Kleptographic Attacks against Implicit Rejection

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Proxy Speaker: Yanbo Chen

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Fujisaki-Okamoto Transform

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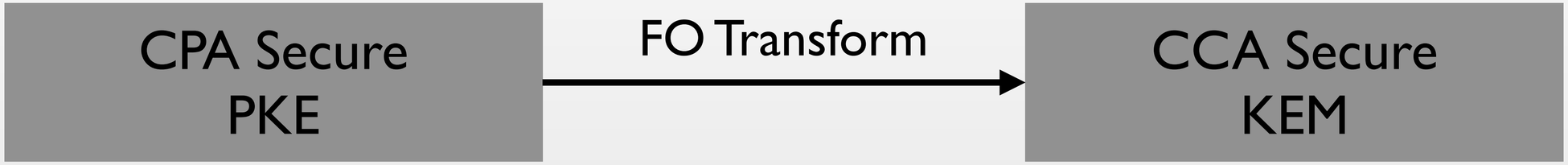
- Analysis in the QROM

Fujisaki-Okamoto Transform



- Analysis in the QROM
- Used in NIST PQC Submissions, e.g., Kyber

Fujisaki-Okamoto Transform

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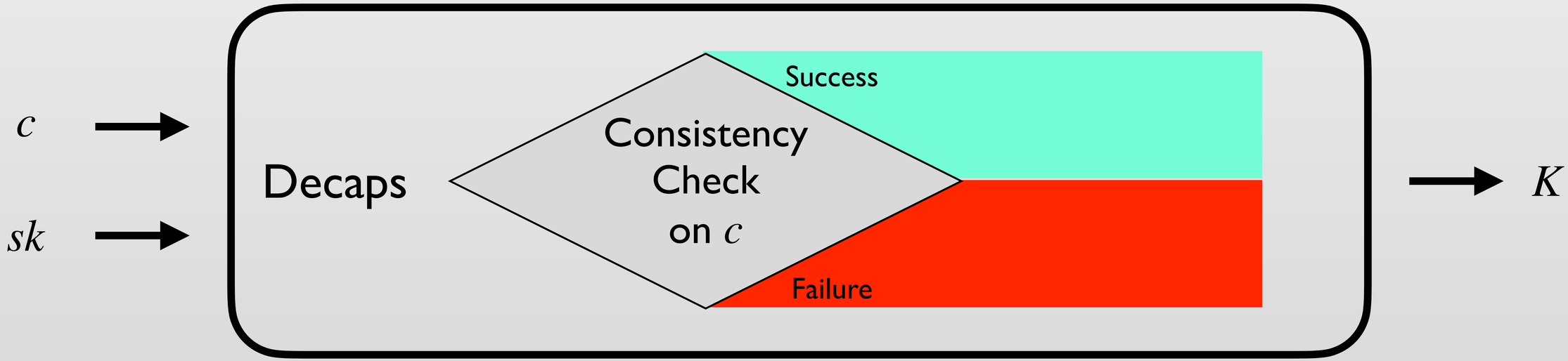

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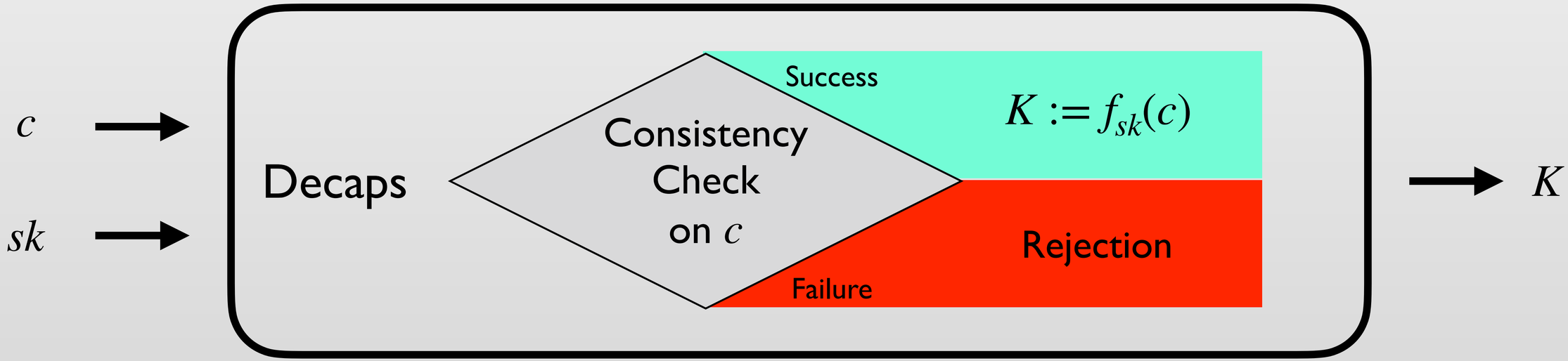

