Asymmetric Cryptography
Cryptographic Primitives

Design and Verification of Security Protocols and Security Ceremonies

Programa de Pós-Graduacão em Ciências da Computacão
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- They are publicly known;
- And ease of computation.

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- The key should control the mapping between the Domain and Image of the MAC function, but not determine its spread.

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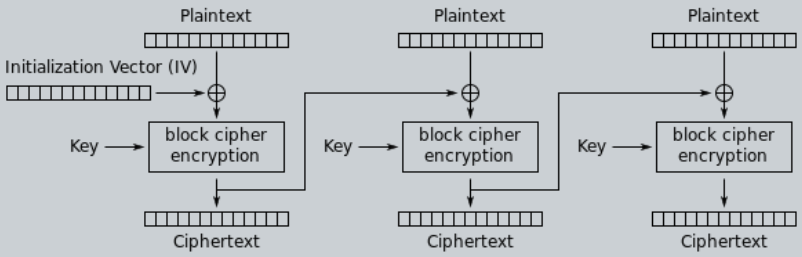
  - Symmetric CBC-MAC;
  - CMAC;
  - Hash based HMAC;

CBC-MAC Mode of Encryption



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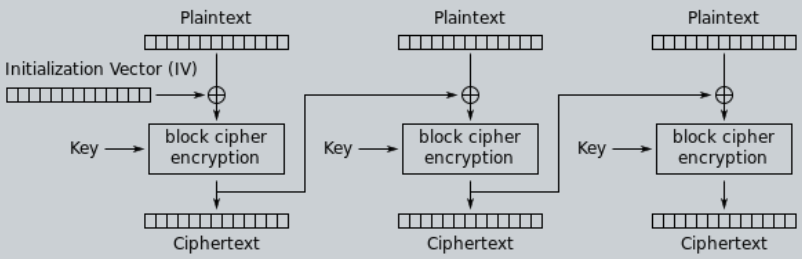

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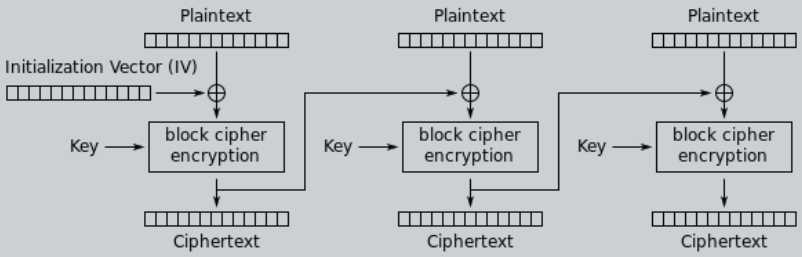

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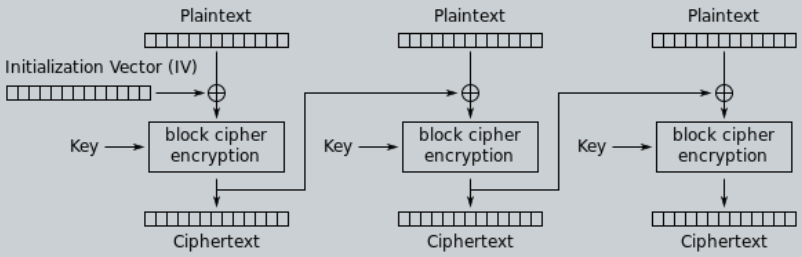

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- Not secure with variable lengths;
- Needs to be used with one key to each message length or do length pre-pending;

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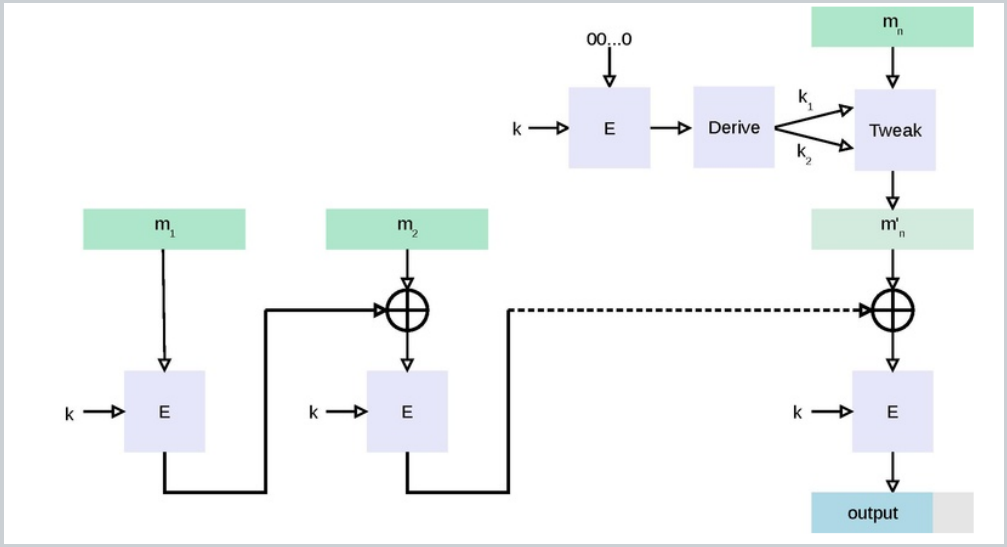

