Putting Wings on SPHINCS

PQCRYPTO 2017 - Recent Results

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Putting Wings on SPHINCS

SPHINCS

- Hash-based Signature Scheme
- **Stateless**
- 128-bit post-quantum security
- Sizes:
  - Public Key: 1kb
  - Secret Key: 1kb
  - Signature: 41kB

`https://sphincs.cr.yp.to/`

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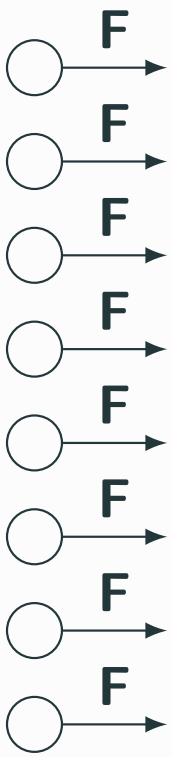
For one signature

- 450.000 times $\mathbf{F} : \{0,1\}^{256} \rightarrow \{0,1\}^{256}$
- 90.000 times $\mathbf{H} : \{0,1\}^{512} \rightarrow \{0,1\}^{256}$

Many calls in parallel:



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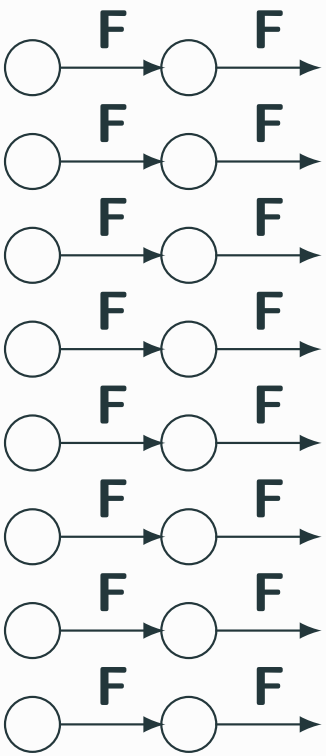

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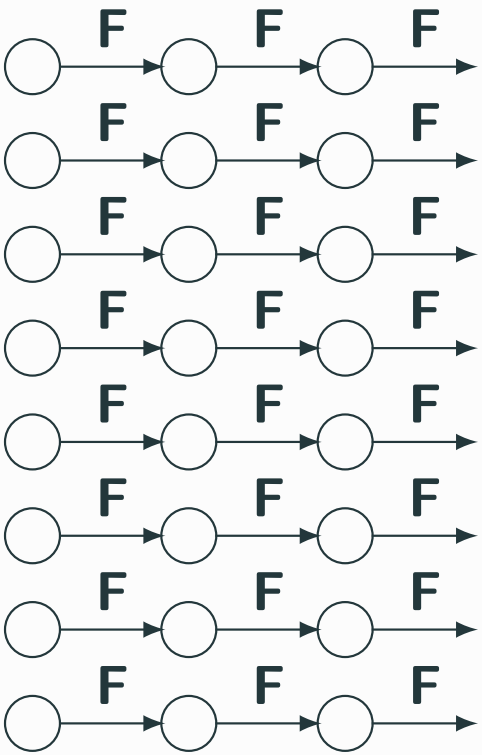

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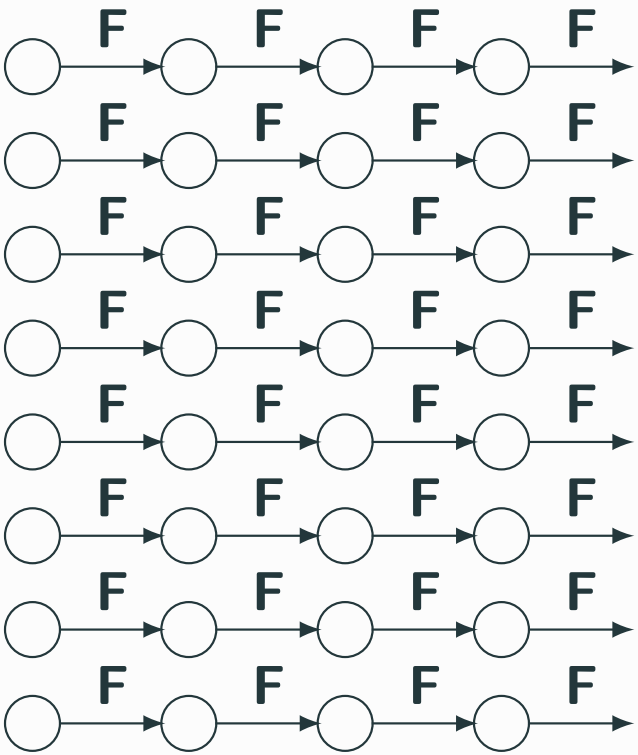