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Failure	$K := \perp$

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- Implicit rejection in Kyber

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- Implicit rejection in Kyber

Our Observation:

Implicit rejection can be less secure!

Our Work

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Implicit rejection in a kleptographic setting

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Kleptographic attacker can break it!

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Implicit rejection in a kleptographic setting

Kleptographic attacker can break it!

	Subvert	Memory	Time Offline	Time Online	Advantage
Attack 1	Decaps	2^8	2^0	2^2	0.997
Attack 2	Key Gen	2^7	2^0	2^{130}	0.999
Attack 3	Key Gen	2^{111}	2^{154}	2^{106}	0.692

* applied to Kyber

Kleptography

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Cryptographic Algorithm

Kleptography

Cryptographic Algorithm

Subverted Algorithm

- Kleptographic attacker subverts algorithm

Kleptography

Cryptographic Algorithm

Subverted Algorithm

- Kleptographic attacker subverts algorithm
- Attacker's goals: Success and Undetectability

Kleptographic Attacker's Goals

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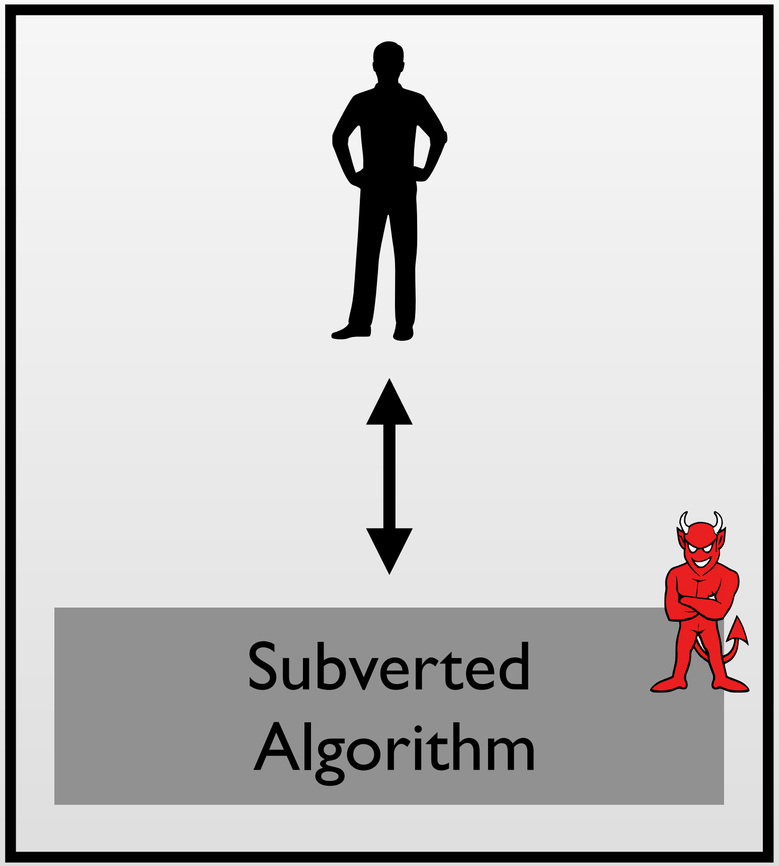

