Public-Key Cryptography

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Lecture 10

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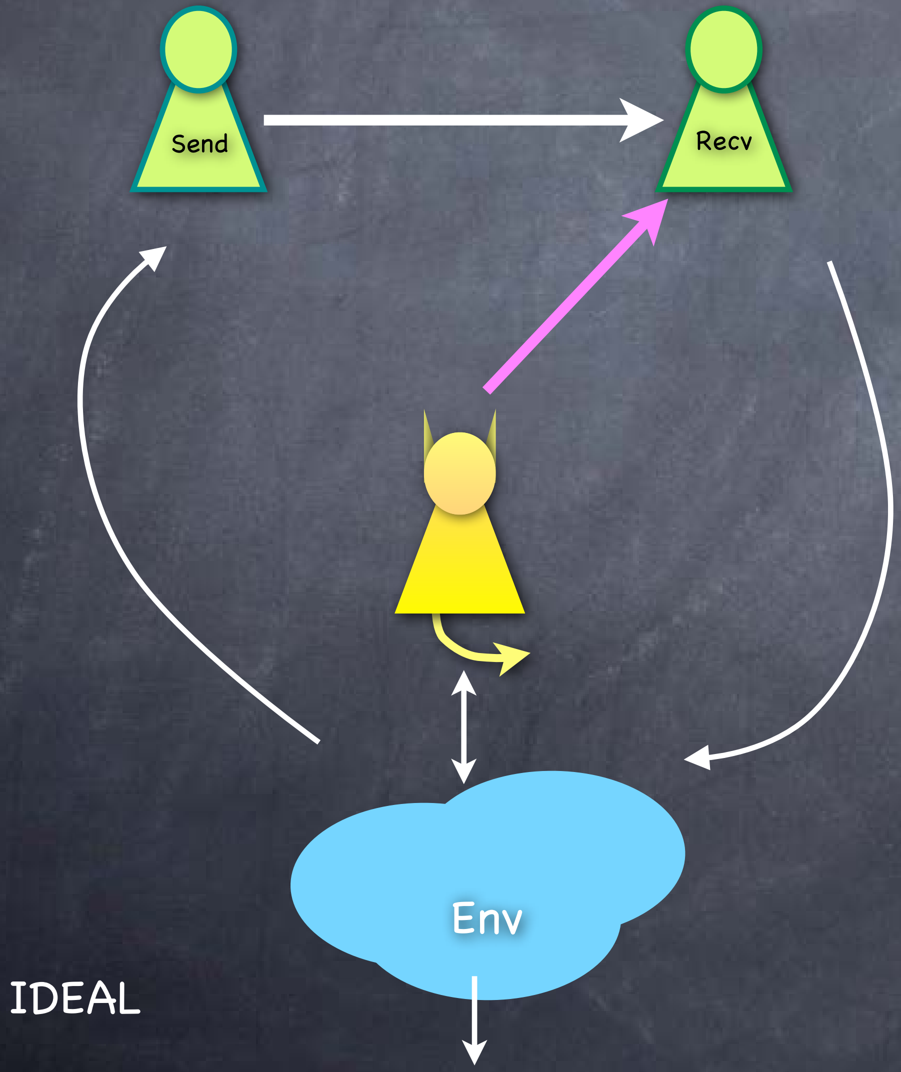
CCA Security

Hybrid Encryption

SIM-CCA Security (PKE)



