JAMBU
A Lightweigt Authenticated Encryption Mode

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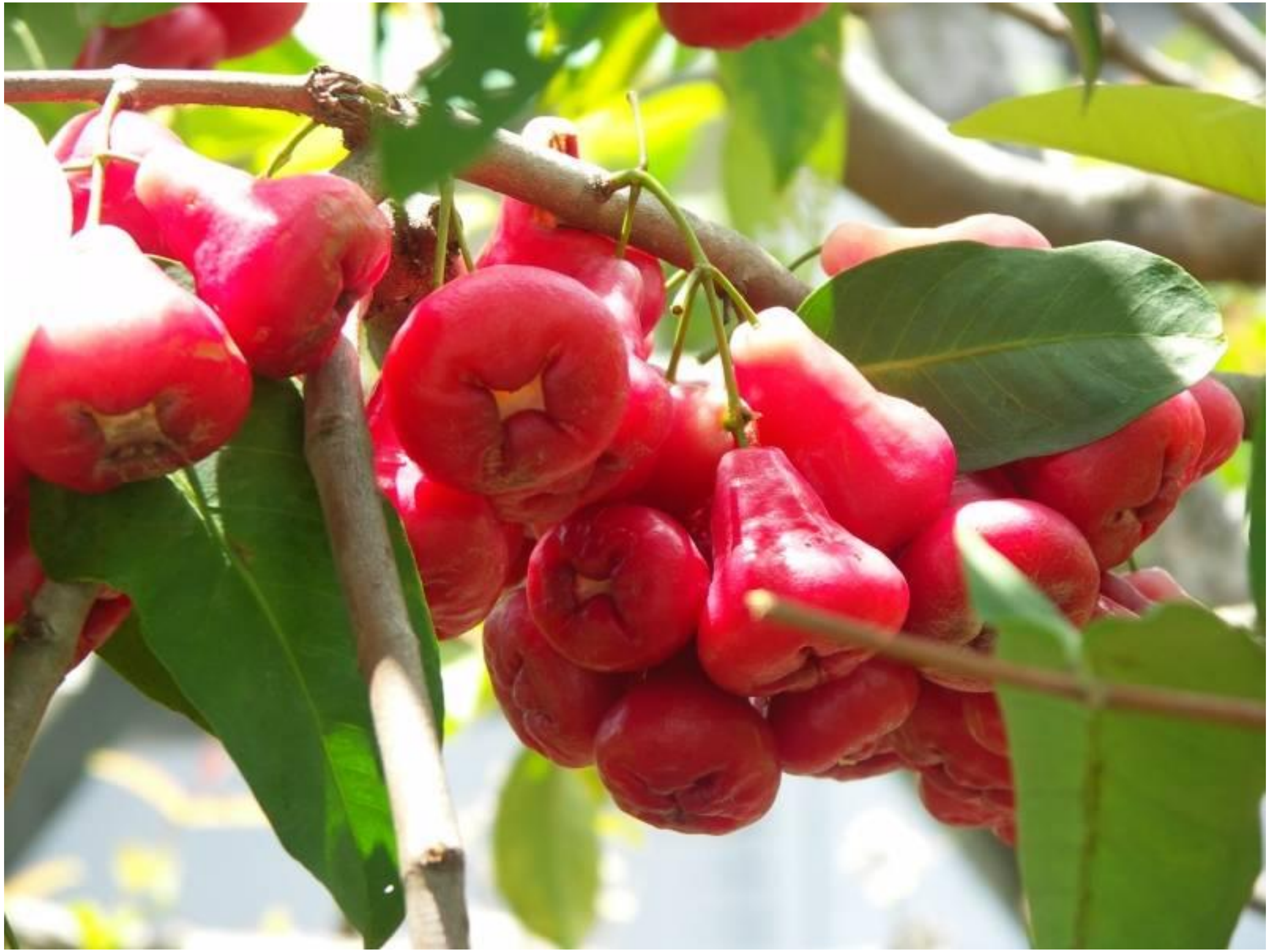
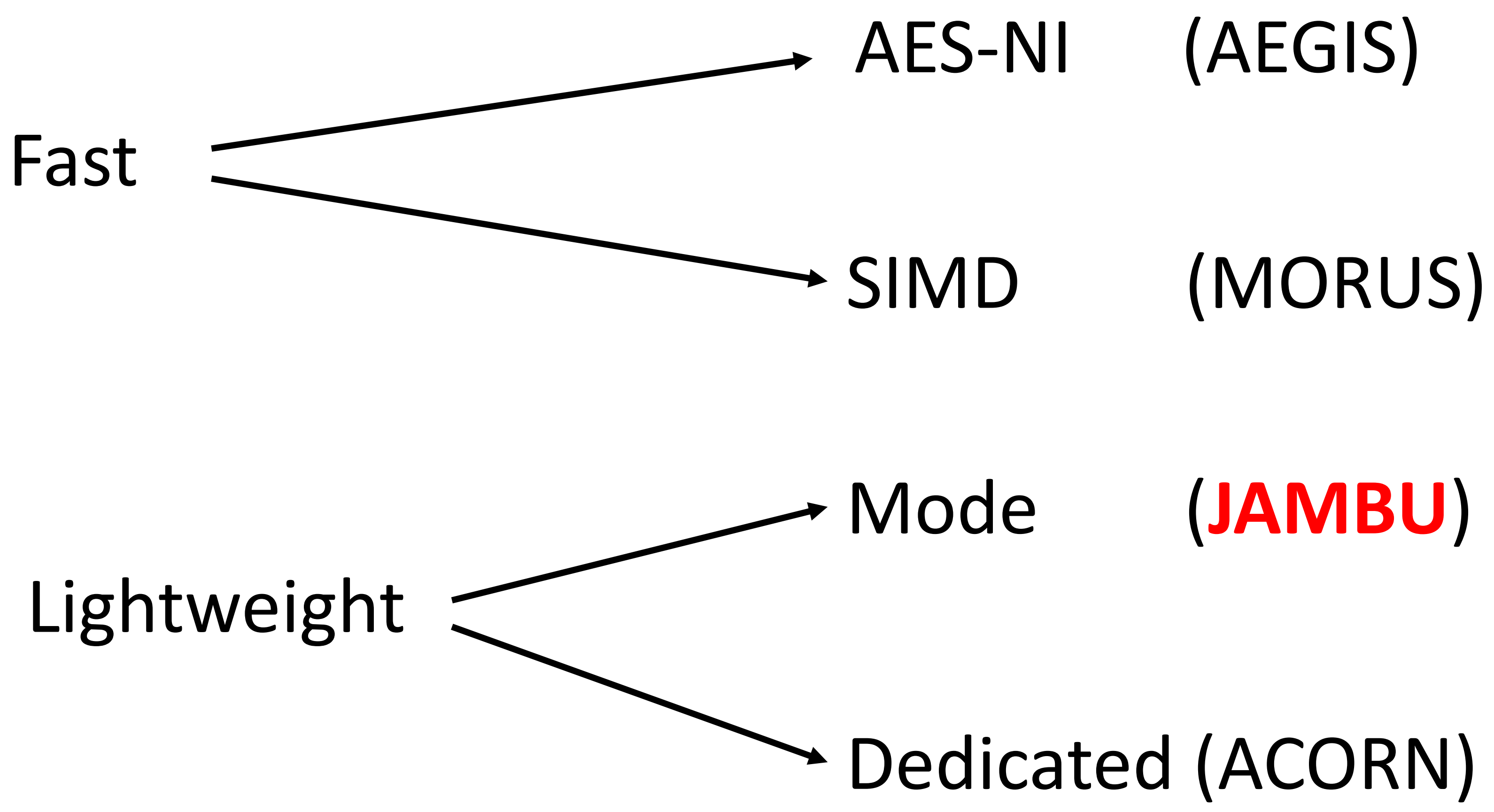