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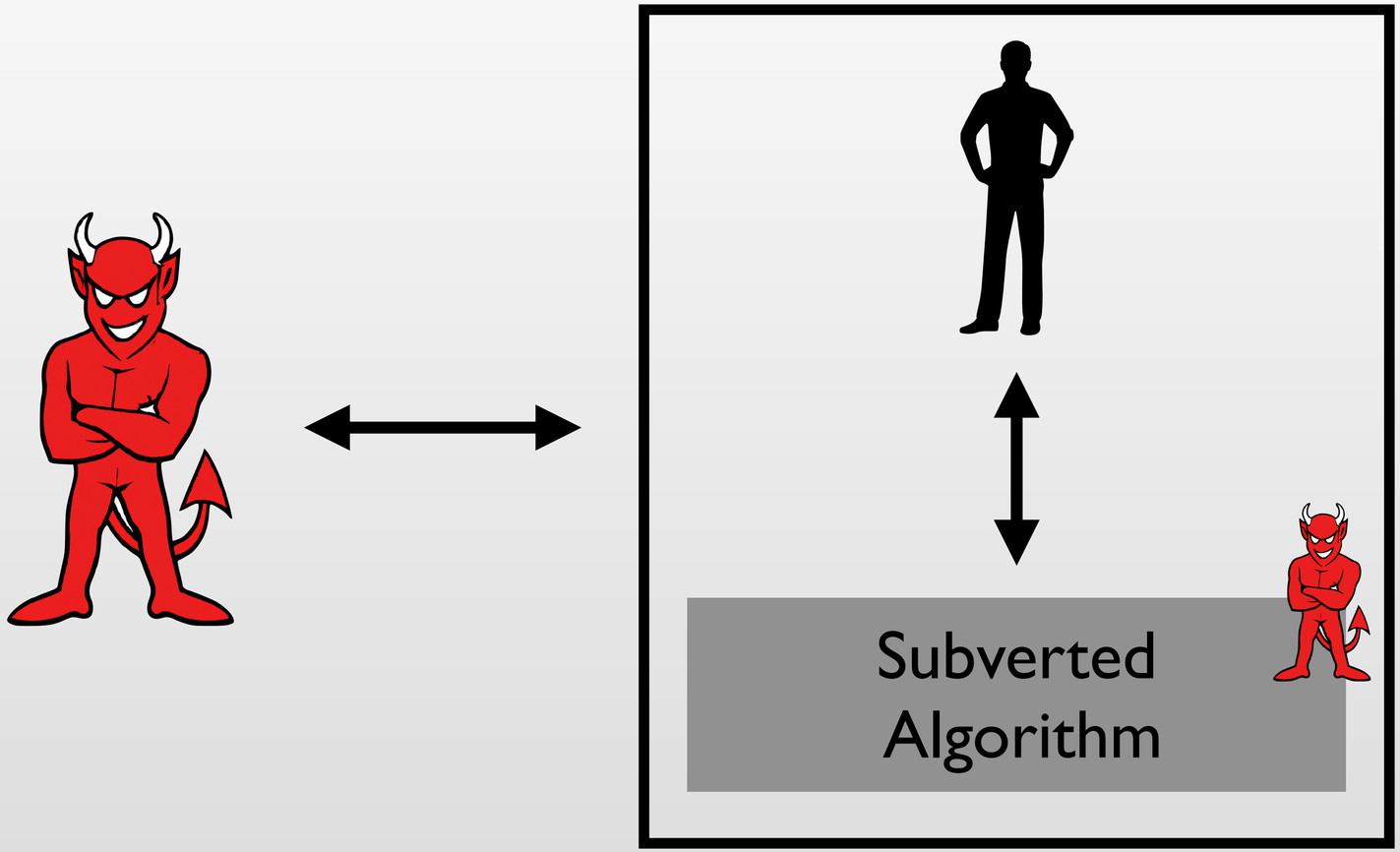

