

CubeHash

D. J. Bernstein

University of Illinois at Chicago

CubeHash security
is very well understood.

Third-party analyses by
Aumasson, Brier, Dai,
Ferguson, Khazaei,
Khovratovich, Knellwolf,
Lucks, McKay, Meier,
Naya-Plasencia, Nikolic,
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Thanks for all the analysis!

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CubeHash16/32 finalization:
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Resulting collision costs:
doable for CubeHash4/64;
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 2^{132} estimate for CubeHash6/256;
 2^{180} estimate for CubeHash16/512.

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Slower on some old
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FPGA: Faster than
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Despite the security margin,
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Slower on some old CPUs
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8.23 cycles/byte on Core i5
Will be < 5 cycles/byte
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FPGA: Faster than SHA-256
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CubeHash is the *smallest*
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Several meanings of "smallest":

- Smallest memory use.
- Smallest description.
- Smallest code size.
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Can anyone show me another
SHA-3 candidate that fits full
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... with security above 2^{128} ?

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Some other proposals
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The hardware cannot talk to
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Implementation nightmare,
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Microcontroller? M
Limited RAM size
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RAM competition
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CubeHash fits an

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Implementation nightmare,
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Tiny ASIC takes advantage
tiny CubeHash state *and*
tiny CubeHash code.

Same features help CubeHash
on many other platforms.

Microcontroller? No problem.

Limited RAM size? No problem.

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RAM competition? No problem.

ROM competition? No problem.

CubeHash fits anywhere.

How many users will care about performance of SHA-3?

Maybe 1/100 care about time.

Maybe 1/10 care about size.

CubeHash is the best choice whenever size is critical.

Some other proposals can fit into ≈ 10000 gates **if security is limited to 2^{128} .**

The hardware cannot talk to high-security protocols that send 512-bit hashes.

Implementation nightmare, as bad as having two SHA-3s.

Tiny ASIC takes advantage of tiny CubeHash state *and* tiny CubeHash code.

Same features help CubeHash on many other platforms.

Microcontroller? No problem.

Limited RAM size? No problem.

Limited ROM size? No problem.

RAM competition? No problem.

ROM competition? No problem.

CubeHash fits anywhere.