FROST

draft-irtf-cfrg-frost

Connolly, Komlo, Goldberg, Wood - IETF 114 - CFRG

A Flexible Round-Optimized Schnorr Threshold signature scheme

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2 rounds (not including keygen)

A Flexible Round-Optimized Schnorr Threshold signature scheme

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Only Schnorr, no ECDSA here

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t-of-n signers

A Flexible Round-Optimized Schnorr Threshold signature scheme

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Indistinguishable from single signer

Two-Round FROST Signing Protocol

Keygen is done prior.

Round 1: generating nonces & commitments, publishing commitments

Round 2: signature share generation & publication

Coordinator aggregates signature shares into the final signature

FROST Overview

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0. Key generation and configuration

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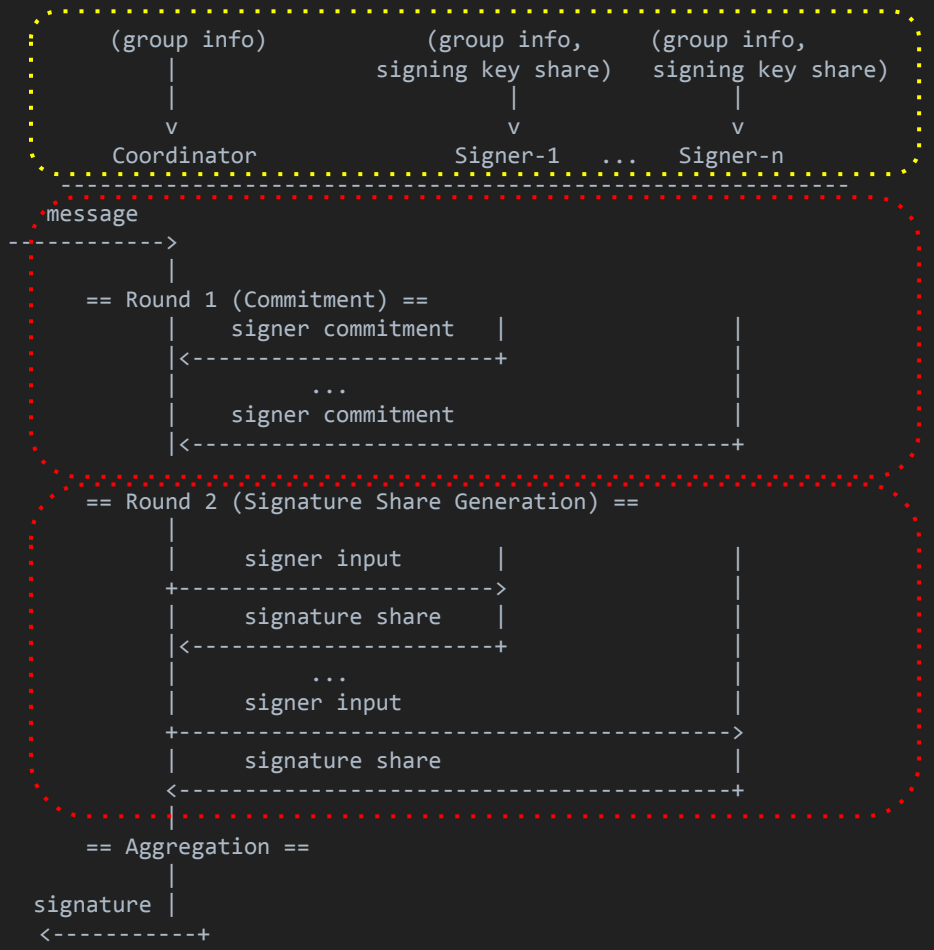
1. Round 1: nonce and commitment generation

FROST Overview

0. Key generation and configuration

1. Round 1: nonce and commitment generation

2. Round 2: signature share generation and verification



FROST Overview

0. Key generation and configuration

1. Round 1: nonce and commitment generation

2. Round 2: signature share generation and verification

3. Share aggregation and final signature publication

Status

Online signing protocol fully specified and stabilized

Four ciphersuites defined (Ristretto, P-256, Ed25519, Ed448)

- Ed25519 and Ed448 are compatible with RFC8032

5+ interoperable implementations in Rust, C, Python (Sage), multiple ciphersuites

Latest updates

Reverted group commitment optimizations per analysis

- Optimization led to inter-round signer malleability
- Non-optimized version requires O(t) scalar operations instead of O(1)

Verification is a per-ciphersuite routine

- RFC8032-style verification stays in RFC8032
- Verification of signatures over prime-order groups is specified in FROST

Next Steps

Seeking Crypto Panel Review and wider CFRG review, specifically:

- Is the draft clear and unambiguous?
- Is there anything technically incorrect, non-secure, or unsafe in the specification?
- Is the specification written in a way that makes embedding FROST into higher-level application protocols straightforward?

More implementations welcome

Interest in one more ciphersuite (secp256k1)

Questions?

https://github.com/cfrg/draft-irtf-cfrg-frost

draft-irtf-cfrg-frost

Keygen

We define trusted dealer in the document appendix.

We support distributed key generation (and implement it elsewhere) but do not define it in this document.

> *(The protocol requires signers to get public keys and private key shares that meet certain requirements, but is agnostic as to the algorithm/protocol that generates them.)*

Reverting from FROST 2 to FROST 1

Optimization to make O(t) scalar muls O(1)

Attack[1] showed malleability of set of signers between rounds, doesn't affect signature malleability

Decided to just back it out to O(t) scalar muls to avoid it

[1] https://eprint.iacr.org/2022/833.pdf