draft-barnes-mls-sframe*

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* https://github.com/bifurcation/draft-barnes-mls-sframe

The hard part is always key management

SFrame defines how you encrypt a media payload

What security properties you get from that encryption depends on how the encryption keys are managed

Traditional RTC key-management (SDES, DTLS-SRTP) has addressed 1:1

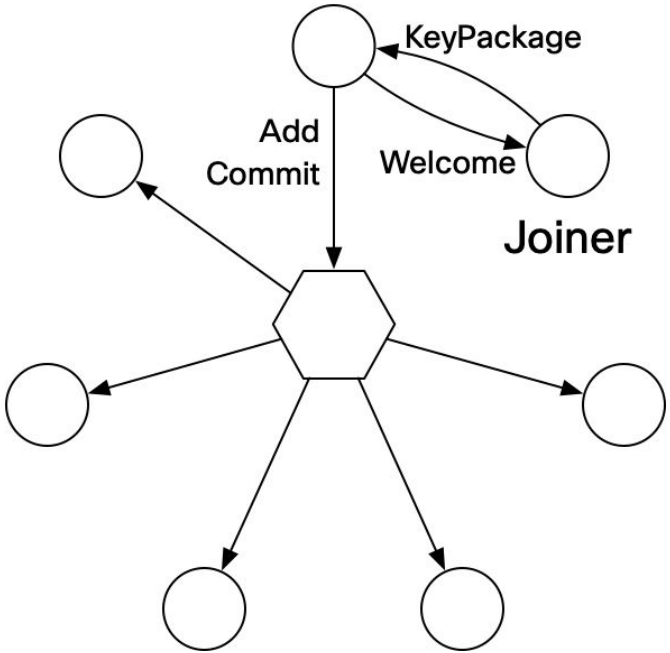
Lots of use cases nowadays are N:N ~ conferencing

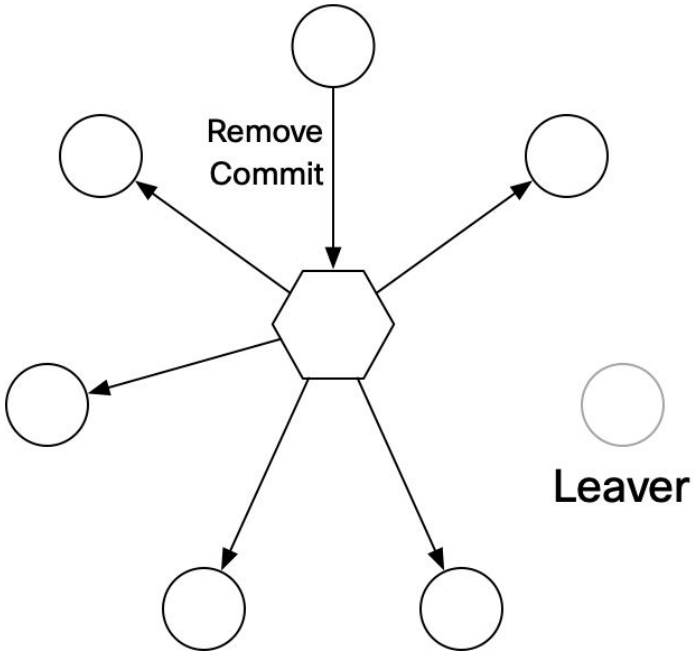
MLS

MLS provides **continuous group authenticated key exchange** with **FS** / **PCS**

- Authenticated key agreement - Makes a key known only to identified parties
- Group - Arbitrary number of parties in the group
- Continuous - Members can join and leave the group
- Forward Security - Recovery

The Shape of MLS [out of scope for SFrame]