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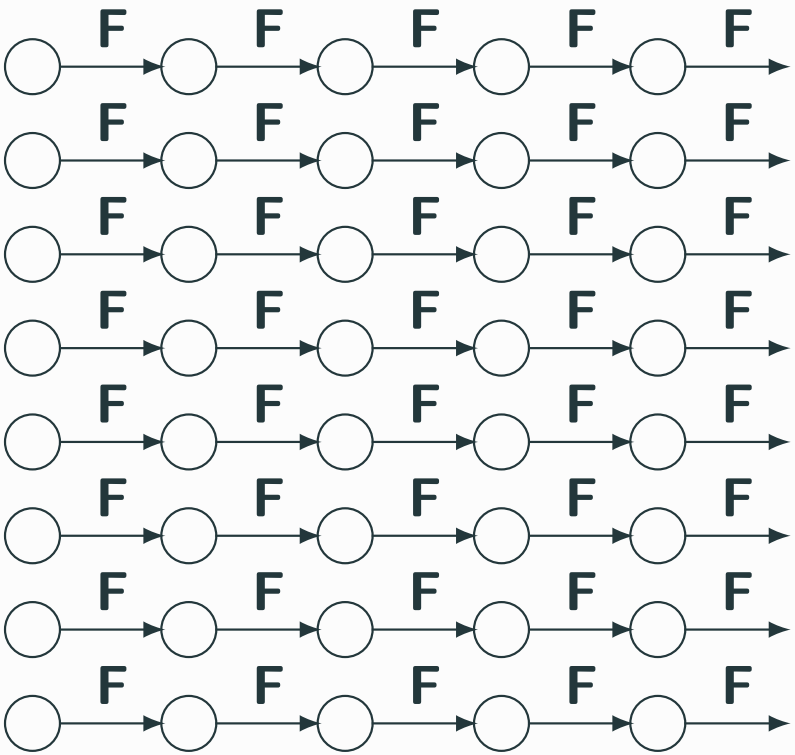

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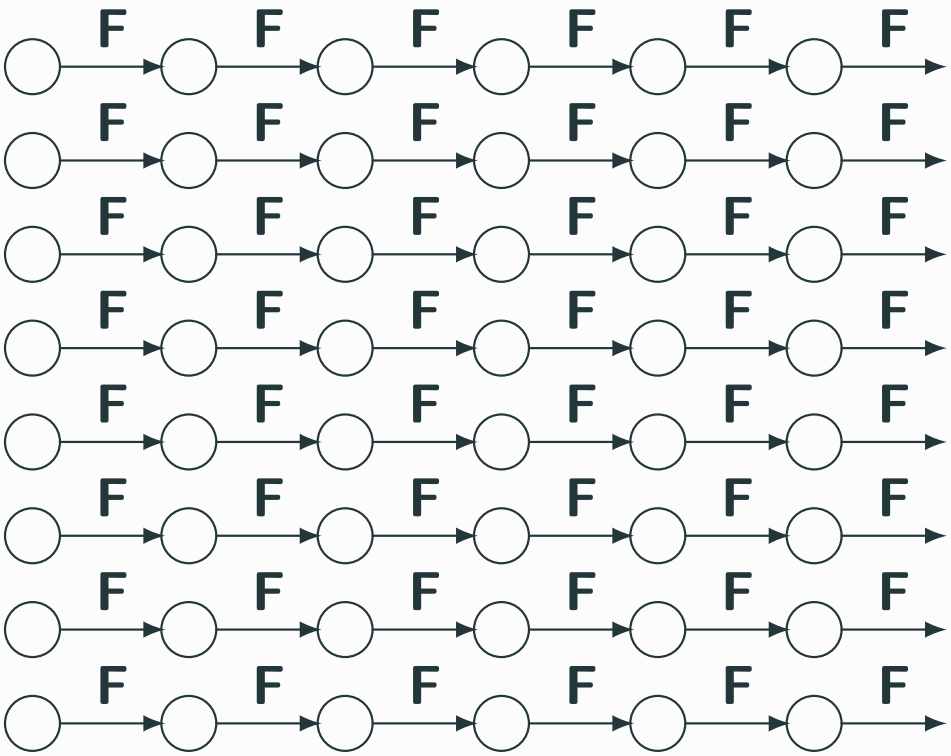

