A Detailed Report on the Overhead of Hardware APIs for Lightweight Cryptography

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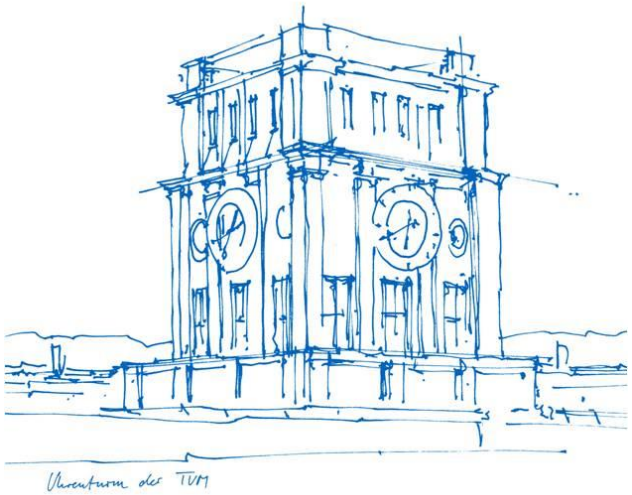

Exemplary API compliant implementations

API	Design	LUT	FF
CAESAR	Ascon128 [1]	1595	818
	SpoC-64 [2]	2136	876
LWC	Ascon128 [2]	1802	539
	SpoC-64 [2]	1565	728
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- What do absolute numbers tell us?
- Common API → fair comparison?
- What about different API implementations?

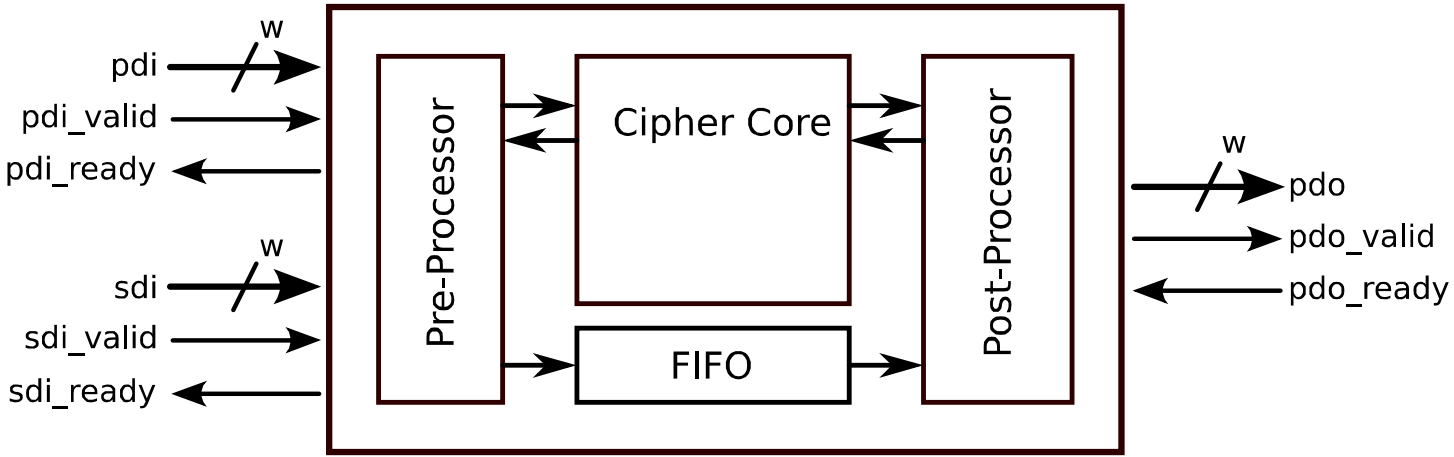
Why?