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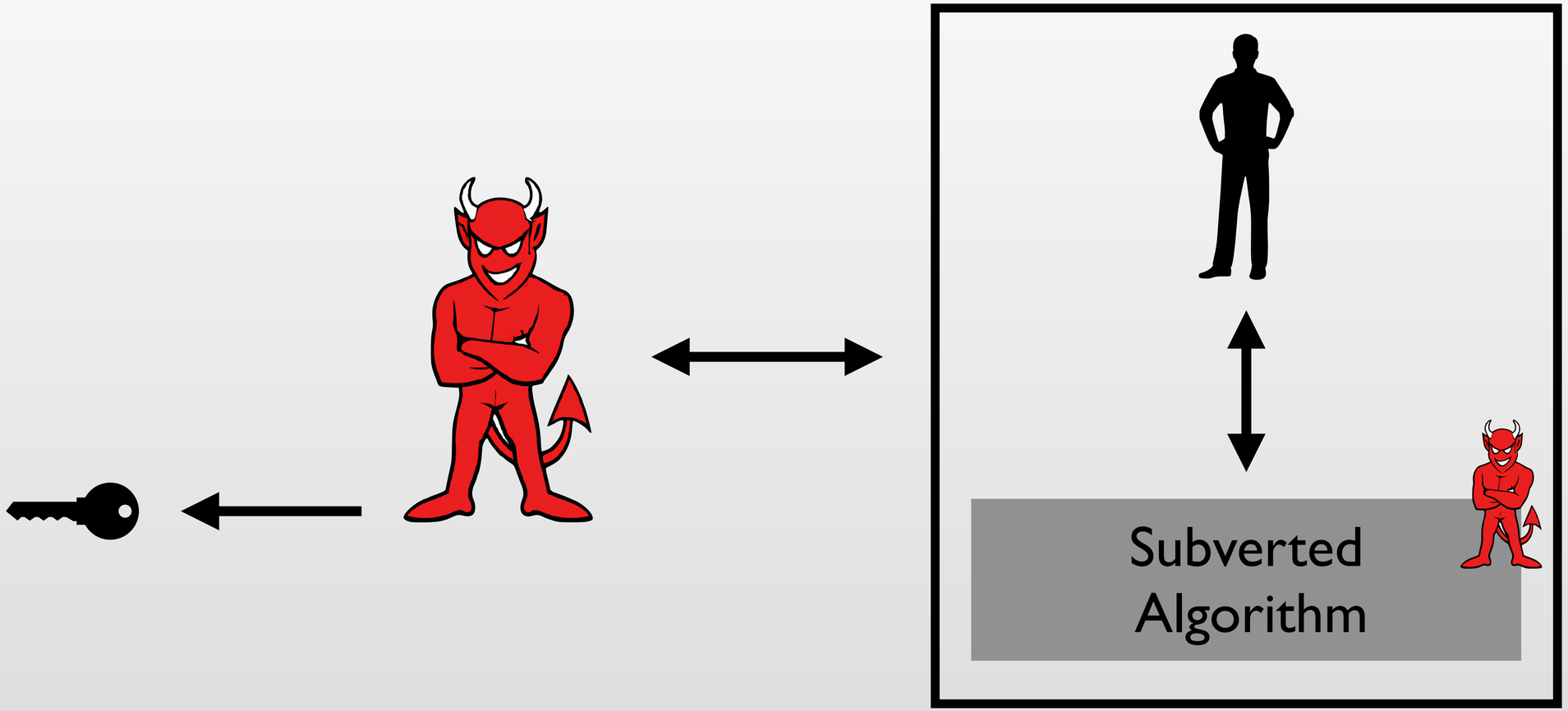

