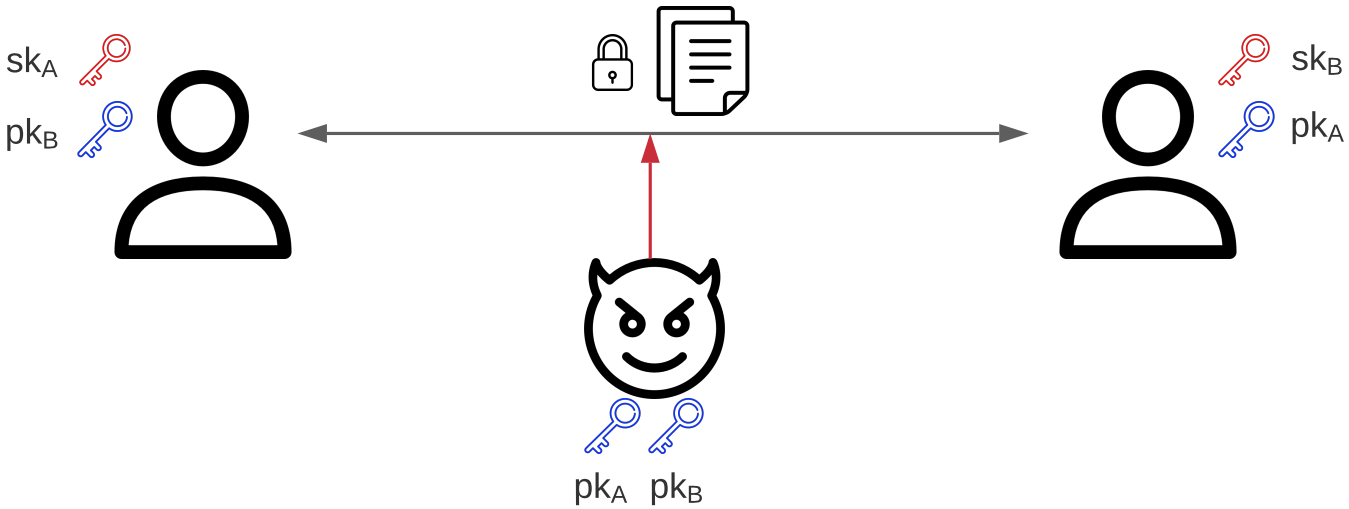

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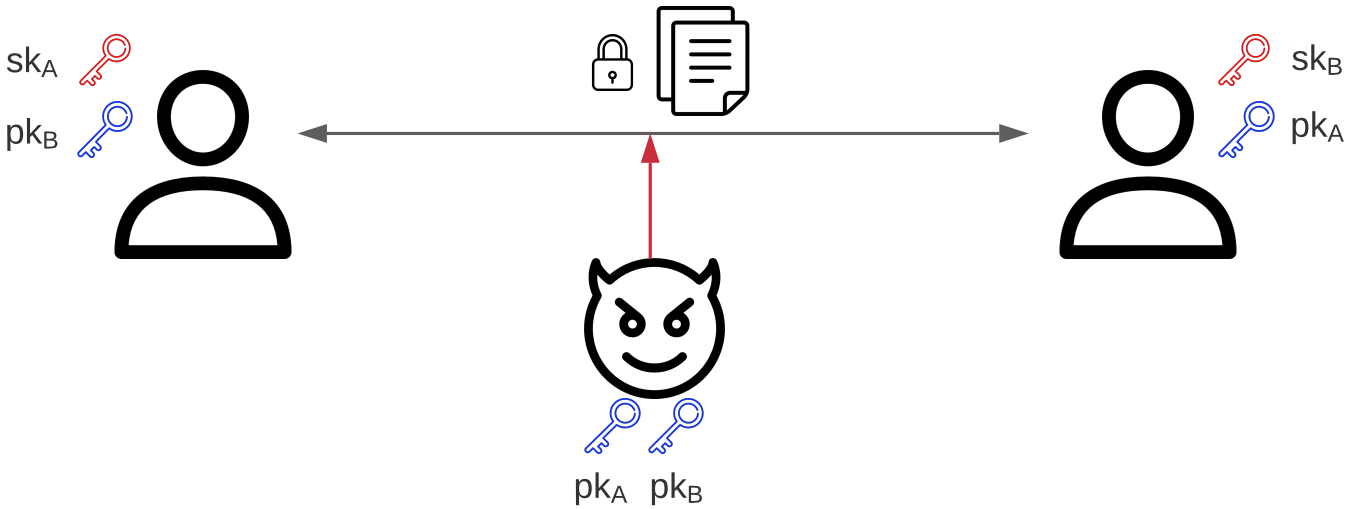

