BBS Signatures

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BBS Signatures Recap

A pairing based, multi message signature supporting selective disclosure and zero-knowledge proofs.
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Signer:
- Signs multiple messages.
- Can also choose a header.
- A header is a value that the Prover must always disclose.
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- Chooses the messages to be disclosed.
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Verifier:
- Validates the proof using only the revealed messages and the Signer's Pk.
- Learns nothing other than that the Prover has a signature on a superset of the revealed messages.
Updates: Random Scalars

The Issue?
- We used `expand_message` to extend a single seed to many pseudo random bytes.
- This imposed a limit of 170 signed messages.

The solution:
- Different approaches: use `expand_message` in a loop, use a CSPRNG in a loop or a combination of both.
- Using a CSPRNG in a loop was the fastest option, that does not introduce a new dependency.
Updates: Proof Test Vectors

- Signature Fixtures
- Map to Scalar Fixtures
- Generators Fixtures
- Proof Fixtures

The situation last IETF
Updates: Proof Test Vectors

The situation now!

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Updates: Proof Test Vectors

What was the issue?
- The proof algorithm is randomized, needing multiple random scalars.
- Describing how to mock those random scalars in a way that would not be abused was not that easy.

The solution:
- Use a single PRF with extendable output.
- Expand a single seed to all the random scalars for the test vectors.
Updates: Proof Test Vectors

- We used `expand_message` from the Hash-to-Curve draft, since we already have a dependency on it.
- Even if someone uses this in production, as long as the seed is random, security holds.
- New fixtures are cross validated by independent implementations.
Other Updates

- Removed "total_number_of_messages" from a required input to ProofVerify.

- Switched to use a CSPRNG instead of a PRF.

- New academic paper on BBS will be presented in this year's EUROCRYPT. Includes simplifications and performance improvements.

- Already made some changes in anticipation of that paper.
Needing Feedback

Negative test cases

We describe test cases that operations should fail.

- Complicate the document. Implementations ignore them.

? Should we remove them?
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Map to Scalar
We use hash-to-scalar, to map messages (octets) to scalars.
- Not possible to combine with other protocols (i.e., range proofs or accumulators for revocation).
- Should an application or only a ciphersuite be able to define Map to Scalar operations?
- Is there any use for context aware encoding (i.e., dates encoded differently than IDs)?
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Point Encoding
We use the ZCash compact encoding of Bls12381 points.
- Curve specific.
- Should we use I-D.ietf-lwig-curve-representations compressed or uncompressed format?
Questions?