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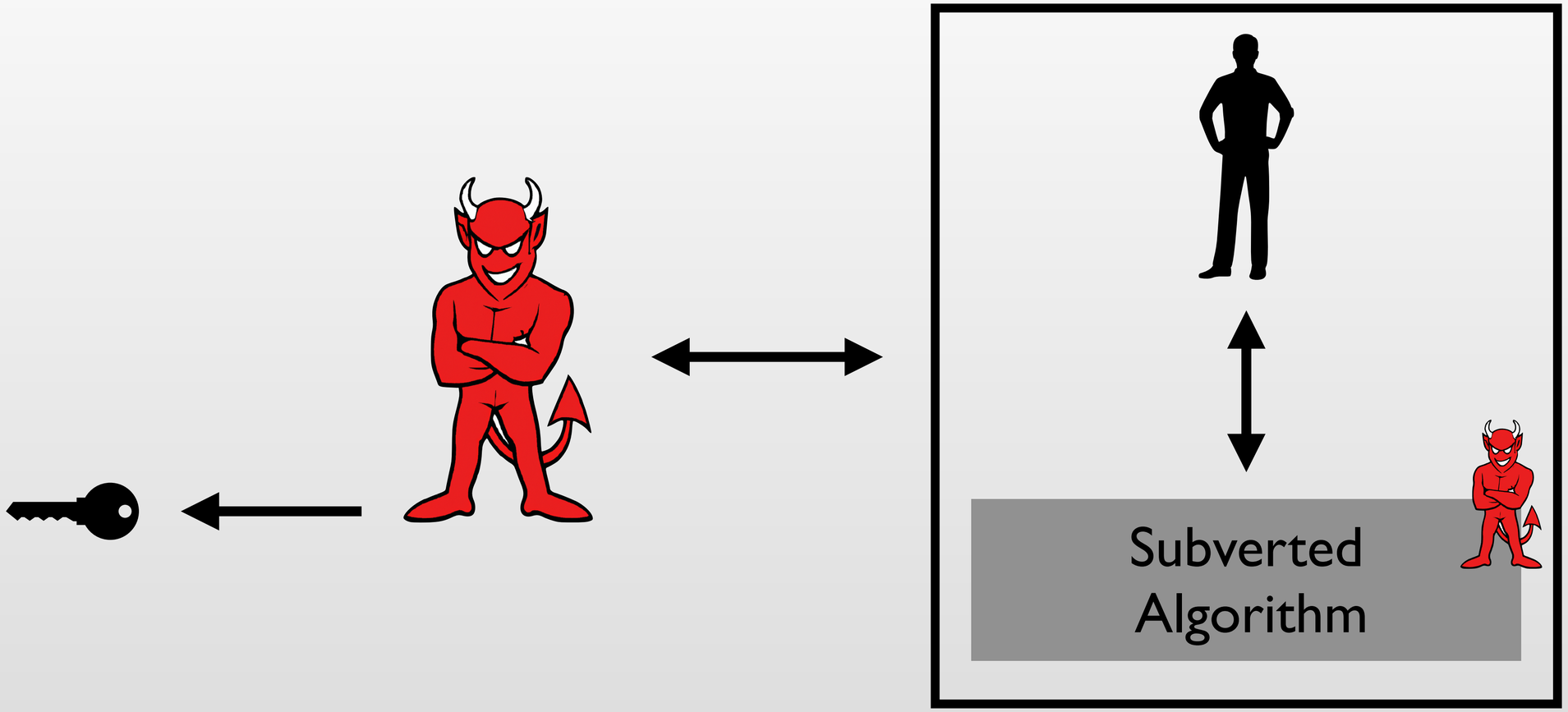

- Success: attacker breaks security for subverted user

Kleptographic Attacker's Goals

- Undetectability: user cannot detect subversion

Main Idea of Our Attacks (#2 and #3)

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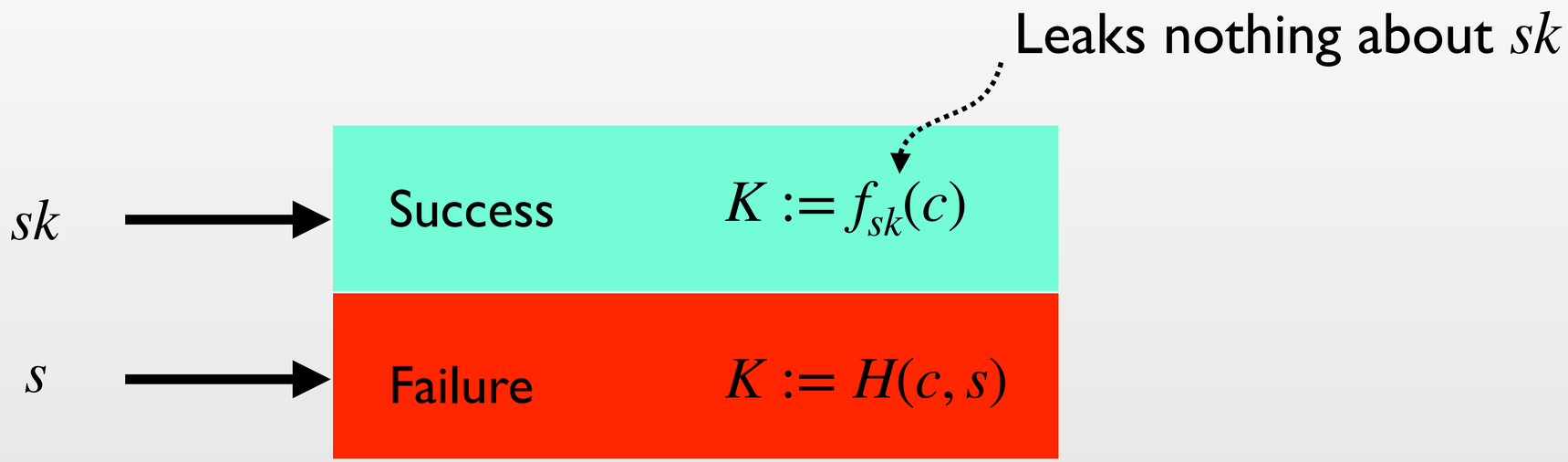