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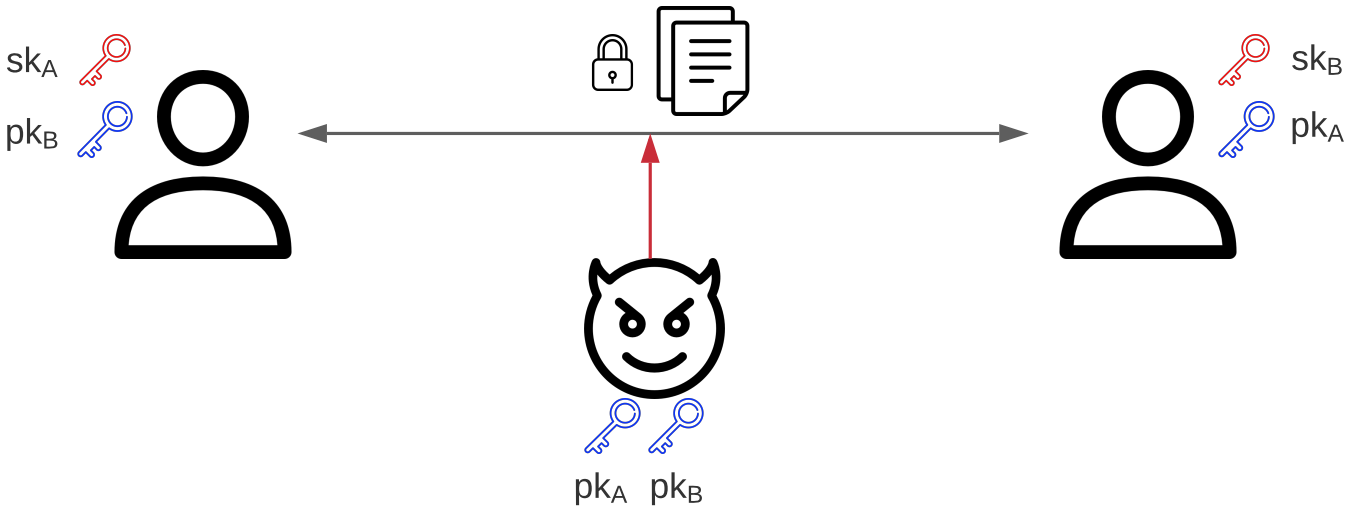

