EdDSA for more curves

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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
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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.

EdDSA eprint.iacr.org/2015/677

Speakers: Daniel J. Bernstein (UIC, TU/e) and Tanja Lange (TU/e)
New: EdDSA for more curves

Ed25519 is an example of “EdDSA” defined in 2011 paper. 2015 Bernstein–Josefsson–Lange–Schwabe–Yang “EdDSA for more curves”:

▶ Easy extension of original EdDSA definition.
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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]