- "FPGA Benchmarking of Round 2 Candidates..." by GMU [4]

- 24 submissions:
  - 13 using unmodified dev. Package
  - 8 using modified dev. Package
  - 3 not using dev. Package

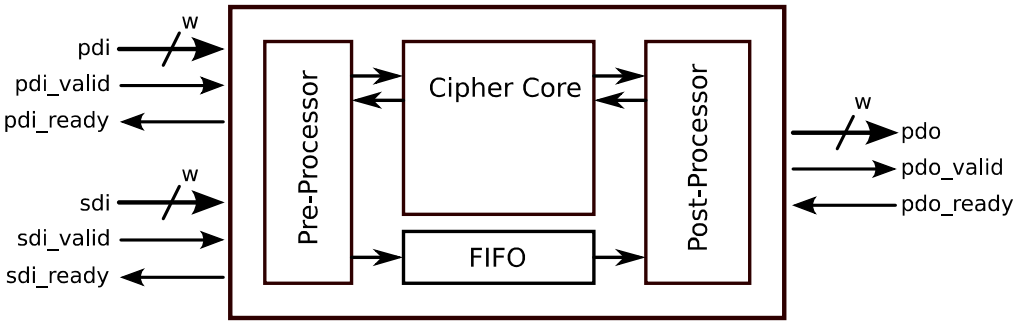
→ What does that mean for comparison?

API compliant Development Packages



API compliant Development Packages

- LWC exclusive features:
  1. Hash support
  2. Extended width conversion
  3. Multi-Segment messages



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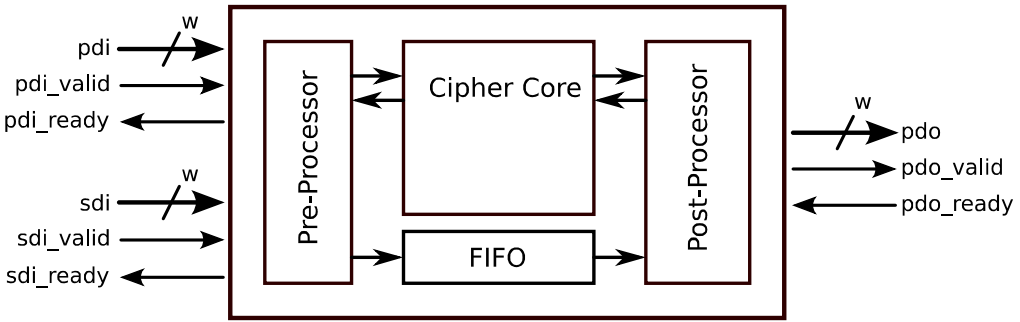
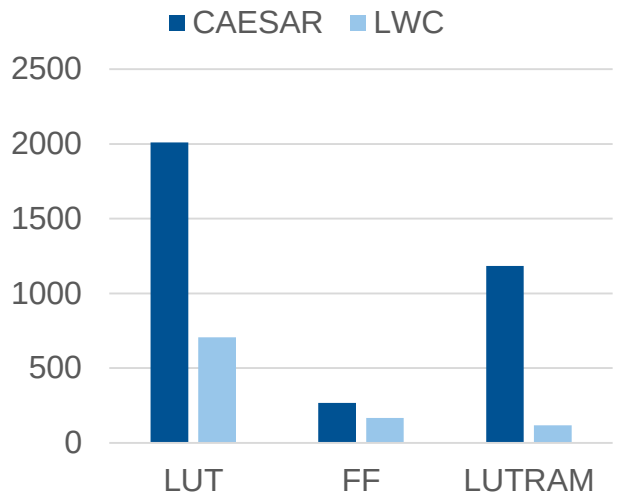


→ Benchmark: common interface

→ Pre-/PostProcessor, FIFO included!

Resource Comparison of CAESAR and LWC

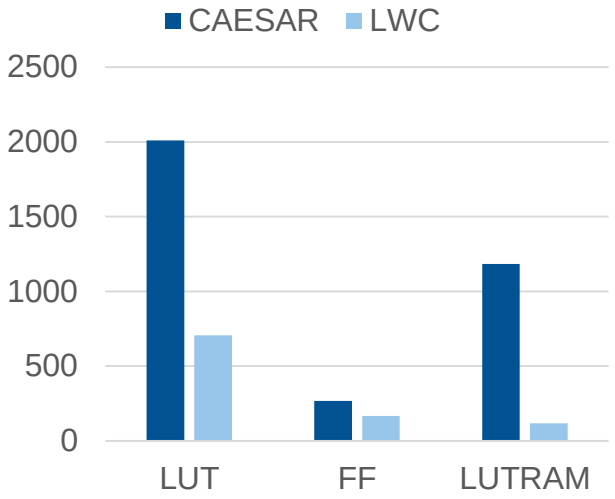
- LWC outperforms CAESAR



E.g. 32-bit designs with default configurations

Resource Comparison of CAESAR and LWC

- LWC outperforms CAESAR
- Exception: 8-bit design with minimized FIFO
- Feature cost constant (e.g. hash, multi-segment)