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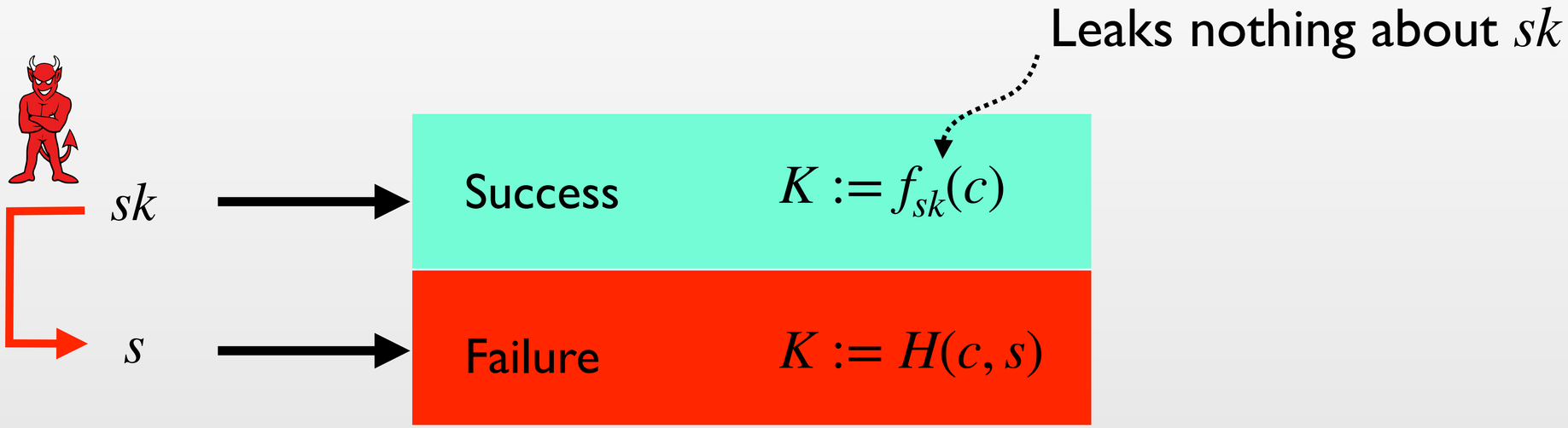