Mapping MLS outputs to SFrame inputs

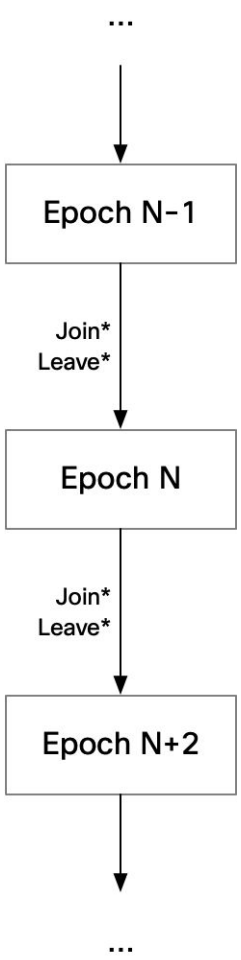
SFrame needs: lookup_key(KID) -> Key

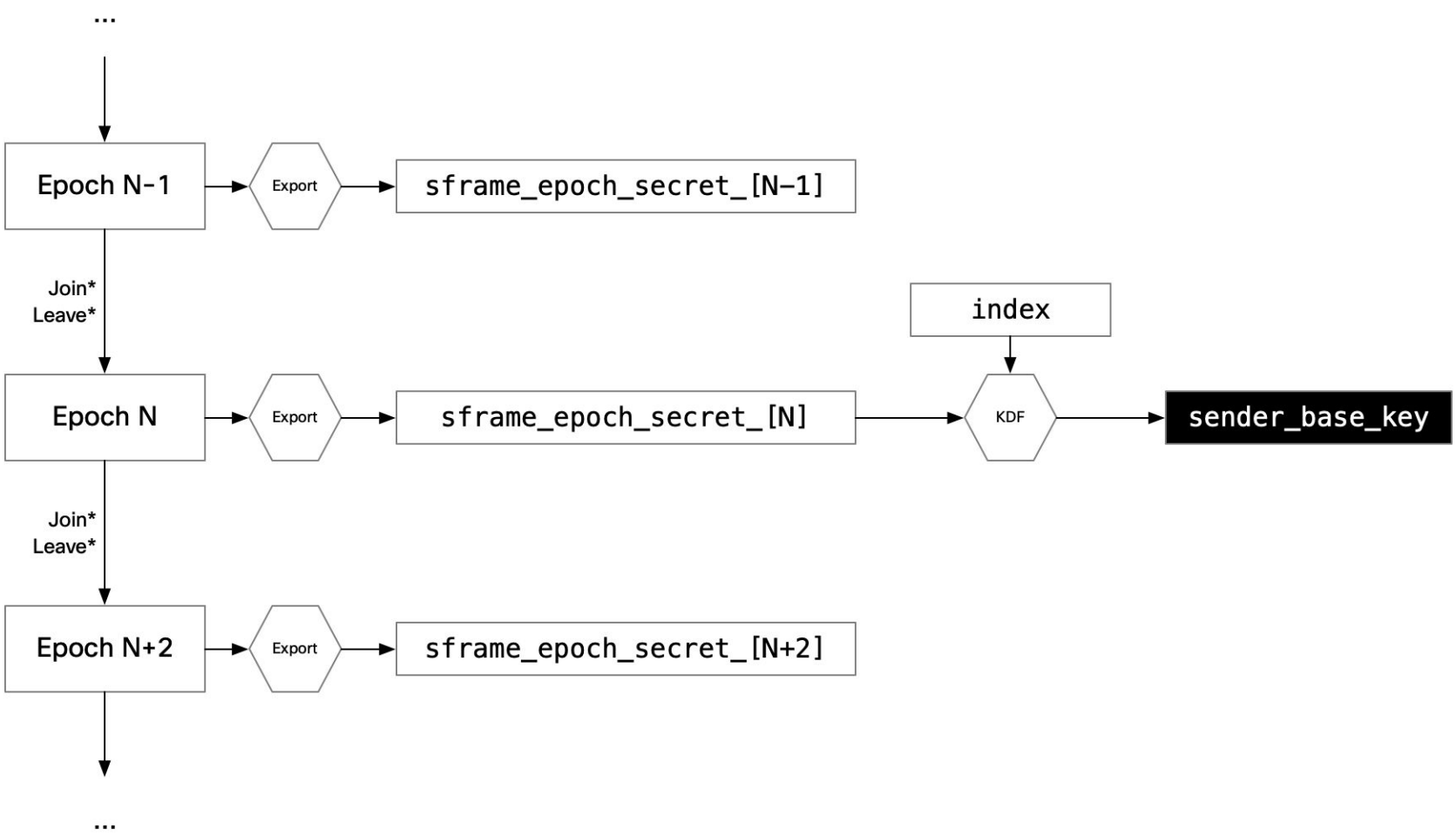
MLS produces a new key per batch of adds/removes/updates (“epoch”)