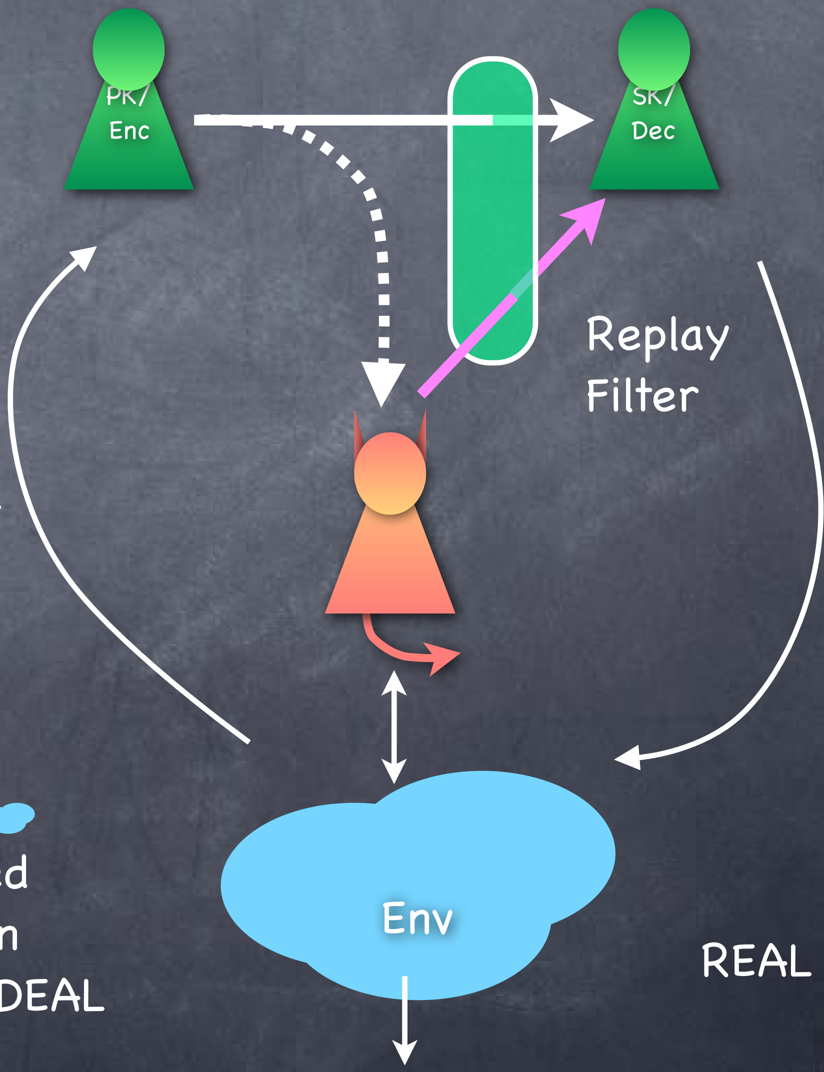
Secure (and correct) if:

∀

∃ s.t.

∀

output of is distributed identically in REAL and IDEAL



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    - $C = (g_1^x, g_2^x, MY^x)$ and $S = (WZ^{H(C)})^x$
    - g_1, g_2, Y, W, Z are part of PK
      - $Y = g_1^{y1}\, g_2^{y2}$, $W = g_1^{w1}\, g_2^{w2}$, $Z = g_1^{z1}\, g_2^{z2}$.
        SK contains $(y_1,y_2,w_1,w_2,z_1,z_2)$

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  - Decryption: Check S (assuming $x_1=x_2$) and extract M

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- Formally using a "hybrid argument" (0 advantage in last hybrid)

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  - Part of RSA Cryptography Standard (PKCS#1 Ver 2.1). Commonly used in SSL/TLS implementations

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- Rigorous proofs of security, after moving to the ROM

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  - Secure against attacks that treat H as a blackbox (and for which H is pseudorandom)

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  - Less security sufficient: KEM used to transfer a random key; DEM uses a new key every time.

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- CCA security based on a complex (non-standard) assumption involving Hash and the group: "Oracle Diffie-Hellman Assumption"

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  - Very weak security sufficient for encryptions used in KEM and DEM (but only with H, G modeled as random oracles)

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    - In IBE, receiver has to obtain its SK from the authority

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- IBE (even CPA-secure) can easily give CCA-secure PKE!

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Today

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- Next up: Digital Signatures