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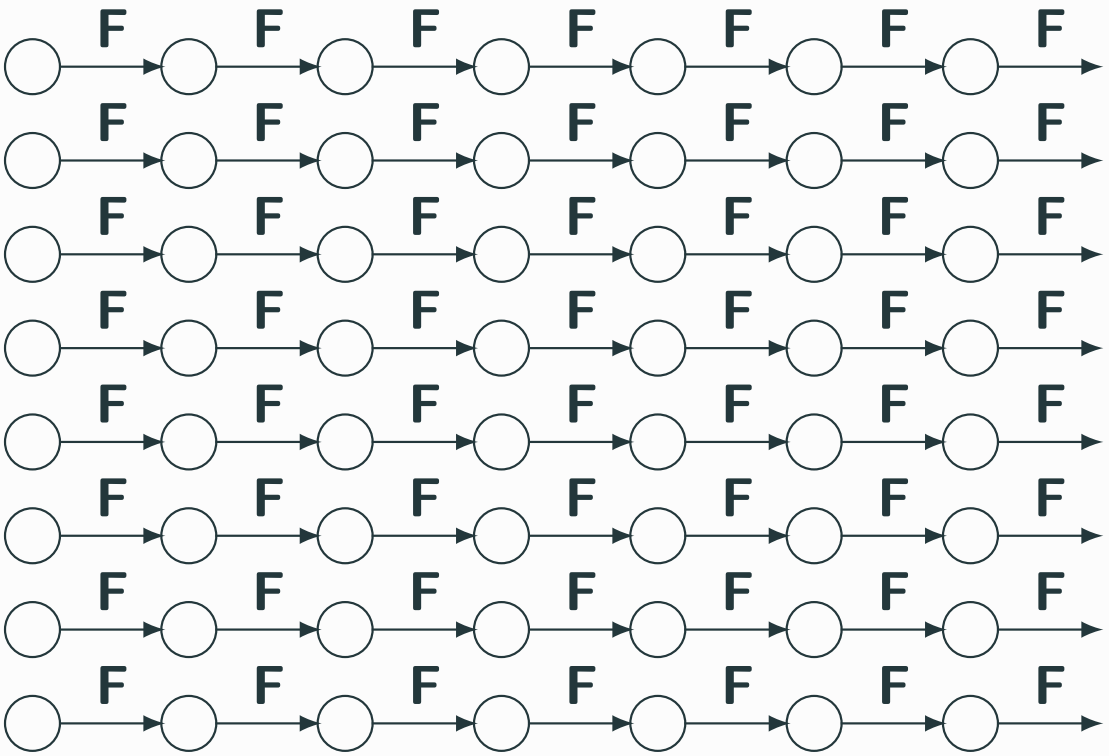