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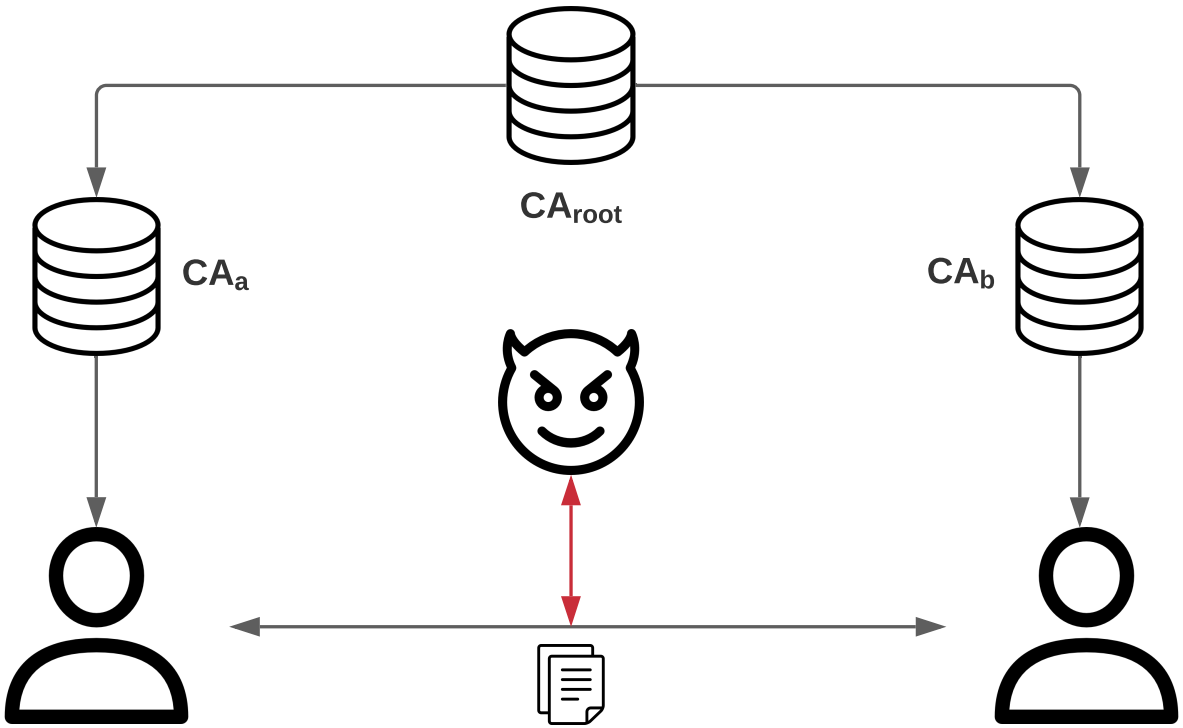

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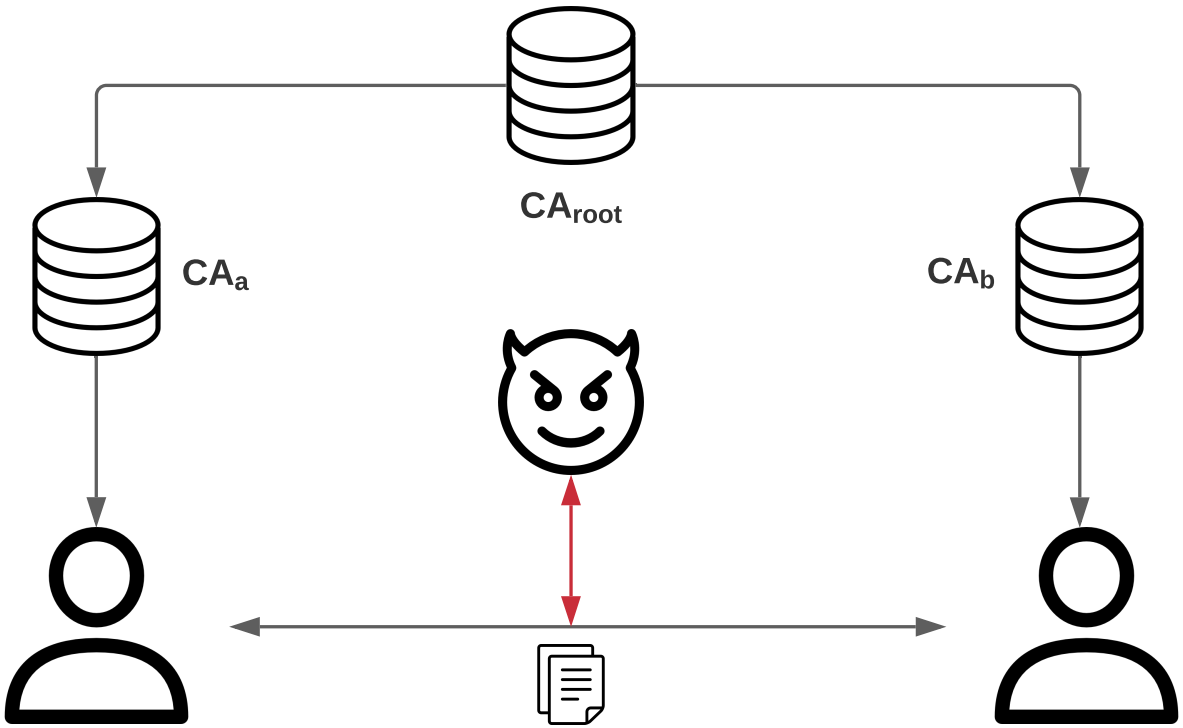