E.g. 32-bit designs with default configurations

CAESAR FIFO configuration

- Optional tag buffering
- E.g. 32-bit implementation, 128-bit tag → 8 entries sufficient

CAESAR FIFO configuration

- Optional tag buffering
- E.g. 32-bit implementation, 128-bit tag → 8 entries sufficient
- Default: 1024 entries

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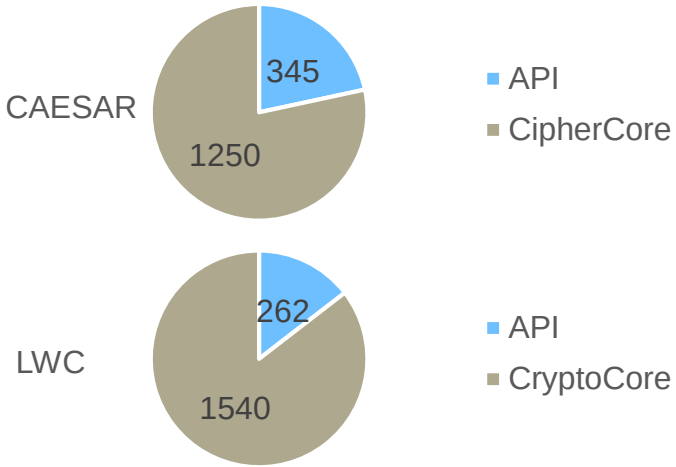
[1] HeaderFifo: 4 x 24-bit

[2] HeaderFifo: 512 x 32-bit

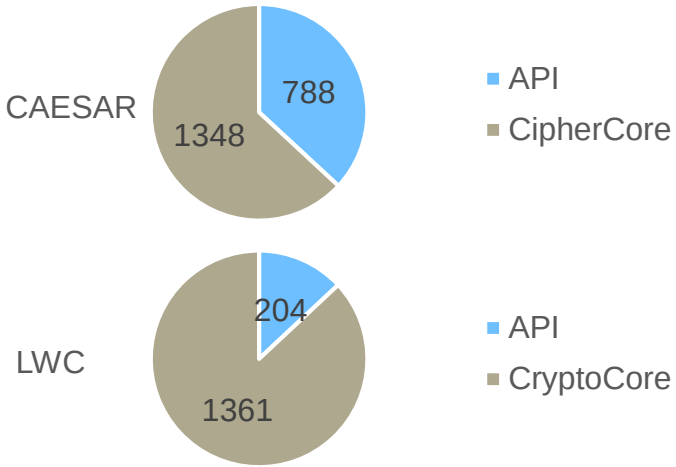
CAESAR Ascon128 [1] / LWC Ascon128 [2]



- CryptoCore by different designers

→ Ideally: multiple designs per cipher

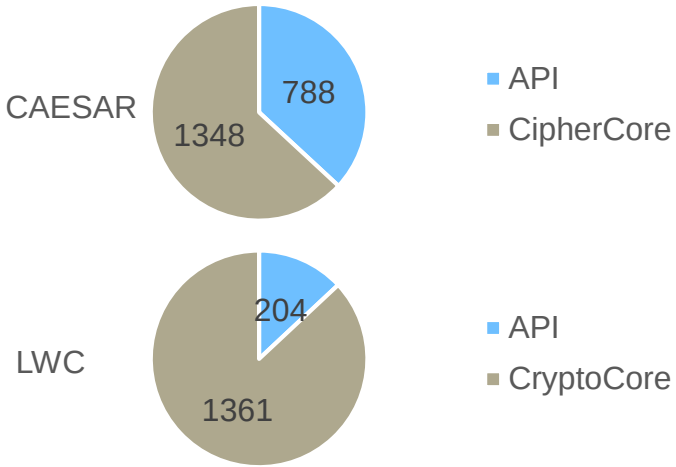
CAESAR SpoC-64 [2] / LWC SpoC-64 [2]



- FIFO: 512 vs. 4 entries

→ FIFO dominates

CAESAR SpoC-64 [2] / LWC SpoC-64 [2]