JAMBU

Comparison between AEGIS, MORUS, JAMBU, ACORN



Fast

AES-NI (AEGIS)

SIMD (MORUS)

Lightweight

Mode (JAMBU)

Dedicated (ACORN)

JAMBU: Design Goal

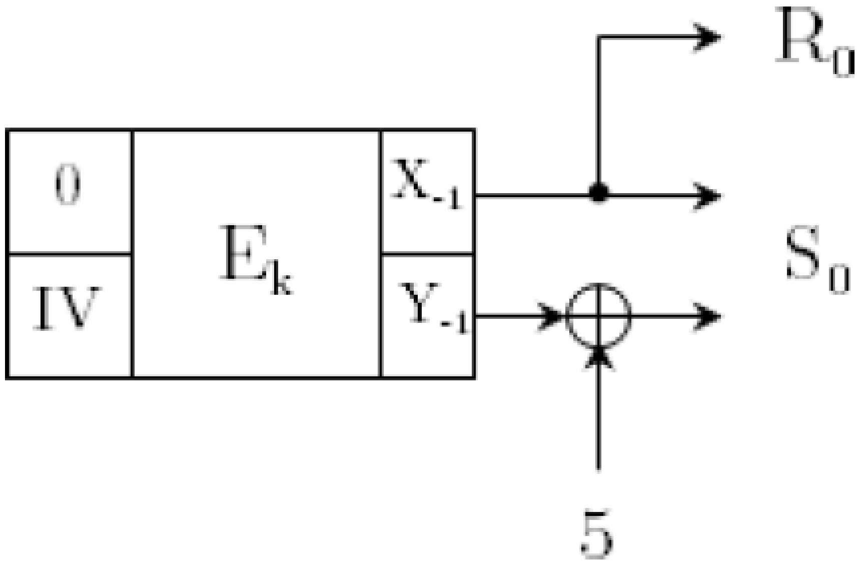
- Design Goal:
  - To design a **lightweight** AE **mode**
- The previous AE modes are not that lightweight
  - For n-bit block size, the extra state sizes are

CCM	n-bit (authenticate-then-encrypt)
GCM	2n-bit
OCB3	2n-bit
EAX	3n-bit
JAMBU	0.5n-bit

JAMBU: Design

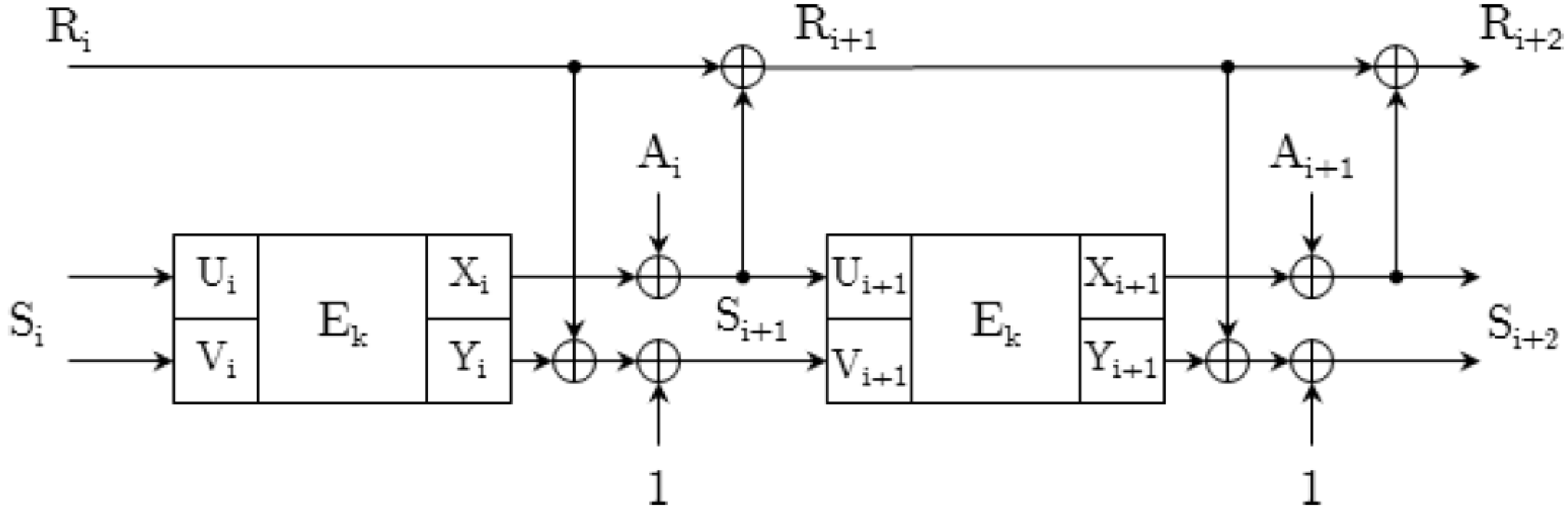
- JAMBU is a light-weight block cipher authenticated encryption mode
  - Benefits
    - Use the existing block ciphers directly
    - Light-weight mode
      - Only **n/2 extra state** is introduced (for n-bit block size)
      - Only simple XORs are introduced at each step
    - Reasonably strong when IV is misused
  - It is not computationally efficient
    - The computational cost is twice that of CBC encryption

