# MLS Protocol

draft-ietf-mls-protocol-~~13~~14

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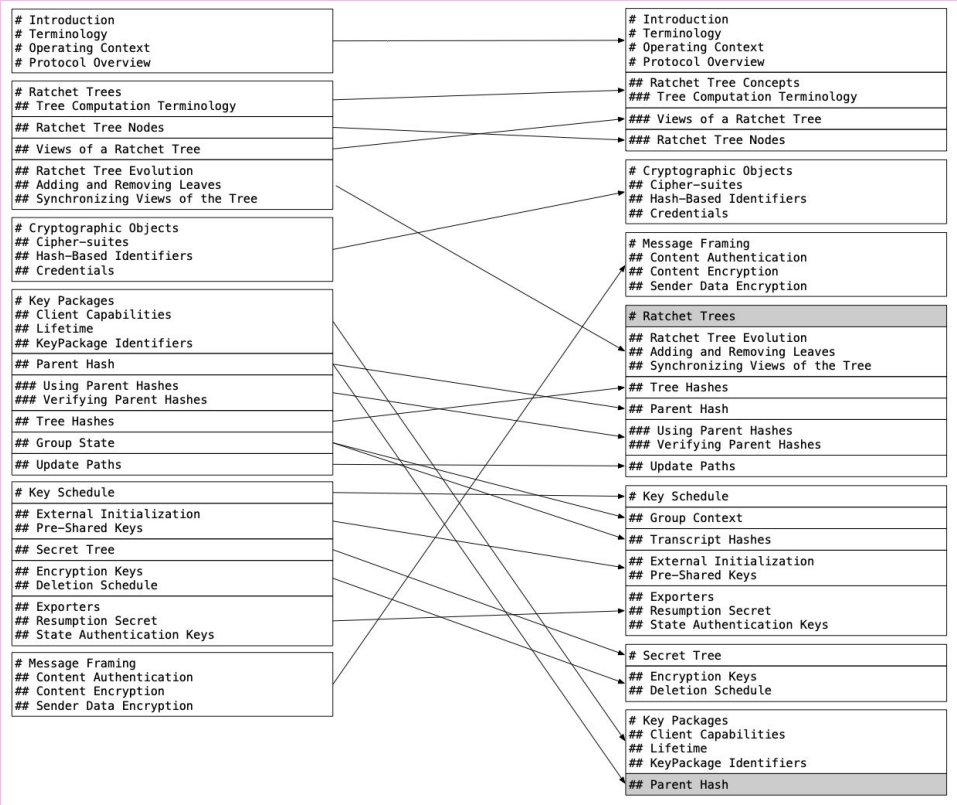
DRAFT-13

# Change Log

- **TLS syntax updates (including variable-header-length vectors) (*)**
- **Stop generating redundant PKE key pairs. (*)**
- Move validation of identity change to the AS
- Add message/mls MIME type registration
- **Split LeafNode from KeyPackage (*)**
- Remove endpoint_id (*)
- **Reorganize to make section layout more sane**
- Forbid proposals by reference in external commits (*)
- Domain separation for KeyPackage and Proposal references (*)
- Downgrade MUST to SHOULD for commit senders including all valid commits
- **Stronger parent hashes for authenticated identities (*)**
- Move wire_format to a separate tagged-union structure MLSMessage
- Generalize tree extend/truncate algorithms
- Add algorithms for link-based trees
- Forbid self-Update entirely (*)
- Consolidate resumption PSK cases (*)
- 384 Ciphersuite Addition
- Remove explicit version pin on HPKE (*)
- Remove the requirement for Add in external commit (*)
- Use smaller, fixed-size hash-based identifiers (*)
- Be explicit that Credentials can attest to multiple identities (*)