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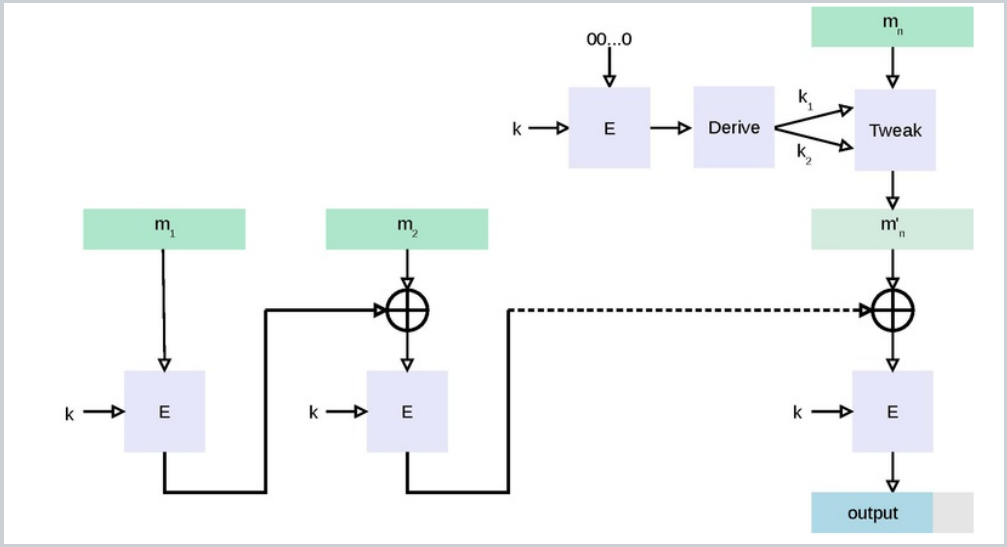

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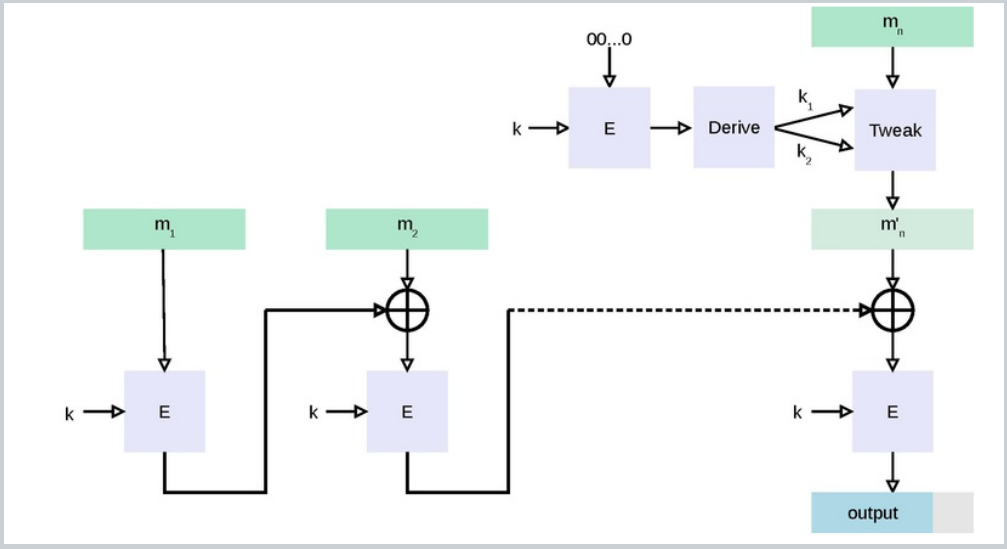