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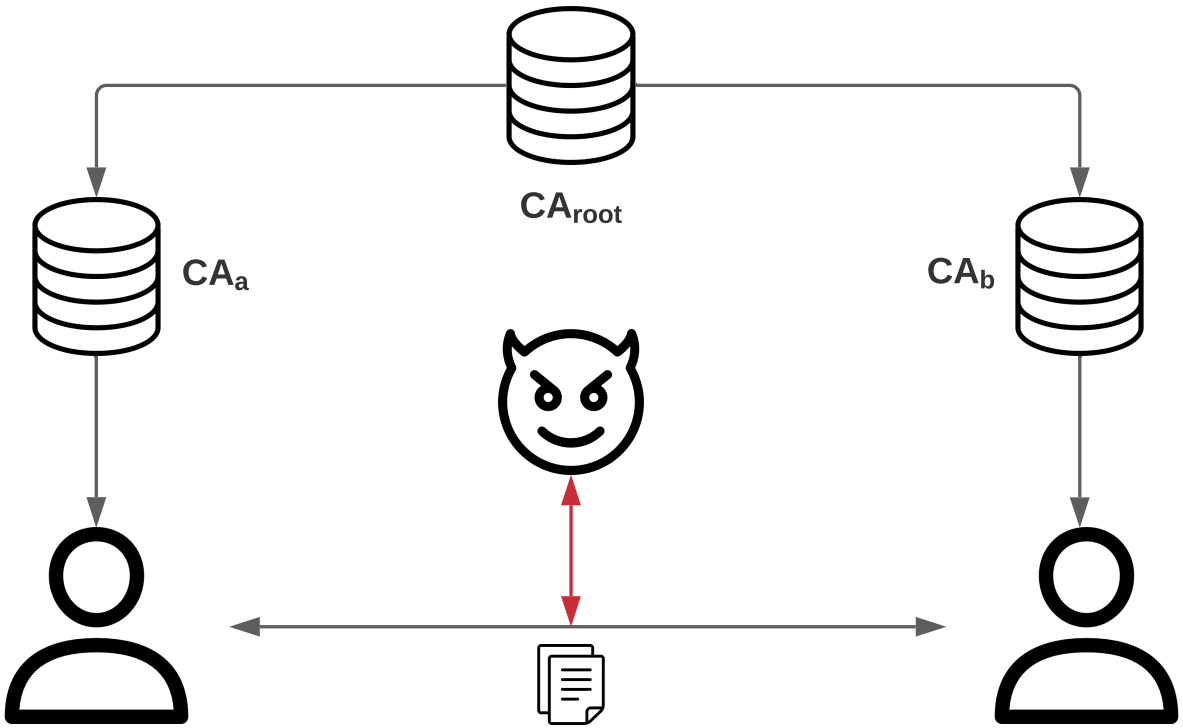