JAMBU: Initialization



Block cipher: n–bit block size
IV: n/2-bit

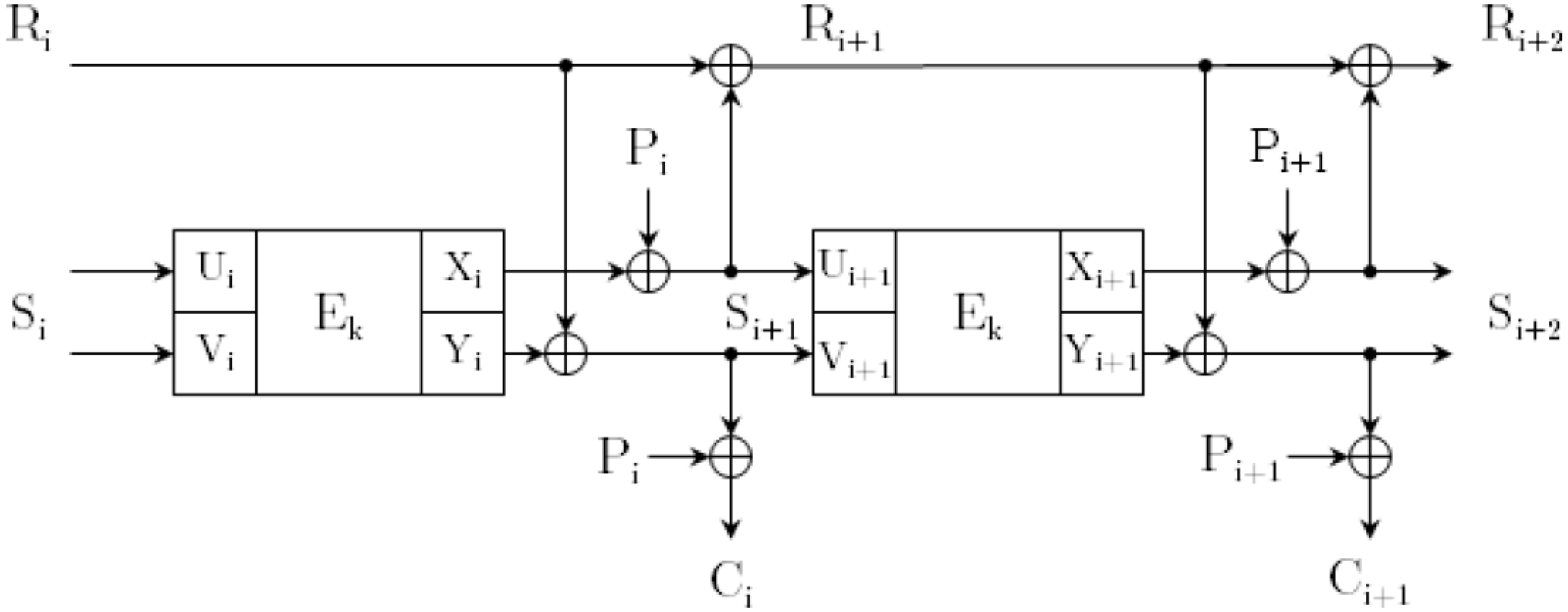
JAMBU: Process associated Data



Data block size: n/2 bits

Pad the associated data with: 10^*

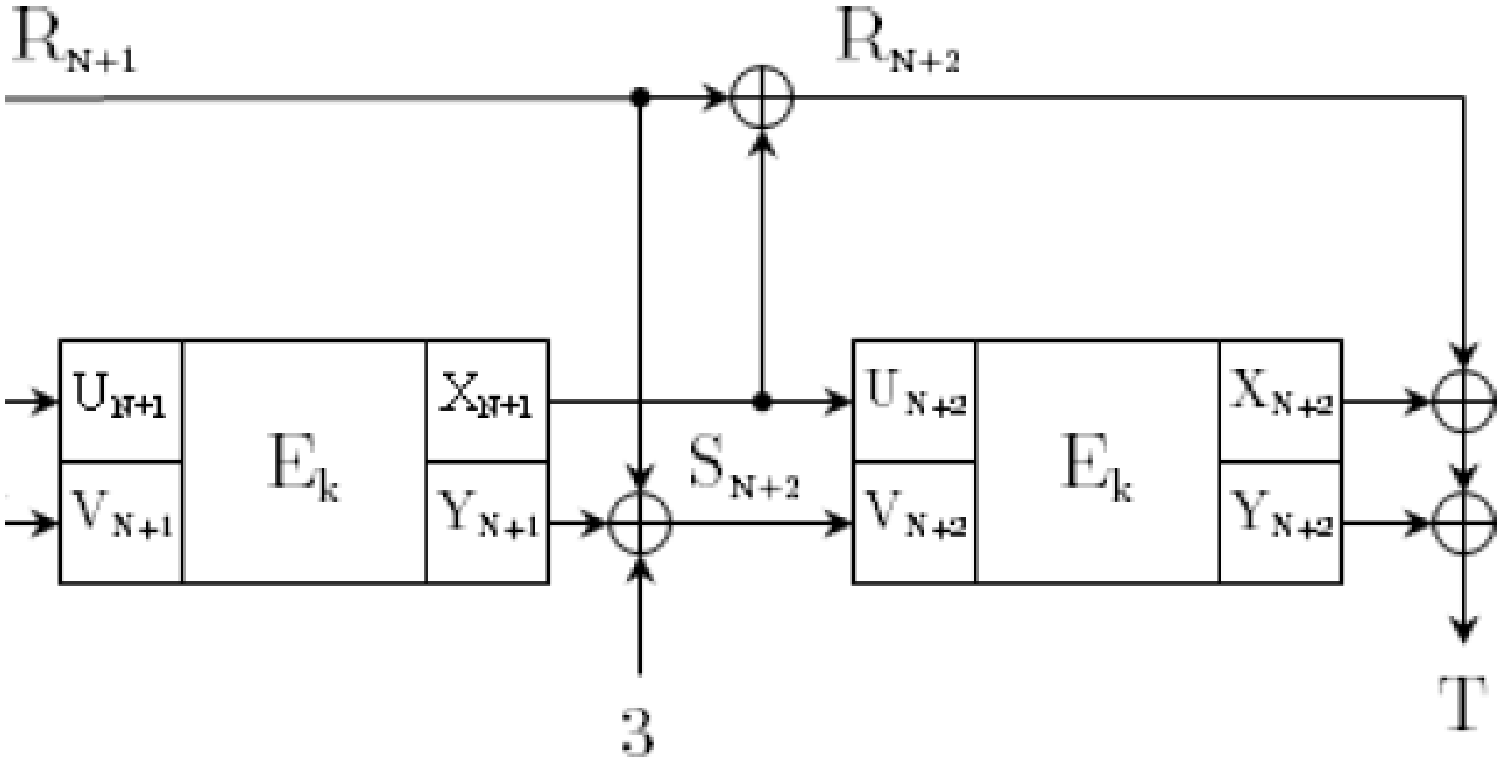
JAMBU: Process plaintext



Data block size: n/2 bits

Pad the plaintext with: 10^*

JAMBU: Finalization



Tag: n/2-bit

JAMBU: Security

- Encryption: as secure as CFB mode
- Authentication
  - n/2-bit tag
  - Provide **n/2-bit security** when **$2^{n/2}$ message blocks** get protected

- The nonce misuse in JAMBU affects security, but JAMBU is still reasonably strong

- We performed security analysis of JAMBU
  - security proof will be provided later

JAMBU mode: Performance

- Any strong block cipher can be used in JAMBU
- In our submission, we used AES as an example
  - The speed of AES-JAMBU is about half that of AES-CBC

- The hardware area cost of JAMBU is very close to that of the underlying block cipher
  - I guess that **JAMBU is probably the most compact AE mode** in the CAESAR competition

Conclusion

- JAMBU: A lightweight authenticated encryption mode
  - Reasonably strong when nonce is misused
  - Probably the most compact authenticated encryption mode