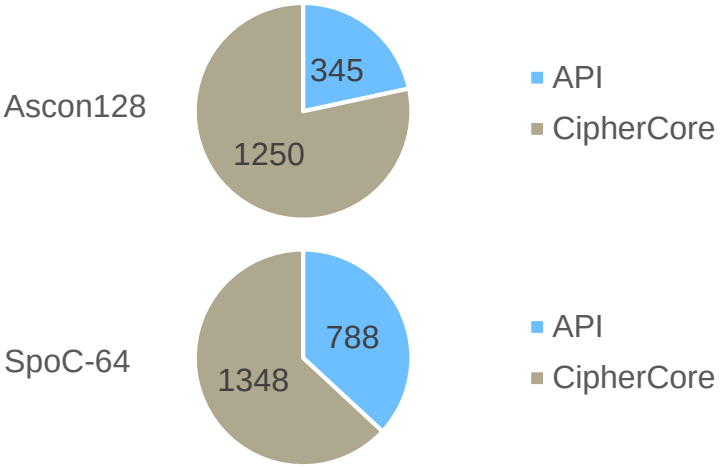


- FIFO: 512 vs. 4 entries

→ FIFO dominates

→ Removing FIFO? Critical Path!

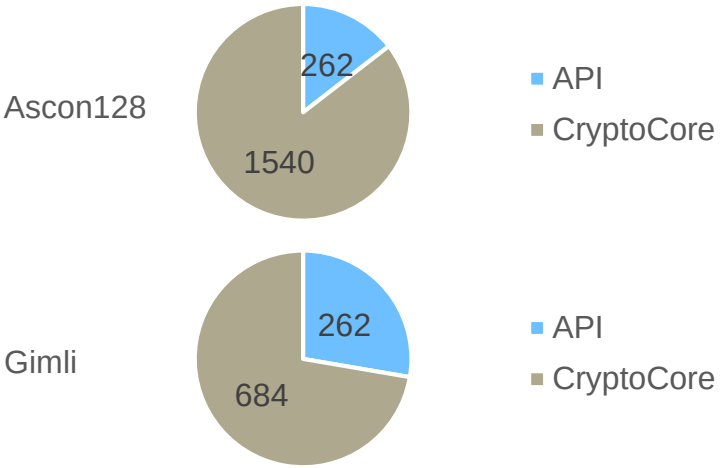
CAESAR Ascon128 [1] / CAESAR SpoC-64 [2]



- CipherCore difference not that huge

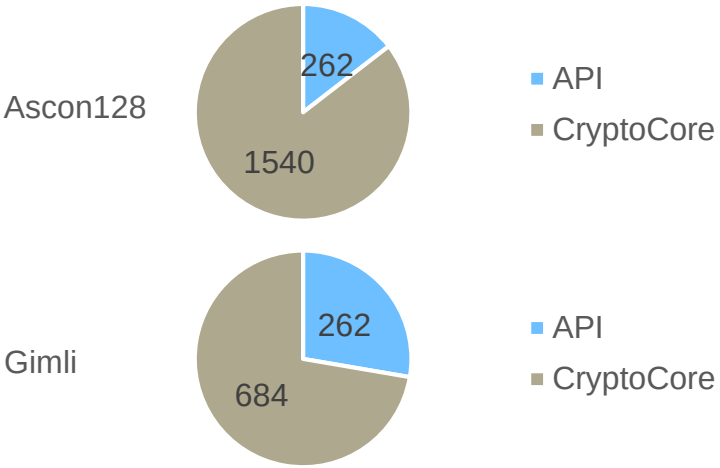
→ FIFO difference (API package)

LWC Ascon128 [2] / LWC Gimli [3]



- Equal assumptions for API implementation

LWC Ascon128 [2] / LWC Gimli [3]



- Equal assumptions for API implementation

→ Improved API implementation + config

→ Fair comparison possible

Conclusion

- Absolute numbers can lead to false impressions
  - ➢ Improvement of LWC over CAESAR package

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- Compare ciphers only
  - ➢ Benchmark int. interface, i.e. CryptoCore?

Conclusion

- Absolute numbers can lead to false impressions
  - Improvement of LWC over CAESAR package
- Compare ciphers only
  - Benchmark int. interface, i.e. CryptoCore?
- Ciphers require API
  - Include API implementation?

Thank you for your attention!

References

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[3] Accessed: 13.1.2020. Chair of Security in Information Technology, Technical University of Munich.
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