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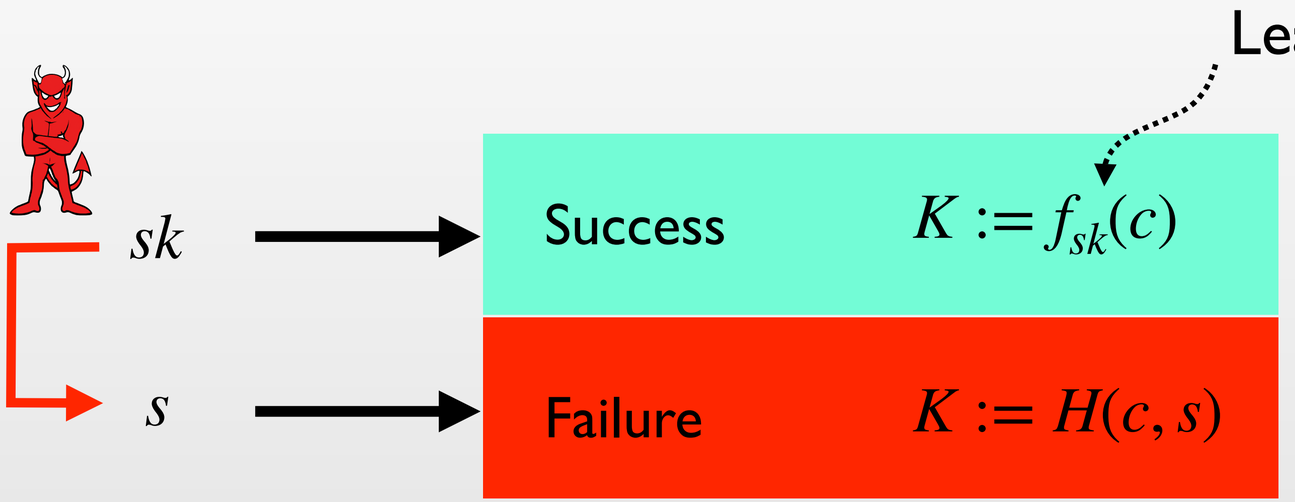

$s = H(ak, \text{truncate}(sk))$

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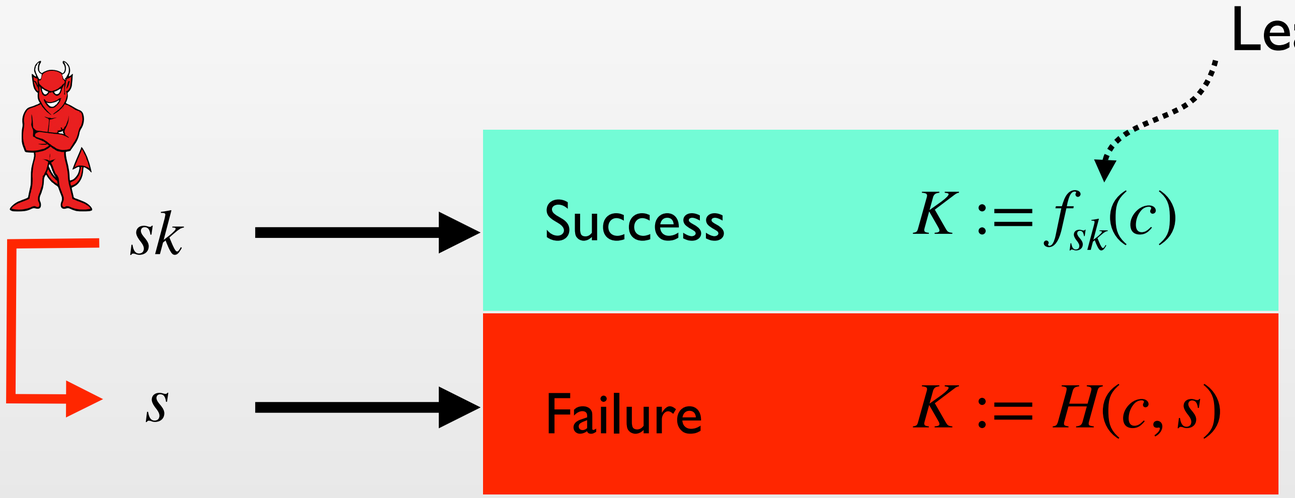