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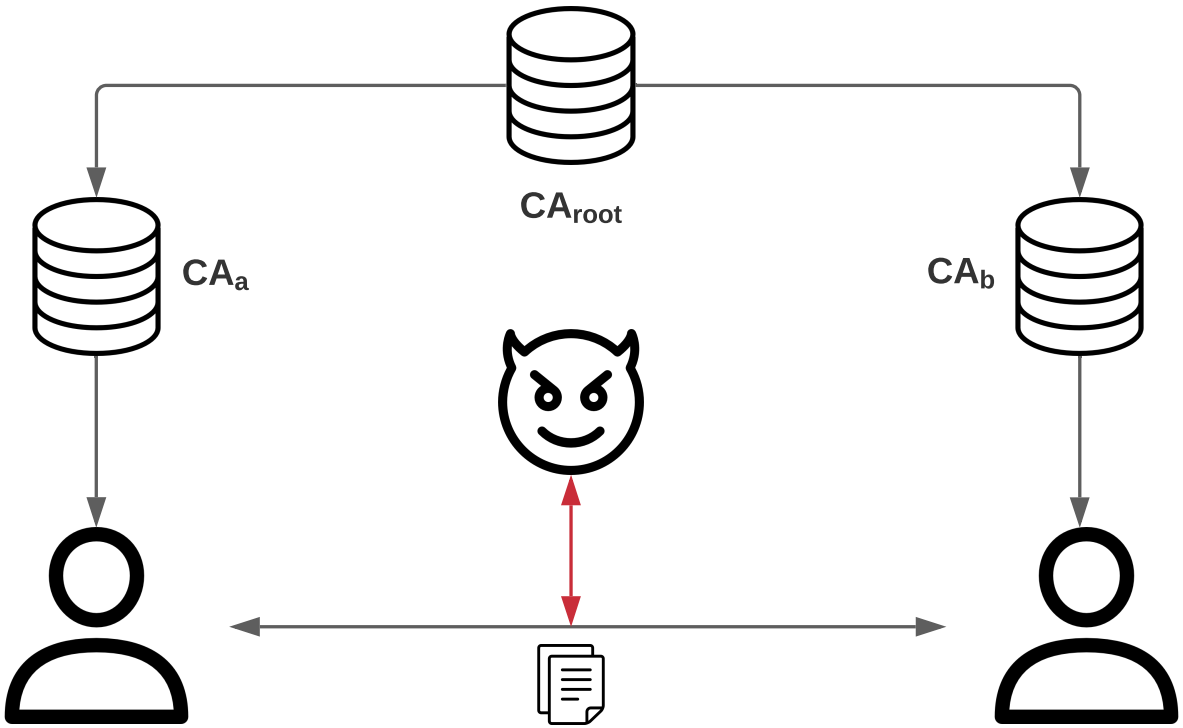