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- Efficiently addresses the security deficiencies of CBC-MAC;
- Derives 2 keys to cypher the last block;

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- Have a well-understood analysis of the strength of the authentication mechanisms;

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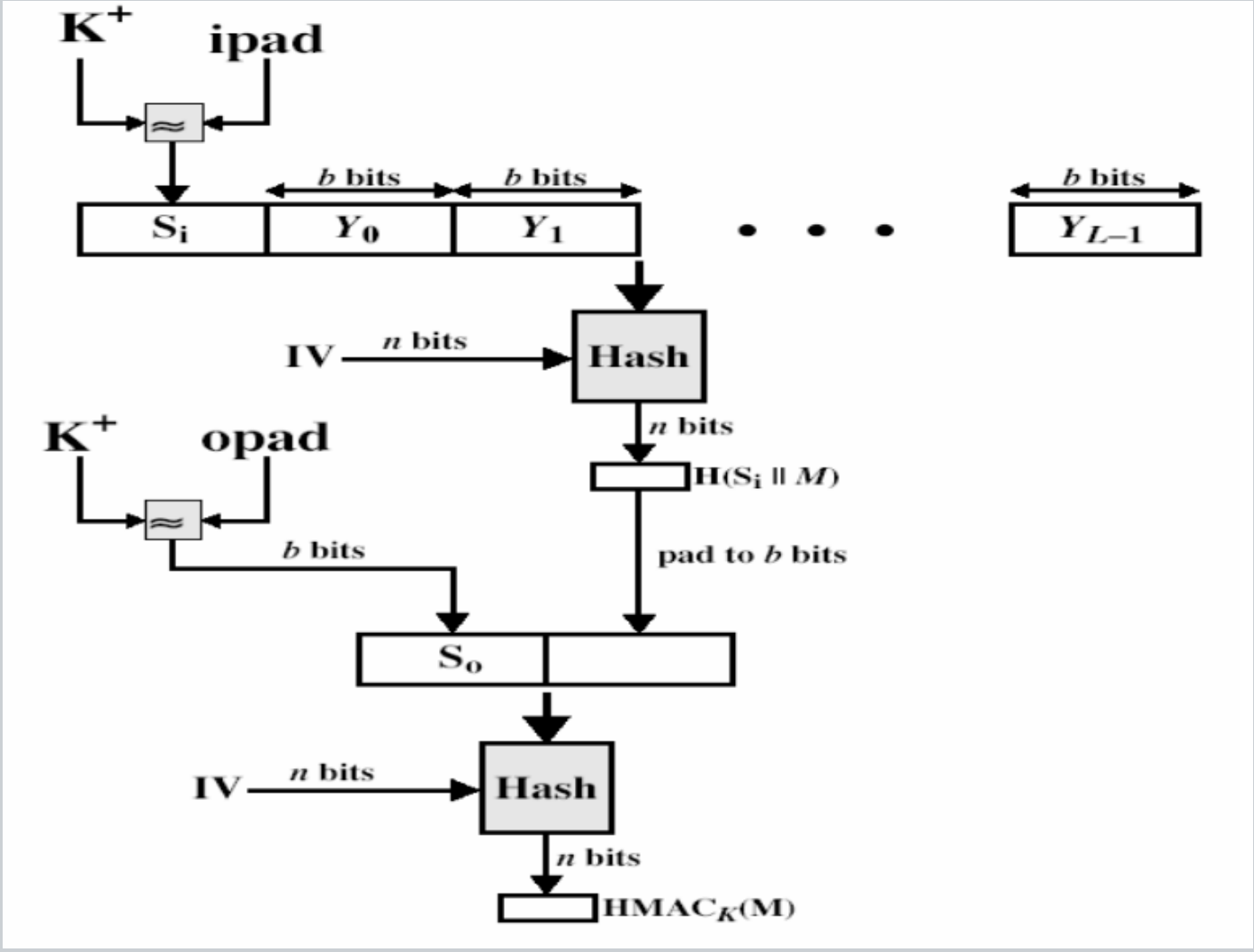
K+
ipad
b bits
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b bits
Si
Y0
Y1
YL–1
IV
n bits
Hash
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K+
opad
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So
IV
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HMACK(M)

Security of HMAC

- Security of HMAC relates to that of the underlying hash algorithm;
- If used with a secure hash functions and according to the specification (key size, and use correct output), no known practical attacks;

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- Usually it is thousand of times more computationally intensive than symmetric cryptography.

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- For security and authenticity, encrypt the signed message with the receiver's public key;

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