

EdDSA for more curves

Daniel J. Bernstein, University of Illinois at Chicago; TU/e

Simon Josefsson, Simon Josefsson Datakonsult

Tanja Lange, Technische Universiteit Eindhoven

Peter Schwabe, Radboud Universiteit

Bo-Yin Yang, Academia Sinica

CFRG, IETF 93, Prague

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Background

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1992 Rivest (on DSA):

“The poor user is given enough rope with which to hang himself—something a standard should not do.”

The Ed25519 signature system

2011 Bernstein–Duif–Lange–Schwabe–Yang
“High-speed high-security signatures”

ed25519.cr.yp.to:

Eliminate failures.

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Take advantage of crypto research:

- ▶ Curve25519.
- ▶ Edwards curves.
- ▶ Schnorr signatures, including collision resilience.
(Schnorr patent expired 2008.)
- ▶ Conservative hash functions.
- ▶ Fast batch verification.
- ▶ Barwood–Wigley pseudorandom nonce generation.

Ed25519-SHA-512 deployment

Nicolai Brown is tracking applications and implementations:
ianix.com/pub/ed25519-deployment.html

Examples of applications:

- ▶ OpenSSH.
- ▶ GnuPG.
- ▶ GNUnet.
- ▶ DNSCrypt.
- ▶ OpenBSD's signify.

Many independent interoperable implementations.

A few examples of Ed25519 implementations

Fast constant-time implementation from [2015 Chou](#):

- ▶ 57164 cycles for keygen on Intel Sandy Bridge.
- ▶ 63526 cycles for sign.
- ▶ 205741 cycles for (non-batch) verify. Compare to 430000 cycles for OpenSSL 1.0.2 ecdsap256 verify.

Small constant-time implementations of Salsa20+Poly1305+X25519+SHA-512+Ed25519:

- ▶ [2013 Hutter–Schwabe](#) “NaCl on 8-bit AVR microcontrollers”: 17366 bytes of object code.
- ▶ [2014 Bernstein–van Gastel–Janssen–Lange–Schwabe–Smetsers](#) “TweetNaCl: a crypto library in 100 tweets”.

New: EdDSA for more curves

Ed25519 is an example of “EdDSA” defined in 2011 paper.

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- ▶ Also allows Ed448-Goldilocks.
- ▶ Also allows Curve41417 and E-521.

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- ▶ Also allows Ed448-Goldilocks.
- ▶ Also allows Curve41417 and E-521.
- ▶ Also explicitly describes prehashing: e.g.,
GnuPG uses Ed25519-SHA-512 to sign SHA-256(m).
Note: Mixing SHA-256+SHA-512 is bad for code size!

[switch to browser showing [merged Python implementation](#)
for comparing details of signature proposals]