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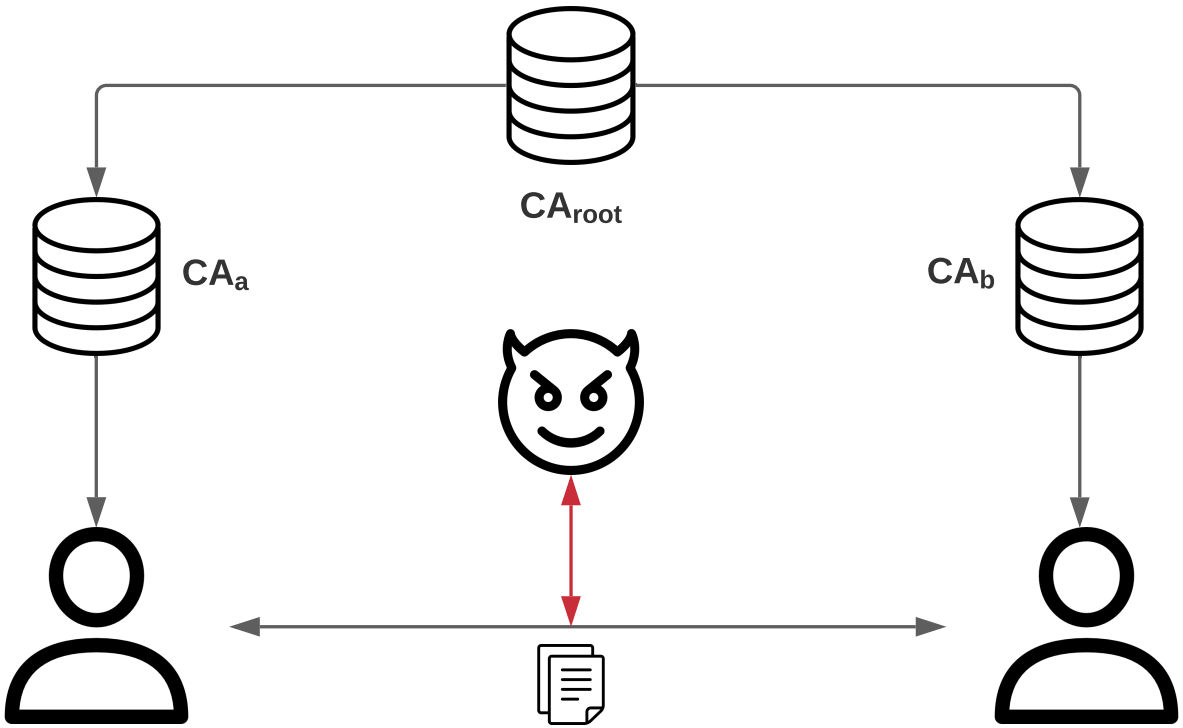

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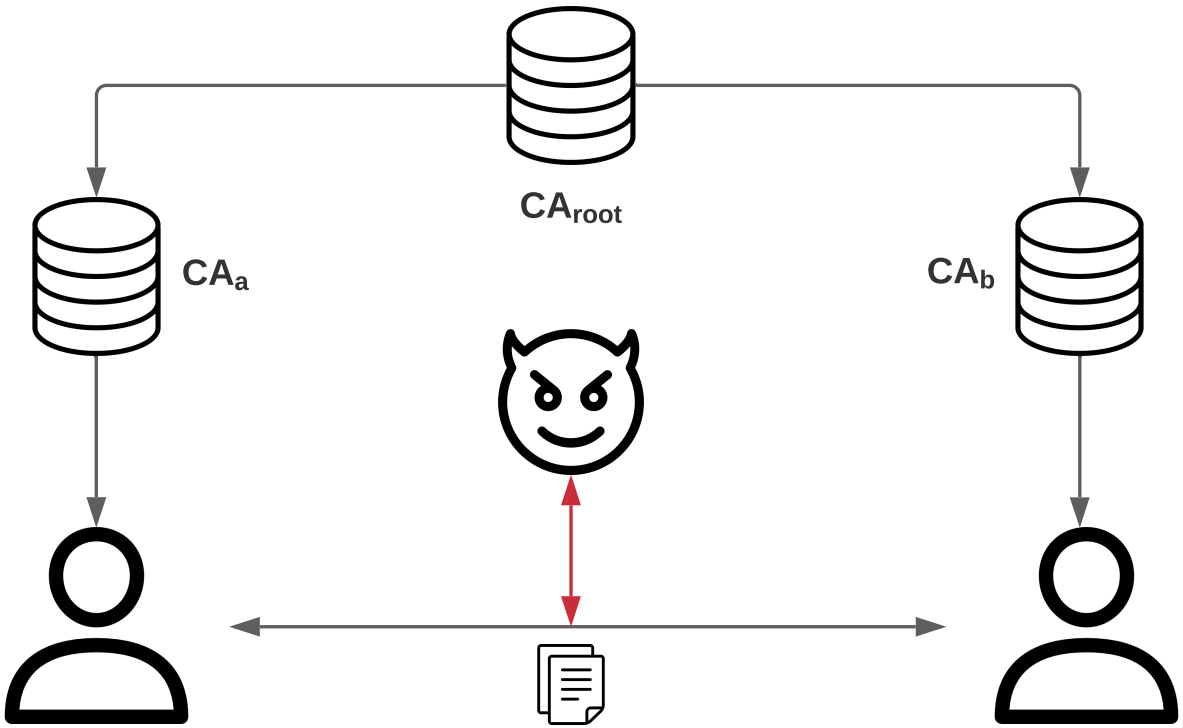