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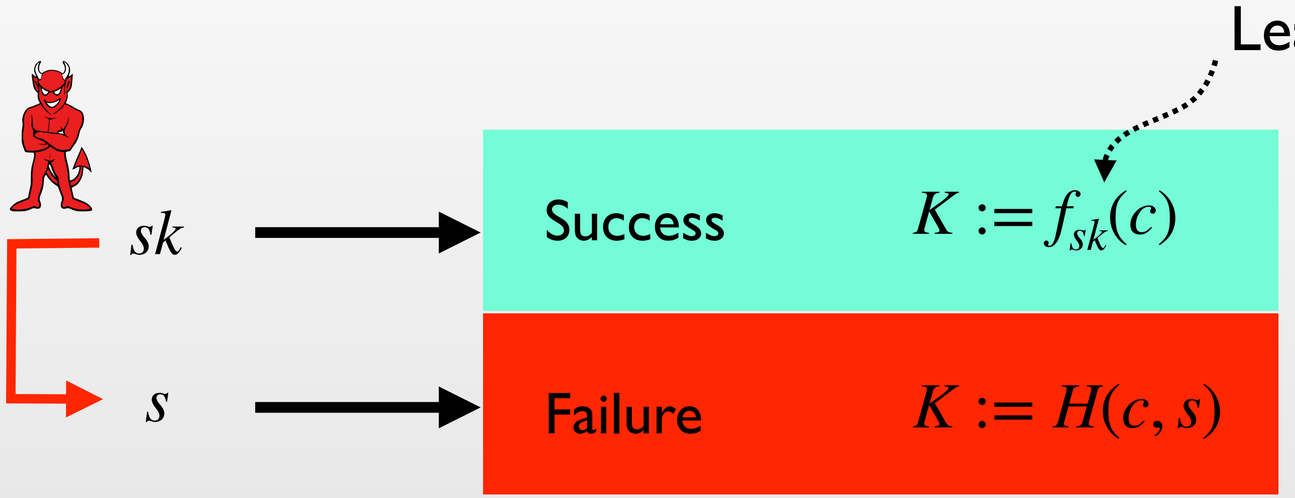

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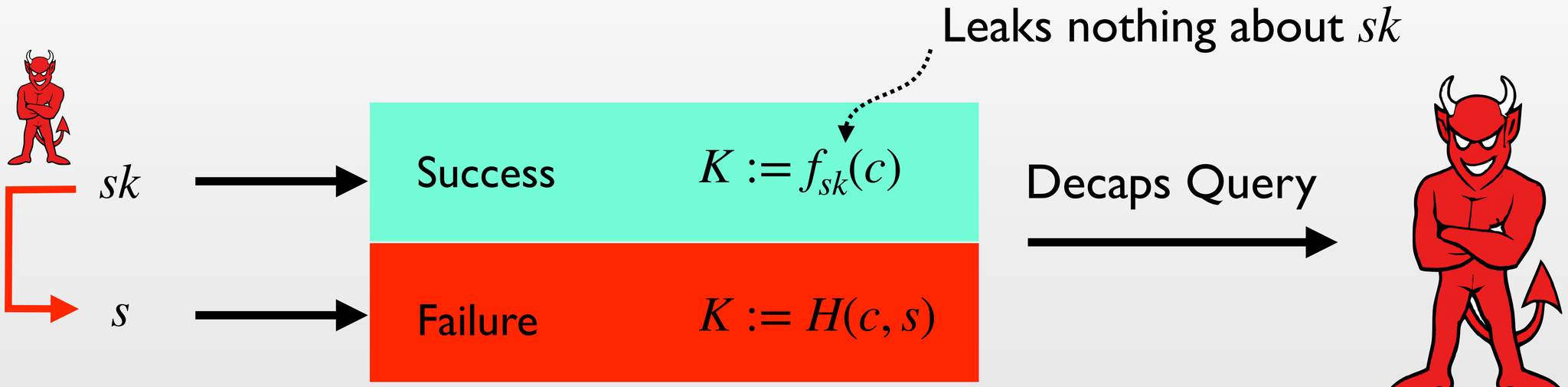

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- Conclusion for NIST PQC Standardization?

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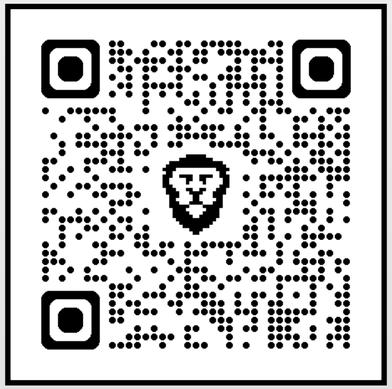
- Conclusion for NIST PQC Standardization?
- Can we apply technique to other primitives, like PAKE?

Thank you!



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