# Section Reordering



# Streamlined vector syntax

TLS specifies the size of a vector length

```
opaque vec<0..2^32-1>;
```

This leads to more code and interop hassle

Instead we use a varint length

```
opaque vec<V>;
```

*Full disclosure: idea stolen from CTLS, which stole from QUIC

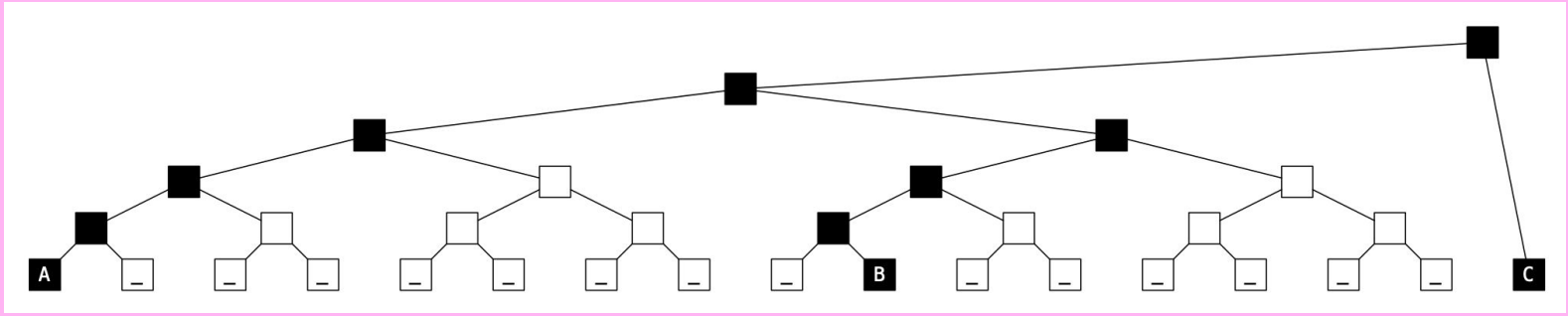
# LeafNode / KeyPackage split

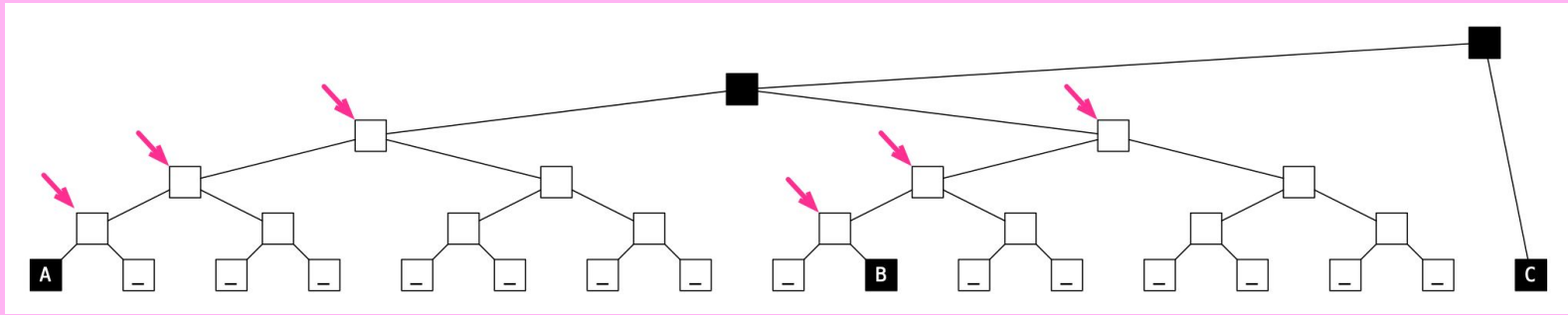
```
struct {
  ProtocolVersion version;
  CipherSuite cipher_suite;
  HPKEPublicKey hpke_init_key;
  Credential credential;
  Extension extensions<8..2^32-1>;
      // Lifetime
      // Capabilities
      // Parent Hash
  opaque signature<0..2^16-1>;
} KeyPackage;
```