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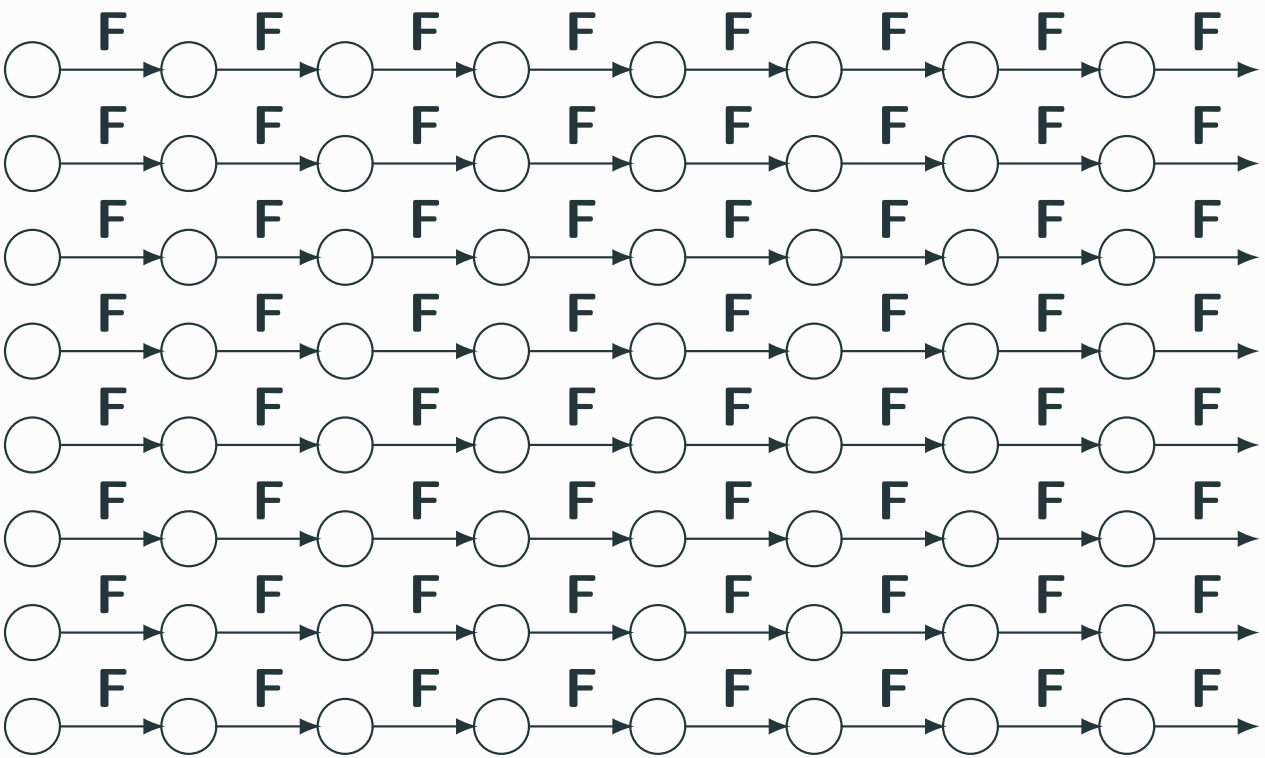