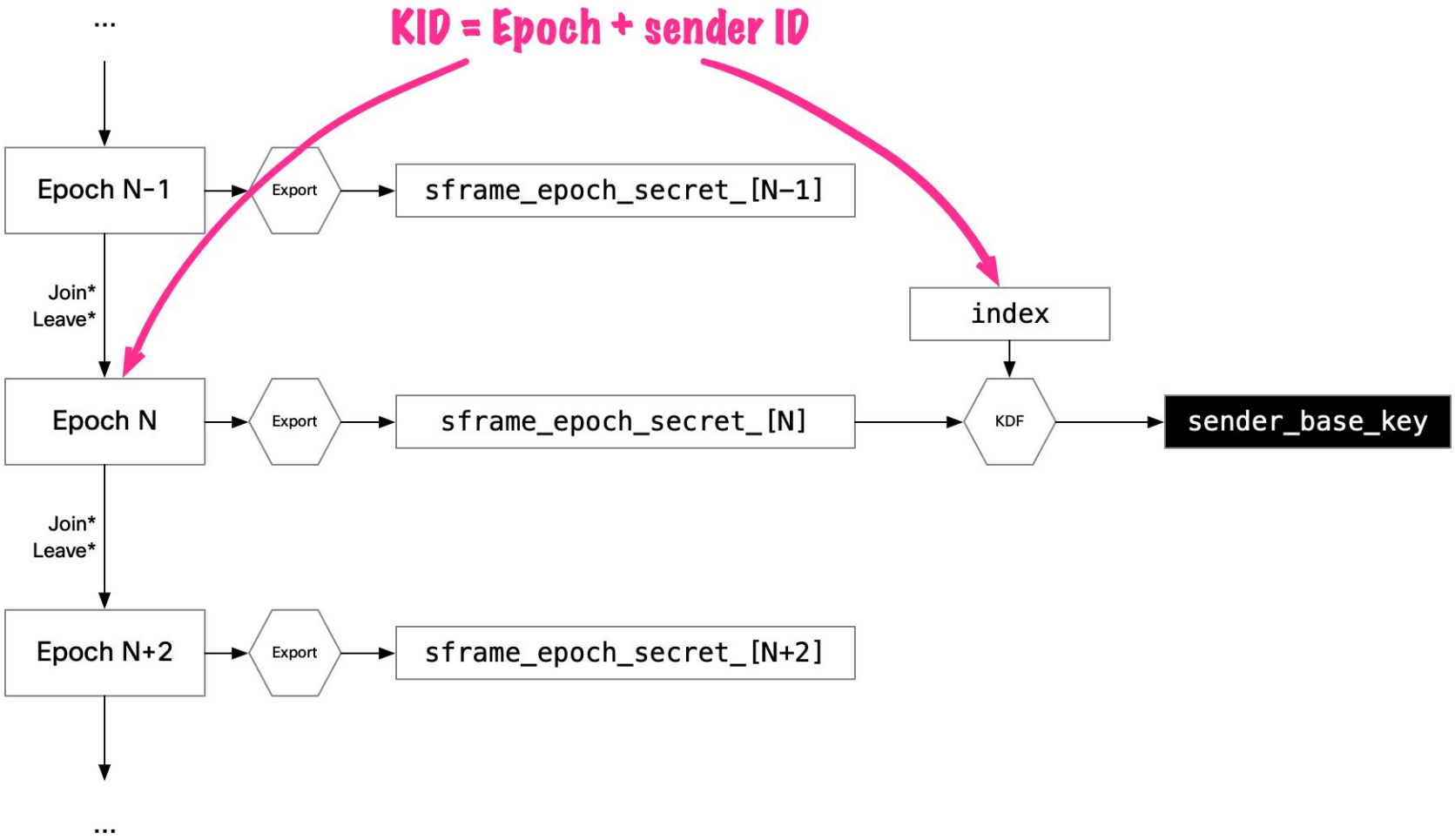
… from which we need to derive a key per member in the group (“sender”)

So we need:

- Scheme for creating sender keys from MLS epochs
- Encoding of (epoch, sender ID) tuple into KID


...
Epoch N-1
Join*
Leave*
Epoch N
Join*
Leave*
Epoch N+2
...


...
Epoch N-1
Export
sframe_epoch_secret_[N-1]
Join*
Leave*
index
Epoch N
Export
sframe_epoch_secret_[N]
KDF
sender_base_key
Join*
Leave*
Epoch N+2
Export
sframe_epoch_secret_[N+2]
...


KID = Epoch + sender ID
...
Epoch N-1
Export
sframe_epoch_secret_[N-1]
Join*
Leave*
index
Epoch N
Export
sframe_epoch_secret_[N]
KDF
sender_base_key
Join*
Leave*
Epoch N+2
Export
sframe_epoch_secret_[N+2]
...

Lossy compact encoding

Epochs in MLS are identified by an **8-byte** counter. Heavy!

For compactness: Truncate the epoch to E bits (value of E agreed by members)

E = 4-8 probably sufficient for most cases, esp. with batched key rotation

```
KID = (sender_index << E) + (epoch % (1 << E))
sender_index = KID >> E
truncated_epoch = KID % (1 << E)
```

The draft in three equations

```
KID = (sender_index << E) + (epoch % (1 << E))


sframe_epoch_secret = MLS-Exporter("SFrame 10 MLS", "", AEAD.Nk)

sender_base_key[index] = HKDF-Expand(sframe_epoch_secret,
                                     encode_big_endian(index, 4), AEAD.Nk)
```

the-draft.hpp (github.com/cisco/sframe)

```
class MLSContext : public SFrame
{
public:
  using EpochID = uint64_t;
  using SenderID = uint32_t;

  MLSContext(CipherSuite suite_in, size_t epoch_bits_in);

  void add_epoch(EpochID epoch_id, const bytes& sframe_epoch_secret);

  output_bytes protect(EpochID epoch_id,
                       SenderID sender_id,
                       output_bytes ciphertext,
                       input_bytes plaintext);
  output_bytes unprotect(output_bytes plaintext, input_bytes ciphertext);
```

Questions for the WG

Does this approach seem generally correct?

An MLS extn could be used to negotiate parameters (cipher, E). Should we?

Should we adopt a draft that defines this approach?