- Split leaf node contents from KeyPackage
  - KeyPackage now only used for async join
- Mandatory extns -> Fields
- Dual signatures on LeafNode & KeyPackage
- Separate init & leaf HPKE public keys
- Update/Commit LeafNode sig covers group_id

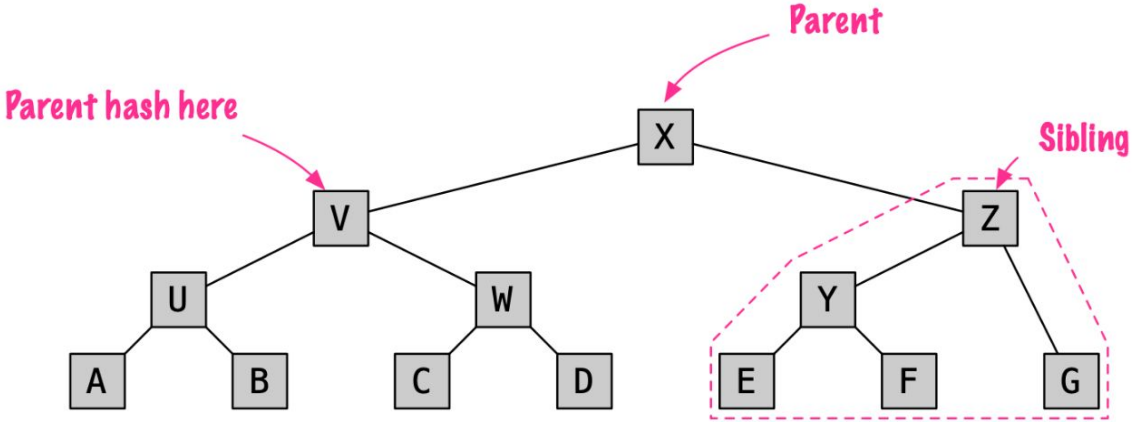
```
struct {
  HPKEPublicKey public_key;
  Credential credential;
  Capabilities capabilities;

  LeafNodeSource leaf_node_source;
  select (leaf_node_source) {
      case add:   Lifetime lifetime;
      case update:  struct {}
      case commit:  opaque parent_hash<V>;
  }

  Extension extensions<V>;
  opaque signature<V>;
} LeafNode;

struct {
  ProtocolVersion version;
  CipherSuite cipher_suite;
  HPKEPublicKey init_key;
  LeafNode leaf_node;
  Extension extensions<V>;
  opaque signature<V>;
} KeyPackage;
```