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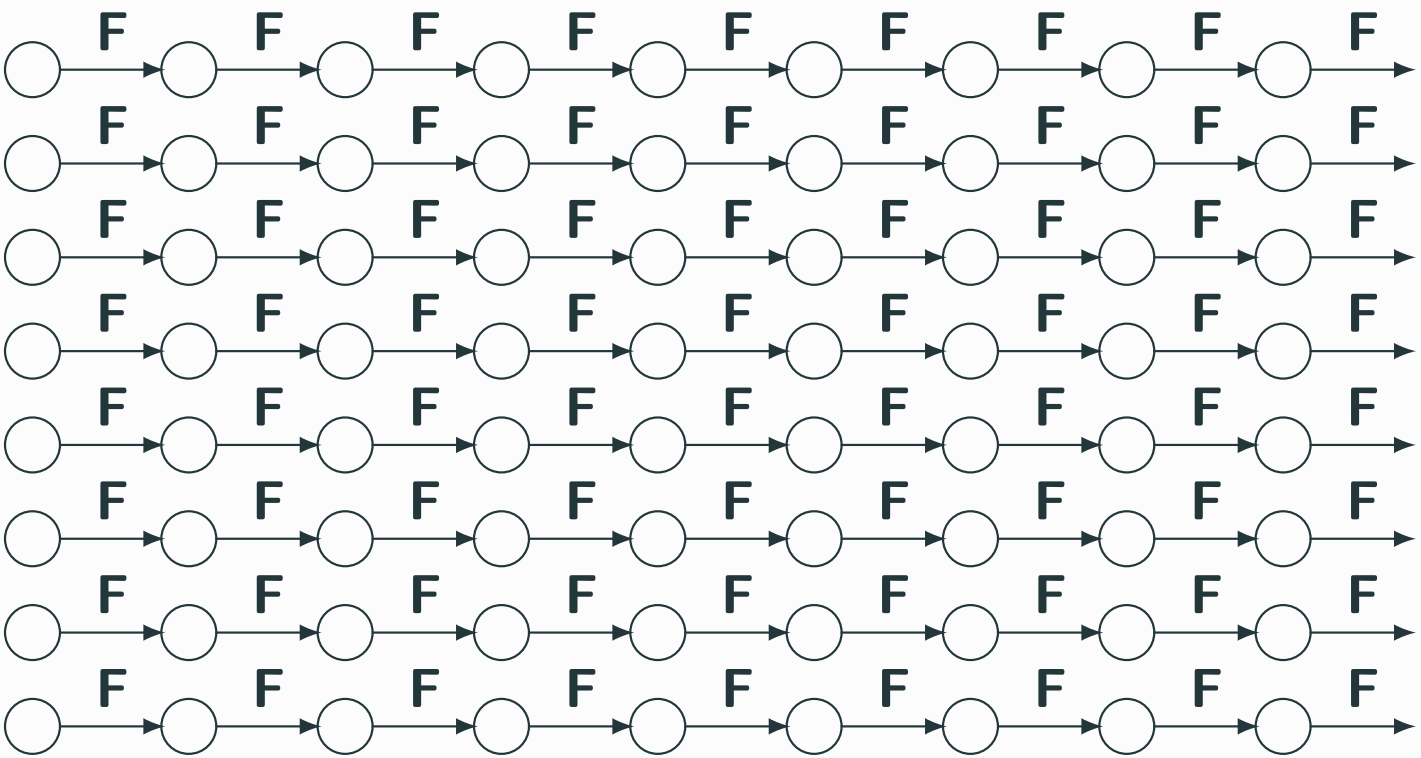

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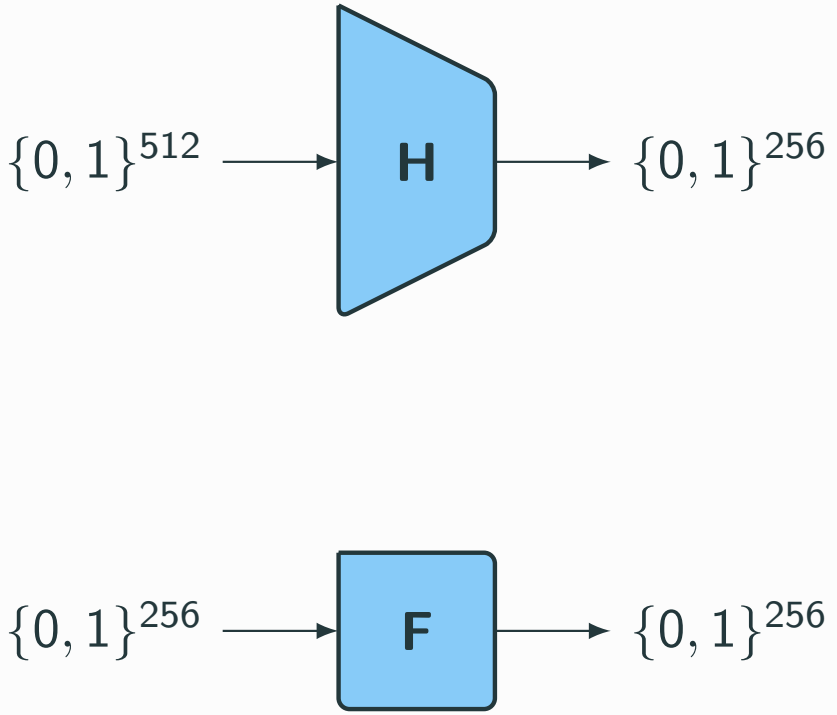
How to instantiate?

- SHA-3 / Keccak
- SHA256
- ChaCha
- Haraka (AES-based)
- Simpira (AES-based)



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How to get fast implementation?