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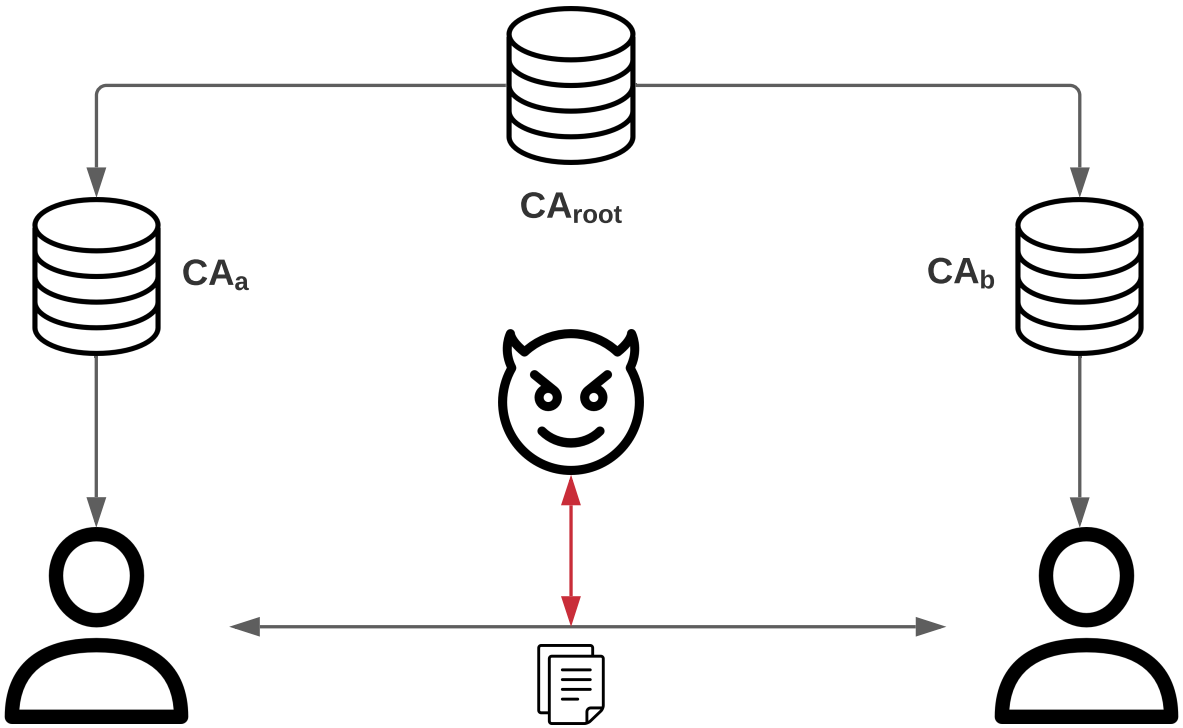

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  - Alice and Bob exchange certificates

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Bottom-line: We have to assume something!

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- Trusted hardware not covered, but important to acknowledge!

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A security context within which participants agree on:

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- It ensures that all parties can rely on the validity and integrity of transactions carried out within that boundary.
- Trust domains can be hierarchical (e.g., PKI), federated (e.g., SAML/OIDC federations), or cross-organizational (e.g., interoperability frameworks).

Access Control

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- Fine-grained set of restrictions to system resources
  - Check system characteristics
  - Read/write data
  - Alter configurations

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