# No more redundant nodes



# Tree-hash-based parent hash



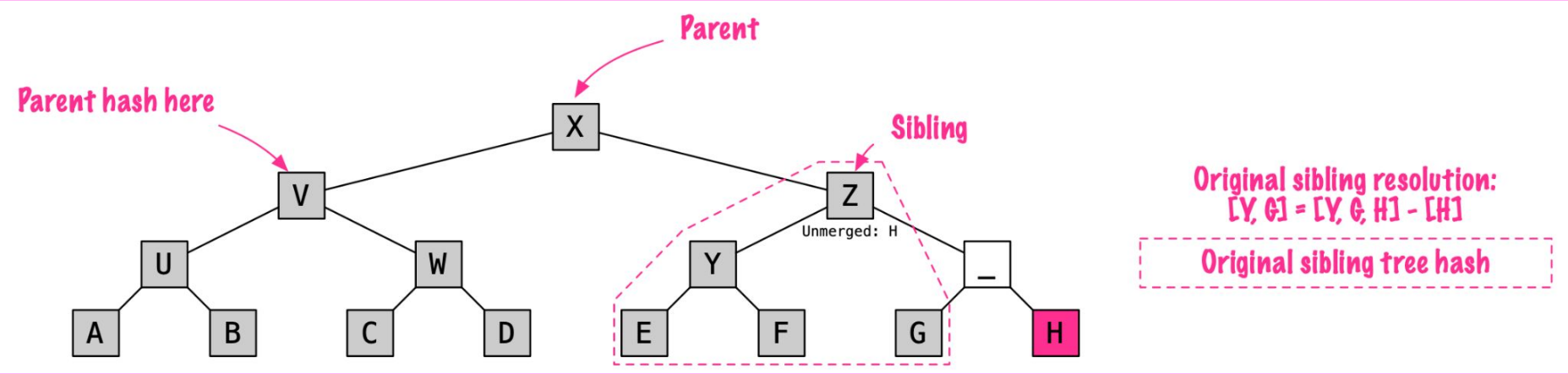

Original sibling resolution: [Z]

Original sibling tree hash

Represent sibling in parent hash by tree hash, not resolution

Bind in tree structure, leaf node contents (e.g., credentials)

# Tree-hash-based parent hash

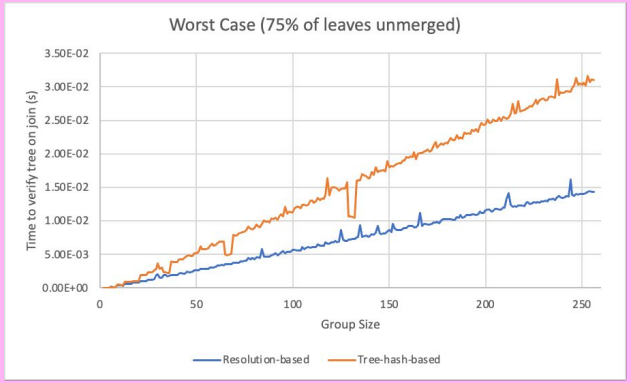


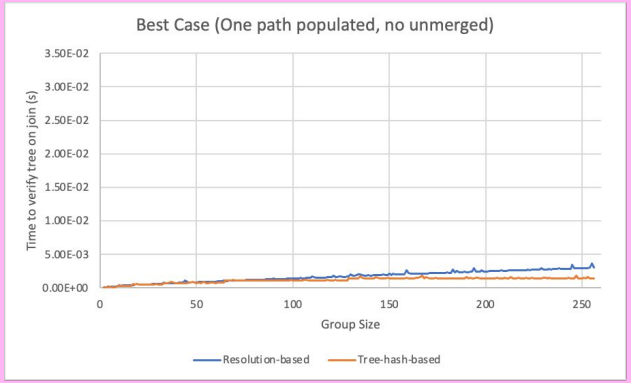

Problem: The tree structure changes at the right edge

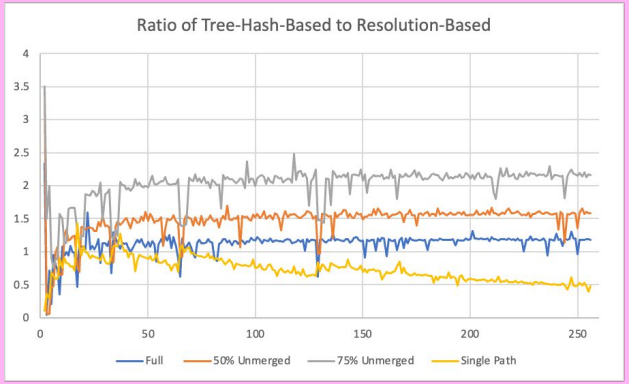
Need to re-compute tree hashes when verifying a tree on joining

O(N log N) hashes naïve, O(N log log N) with memoization (vs O(N) base case)

# Tree-hash-based parent hash




Simulated using updated MLSpp
on 2017-era MacBook Pro

- Full tree (no unmerged)
- 50% unmerged
- 75% unmerged
- One path populated (no unmerged)

# ALMOST READY FOR WGLC...

# draft-14

Over to GitHub...


Onward!
To the IESG!