- Vectorization (AVX2, NEON)
- Hardware Support (AES, SHA-2)
- Parallelization trivial for SPHINCS

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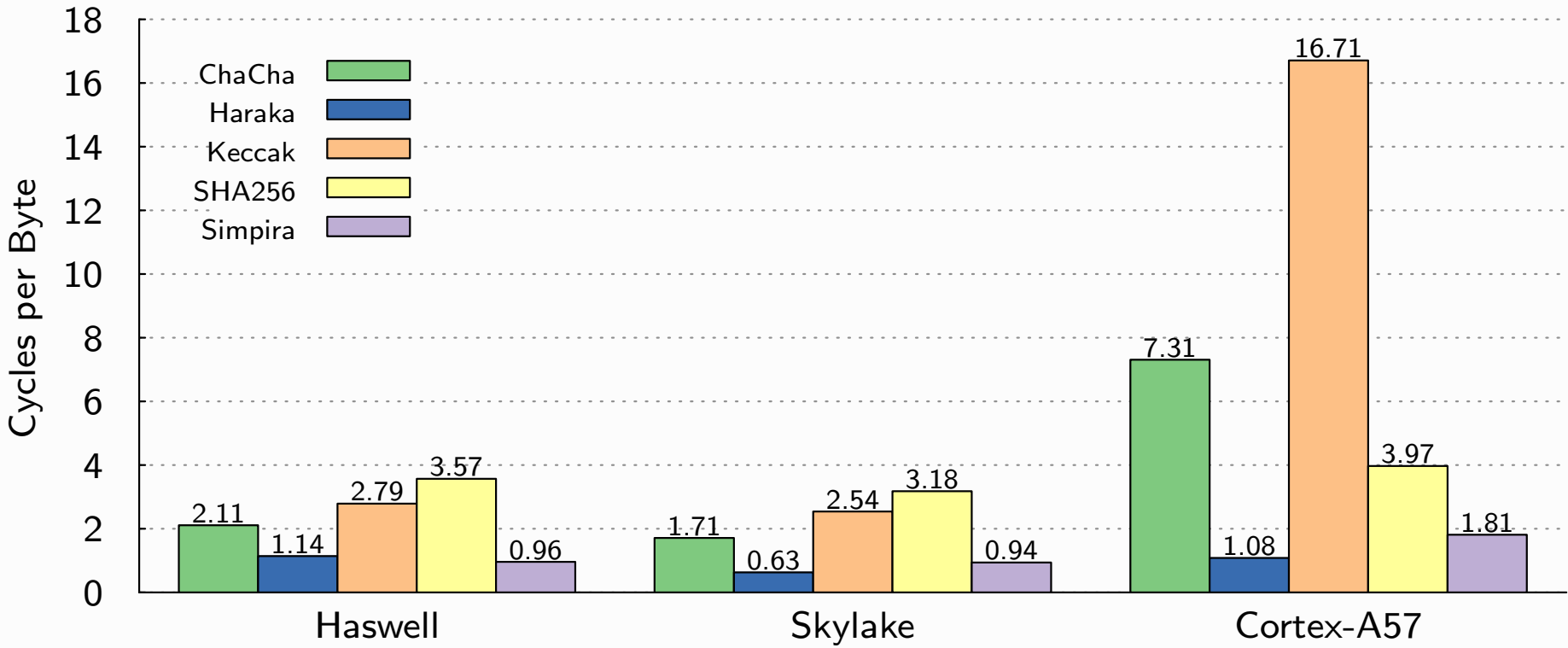
Performance of $\mathbf{F} : \{0,1\}^{256} \rightarrow \{0,1\}^{256}$



[0]Keccak with $b = 800$ and 12 rounds.

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Architecture	Primitive	KeyGen	Sign	Verify
Intel Skylake	ChaCha	2.839.018	43.495.454	1.291.980
	Haraka	1.340.338	20.782.894	415.586
	Keccak	6.589.798	108.629.952	2.152.066
	SHA256	8.724.516	142.063.840	2.812.466
	Simpira	1.808.830	28.408.658	520.832
ARM Cortex A57	ChaCha	10.361.344	191.782.400	3.488.256
	Haraka	2.223.616	46.241.792	750.080
	Keccak	22.006.272	376.908.288	7.358.464
	SHA256	5.292.032	94.082.048	1.679.872
	Simpira	3.044.864	60.507.136	928.256